Bulker Q&As and CIs on the IACS CSR Knowledge Centre

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
161	6/3.4.2.2	Question	Stiffeners	2007/6/11	A point is not clear while calculating the bending moment M0. What must be done when (cf - pz) is negative or null?	The requirement [4.2.3] should be applied both to ordinary stiffeners subjected or not to the lateral pressure. When this requirement is fullfilled for stiffeners subjected to lateral pressure, the term (cf-pz) which appears in the calculation of M0 in [4.2.2] becomes greater than 0. In addition, requirements [4.2.1] and [4.2.2] apply only to ordinary stiffeners subjected to the lateral pressure.	
177	6/1/2.5.1	Question	welded shearstrake	2006/9/27	2.5.1 Welded sheerstrake The net thickness of a welded sheerstrake is to be not less than the actual thicknesses of the adjacent 2m width side plating, taking into account higher strength steel corrections if needed. In this item, does the actual thickness mean actual gross thickness or actual as-built thickness? Is the word 'net' omitted between 'actual' and 'thicknesses' as 'the actual net thicknesses'?	The actual thickness of the adjacent side plating is to be understand as being the actual net thickness, equal to (tas built - tc).	
204 attc	Ch 6	CI	Stiffeners	2007/6/11	Sniped stiffeners, requirement to buckling capacity - please see attachment for full query as it included diagrams and equations.	a)Section 3 covers buckling of ordinary stiffeners and stiffened panels. Therefore sniped buckling stiffeners are subject to Ch. 6 Sec. 3 [4]. b)No. Ch.6 Sec. 2[1], [2] and [3] are applicable to ordinary stiffeners and [4] is applicable to web stiffeners. Buckling stiffeners as shown are subject to 1.Ch. 3 Sec.6 [5.2.1] 2.Ch. 6 Sec.2 [4.1.2] 3.Ch. 6 Sec.3 [4]	Y
212	6/1.2.5.1	Question	side shell plating	2006/11/22	There are some cases where the side shell plating adjacent to sheer strake includes single side part and is increased due to the buckling and hull girder shear strength.Obviously, its reinforcement is not necessary for sheer strake, then please revise the sentence as follows:"...is to be not less than the required thickness of the adjacent 2 m width side plating, which is calculated according to Ch.6, Sec.1,..."	Generally, when the side shell plating adjacent to sheer strake includes single side part and is increased due to the buckling and hull girder shear strength, it is also the case for the sheer strake, which is located above. Consequently, we see no reason to modify this requirement.	
213	6/2.2.2.1	Question	hull girder	2007/1/11	We consider that this requirement has been introduced taking into account shear lag. However, there are some cases where the attached plating is increased due to the buckling of the plating and hull girder shear strength. Therefore we would like to ask you to revise the sentence as follows: "The net thickness of the web of ordinary stiffeners, in mm, is to be not less than the greater of: ・... ・40% of the net required thickness of the attached plating, which is calculated according to Ch.6, Sec.1."	We agree with the modification proposed in the original question: "The net thickness of the web of ordinary stiffeners, in mm, is to be not less than the greater of: - t = 3.0 + 0.015L2 - 40% of the net required thickness of the attached plating, to be determined according to Ch.6, Sec.1. and is to be less than 2 times the net required thickness of the attached plating." We will consider the Rule change proposal.	

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214	6/2.2.3	Question	PMA	2006/12/13	If applying this requirement to longitudinal PMA having wide width, the required scantlings become to be very heavy. This rule seems to be buckling requirement. Since at least longitudinal structural members, such as deck plating, skin plating, longitudinal bulkhead plating, inner bottom plating and longitudinal stiffeners attached to them, are to be complied with Ch.6, Sec.3 "Buckling & Ultimate Strength of ordinary Stiffeners and Stiffened Panels", it is not necessary to apply this rule to them. We would like to ask you to revise the rule taking into account the above.	Such longitudinal PMA having wide width should comply with the requirement of [2.3], where it is applicable considering the configuration of the stiffener. In case the stiffener should not comply with the requirement of [2.3] or [2.3] should not be applicable to the stiffener, such longitudinal should be modeled by shell elements in FEA and its yielding strength and buckling strength should be verified as a primary supporting member.	
215	6/2.3.3.1	Question	BWE	2006/12/8	The net required section modulus [3.2.3] of side frames in holds intended to carry ballast water is excessive than our experience and approximately twice the value required by [3.3.1].The cause of the above is the difference in position to be assessed.In [3.3.1], the position to be assessed is the mid span of side frame. And the position to be assessed in [3.2.3] is the fixed ends.According to [3.3.3], the required section modulus at ends of side frame is to be twice of the required section modulus at mid span.Therefore we would like to ask you to revise the rule as follows:Case A - [3.2.3] "m=20 for side frames of single side bulk carrier"orCase B - [3.3.1]To add the following:"...the net section modulus at lower and upper bracket"	We conclude that there is no need to change the rule formula according to the following reason. With our calculations, we have not seen this ratio of 2 between the application of [3.2.3] for side frames in holds intended to carry ballast water and [3.3.1].It would be interesting to have more detailed information on the comparative calculation to check that all parameters are correctly taken into account, and in particular the span, which is not the same in both requirements. In [3.2.3], the span is defined in Ch 3, Sec 6, [4.2], i.e. by considering reduction of span due to brackets; and, In [3.3.1], the span is defined in Ch 3, Sec 6, Fig 19, i.e. by considering no reduction of span due to brackets.Therefore, the text is kept as it is.	
216	6/2.3.4.1	Question	pressure formula	2006/11/22	The required scantlings by this rule is excessive than our experience. In the formula, counter pressures acting on side longitudinals, hopper / top side longitudinals and backing brackets are ignored. Thus the rule brings heavy scantlings. We would like to ask you to revise the formula in which counter pressures are taken into account. If it is difficult, an alternative analysis such as direct calculation should be permitted.	The pressures to be considered in this formula are the pressures at mid-span of the side frame. In addition, the differential pressures, if any, are to be considered. **Also Included in Corrigenda 5**	
217	6/2.3.4.2	Question	direct calculation	2006/11/23	The required scantling and the material by this requirement are excessive than our experience.An alternative analysis such as direct calculation should be permitted.	From our experience, we have not seen excessive scantlings. We would like to have more information on this "excessive" values. In addition, to accept that alternative analysis such as direct calculation are permitted is a general question for the totality of CSR (oil or bulk). This should be discussed as a general matter.	

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268	6/3.3.1.2	Question	FEM buckling	2006/11/30	The author requests changes and defines e3 & ky as equal to 1. As far as we concern both kx (for longitudinally loaded plating) and ky (for transversely loaded plating) is defined in Tables 2 & 3(for curved plating) and e3 is well defined in Table 4. IACS's proposed additional definition confuses the issue. Propose to leave text as it was prior to errata	Reference is made to: Additional information according to "Corrigenda 1, May 2006", Ch 6, Sec 3, [3.1.2]: The following three lines are the original text: Each term of the above conditions must be less than 1.0. The reduction factors kx and ky are given in Tab 2 and/or Tab 3. The coefficients e1, e2 and e3 are defined in Tab 4. This was the Add. inf.: For the determination of e3, ky is to be taken equal to 1 in case of longitudinally framed plating and kx is to be taken equal to 1 in case of transversely framed plating. We added this additional information due to several requests from other classification societies, how to calculate e3, because in the buckling assessment of a plate field in a transverse section analsys only hull girder bending and shear stress have to be taken into account (Ch6, Sec3, 3.1.2). Therefore the kappa parameter of a load normal to the hull girder bending stress has to be set to "1" to calculate e3 according Table 4. In case of a pressure loaded bilge plate, the pressure induced circumferential stress has to be neglected for a transverse section analysis. In a FEM based buckling analysis this stress has to be taken into consideration and the complete interaction formula of 3.2.4 has to be used. The additional information, given in "Corrigenda 1, May 2006", is kept because this is complete interaction formula of 3.2.4 has to be used. The additional information, given in "Corrigenda 1, May 2006", is kept because this is universally valid for the transverse section analysis.	
276	6/2.3.3	Question	side frames	2006/11/22	The requirement of this rule for side frame seems to be excessive. The section modulus of side frame of CSR is about twice of URS25.	From our experience, we have not seen excessive scantlings. We would like to have more information on this "excessive" values.It would be interesting to have more detailed information on the comparative calculation to check that all parameters are correctly taken into account.	
311 attc	6/4.4.1.1	Question	ve stress	2006/12/21	How to determine the supporting area of the pressure to calculate the compressive stress? If the CSR Bulker Rules has not described, the proposal in the attached file could be taken into consideration.	There may be various arrangement of pillars and other supporting structures. Then supporting area should be determined on a case by case basis.	Y
318	6/3.3.2.4	Question	buckling ratio	2006/12/21	In the first formula in Ch 6, Sec 3, 3.2.4, we are worried about the effect of the third term with B factor which makes the buckling ratio higher in case when one side is in tension than in case when both sides are in compression.Could you confirm that the formula is correct?	We confirm that the formula is correct, with B factor defined in Table 4.	
319 attc	6/2.3.4.2	Question	brackets	2007/1/12	The value of the net connection area of upper and lower brackets to the ith longitudinal stiffener supporting the bracket, obtained from Ch 6, Sec 2, [3.4.2]) may be 2 times the actual value. Such a large increase may imply the following risks: - Uselessly reinforce bracket thickness. - Uselessly ask for web stiffener connected to longitudinals. - Uselessly extend brackets which could interfer with the PMA arrangement. Please forward us the background of formula in [3.4.1] and [3.4.2].	This requirement is coming from work of IACS WP/S at the time of fourth revision of UR S12, in 2002/2003. A Technical Background explaining the formulae of Ch 6, Sec 2 , [3.4] of CSR for bulk carriers is herewith enclosed. The calculation is on the conservative side (i.e. higher part of the end-fixing moments is transferred by transverse supporting webs), but not unduly, and we really don't think a change is technically justified. The only interpretation that could safely be done looking at the derivation of the formula in [3.4.2] is to replace the provided net section modulus wi by its minimum required value to comply with [3.4.1].	Y

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327	6/2.4.1.3	CI	inertial pressure	2007/1/22	Regarding the internal inertial pressure p due to liquid to be applied, our undestanding is that such pressure are those of: - Double Bottom pressure alone acting on bottom longitudinal. Please confirm? - Topside tank ballast pressure alone acting on side and deck longitudinal. Please confirm? - Balance of Double Bottom pressure and Deep Tank ballast pressure acting on Inner Bottom longitudinal of Deep tank. Please confirm? - Balance of Top side tank ballast pressure and Deep Tank ballast pressure acting on top side sloping plate longitudinal. Please confirm? In addition, in no case pressure p acting on watertight floors of double is not to be considered, neither should it be considered for watertight part of bulkheads belonging to wing tanks. Please confirm?	Our interpretation is that the pressure to be considered should be only internal inertial pressure acting on the longitudinal. For better understanding, we will consider the editorial correction of the definition of p in [4.1.3]. **Also Included in Corrigenda 5**	
331	6/1.2.7.4 & 6/2.2.5.4	Question	uniform loads	2007/1/12	In [2.7.4] of Ch 6, Sec 1 for plating and in [2.5.4] of Ch 6, Sec 2 for ordinary stiffeners, for steel coil load with dunnage more than 5, it is stated that the inner bottom may be considered as loaded by a uniform distributed load. But CSR has no definition for uniform loads. So such definition of uniform loads should be introduced CSR.	A definition of uniform loads on inner bottom will be included in CSR for bulk carriers.	
333 attc	3/6.5.2 6/2.2.2 6/2.2.3 6/4.1.5	Question	Web Stiffener	2006/12/18	Web stiffeners of primary supporting members: (1) Because there is no definition for "primary supporting member", the meaning of "web stiffener of primary supporting member" itself is unidentified. Please clarify the definition of "primary supporting members". (2) Please see the attached summary table about rule applications for web stiffeners of primary supporting members based on our understanding. It shows that which requirements should be applied to web stiffeners. Please confirm. (3) We also would like to confirm that whether the web stiffeners fitted on watertight girders, e.g. watertight centre girder and floors, should be applied to the both requirements for primary supporting members of Chapter6/Section4 and for ordinary stiffeners of Chapter6/Section2 or not. (4) If there is any needs to satisfy both requirements for primary supporting members and for members subject to lateral pressure, I would like to know whether the web stiffeners fitted on the watertight bulkheads in the topside tanks and bilge hopper tanks are treated the same or not.	(1) Primary supporting member are defined as: members of the beam, girder of stringer type which ensure the overall structural integrity of the hull envelope and tank boundaries, e.g double bottom floors and girders, transverse side structures, web frames/diaphragms in hopper side tanks, topside tanks, lower stools and upper stools, side stringers, horizontal girders/transverse web frames, hatch side/end coaming. (2) The requirements in Ch 6, Sec2, [2.2] adn [2.3] are not applicable to web stiffeners but to ordinary stiffeners, The only requirements applicatle to web stiffeners in CSR for bulk carriers are the following ones:- Ch 3, Sec6 [5.2.1] for the net thickness of such stiffeners, which refers to the minimum net thickness of the primary members on which they are fitted, i.e. to Ch 6, Sec 4, [1.5.1], and - Ch 6, Sec 2 [4] for the net scantlings of web stiffeners of primary supporting members. (3) The same requirements as stated in (2) above apply to web stiffeners fitted on watertight side girders, centre girders and floors, i.e. Ch 3, Sec 6, [5.2.1]for the net thickness of such stiffeners (and so Ch 6, Sec 4, [1.5.1] and Ch 6, Sec 2, [4]. (4) See our comment in (1) as we consider that stiffeners on these bulkheads are considered as ordinary stiffeners and not as web stiffeners.	Y

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344	Ch.6, Appendix 1/1.3.4	Question	Corrugated BHD	2007/5/14	The current requirement is only considering the buckling strength from the local bending stress as it is only taken the maximum vertical stress without shear component. Therefore, the panel size is only taken as b times b for face plate and 2b times b for web plate. However it should be noted that the buckling strength should be considered not only from the local bending stress but from the global bending and shear stress. It is expected that the higher shear stress would be induced at the connection of corrugated bulkhead to side shell, hence the shear buckling should also be taken into account. To assess the shear buckling, the panel size should be taken separately from above, i.e. full length panel from top of lower stool to bottom of upper stool and the shear stress to be taken as mean shear stress of the large panel.	If a FE analysis derives signifcant shear stress in face plates of corrugated bulkheads you may take this stress into consideration according case b), described in 1.3.4.	
345	Text 6/ Appendix 1/1.3.4	Question	The Maximum Vertical stress	2007/7/2	The current requirement states that “the maximum vertical stress in the elementary plate panel is to be considered in applying the criteria”. This results the severe requirement when the quality of the mesh was poor at the edge of corrugation where the connection of other structures to corrugation is relatively complex. To apply the maximum vertical stress to the “elementary plate panel” is considered unrealistic. This should be enhanced to be more practical.	Assuming a b x b or 2b x b buckling field (depending on the considered area) you may derive the vertical stress as an average value of elements inside this area. Lower part of the web plates prone to include bad shaped elements or triangular elements may be neglected. Each area with a different thickness is to be considered and checked separately.	
346	Chp 6/ Appendix1 /1.3.4	Question	The Edge constraint factor	2007/3/9	The current requirement, the edge constraint factor, F1 = 1.1. This should be 1.0.	As the correction factor F1 is not used for the buckling load cases 1 and 5, the lines "F1=1.1 is to be used" in (a) and (b) of 1.3.4 are not necessary. We will consider the editorial correction.	
356 attc	6/2.3.3.1	Question	Modulus	2007/3/16	Questions on the requirement for mid-span sectional modulus. See the attached.	(a) Yes, ps and pw in the formulas in Ch.6 Sec.2 [3.3] are pressures in intact condition. (b) Yes, Ch.6 Sec.2 [3.2.3] is to be applied to side frame only in way of ballast hold in heavy ballast condition. (c) Q1: The required section modulus by the formula in Ch.6 Sec.2 [3.2.3] should be applied to whole span of side frame. Please note that while the span l in Ch.6 Sec.2 [3.3.1] is to be determined without consideration to end brackets according to Ch.3 Sec.6 Fig.19, the span l in Ch.6 Sec.2 [3.2.3] may be with consideration to end brackets as specified in Ch.3 Sec.6 [4.2]. (d) Q2: The required net section modulus at end brackets is to be not less than twice the greater of the net section moduli required for the frame mid-span area obtained from Ch.6 Sec.2 [3.3.1] and Ch 6 Sec.2 [3.2.3] for ballat hold.	Y
357	6/2.4.1.1	Question	Web Stiffener	2007/5/14	Which value of k1 is to be used for a web stiffener on watertight primary supporting member ?	For a web stiffener on watertight primary supporting member, i.e. with full collar plate, k1 is to be taken equal to 0.2.	

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360 attc	Table 6.3.2	Question	Rule Change	2007/7/1	Ch6 Sec3 We get different results for LC5 in Table 2 depending on whether we denote the longer side b and the shorter side alpha*b, or vice versa. This is an unexpected result. We suspect this is caused by an inaccurate definition of b. The definition of b should be similar to the definition of la in CSR Tank. We propose the following definition, which is in line with CSR Tank: b: length in mm, of the shorter side of the plate panel for Cases 1 and 2, or length in mm, of the side of the plate panel as defined for Cases 3-10. Further we suspect the formula for reference stress sigma_e in the List of Errata of April 2006 is incorrect. b, as defined above, should be used for the calculation, not b'. This means the formula as printed in the Rules of January 2006 is correct. By making the above described modifications we avoid the problem for LC5, and we are also in line with CSR Tank. Please comment.	Your conclusions are right. We will prepare a rule change proposal as follows: Definitions in Symbols a: Length in mm of the longer side of the partial plate field in general or length in mm of the side of the partial plate field according Table 2, BLC 3 - 10 b: Length in mm of the shorter side of the partial plate field in general or length in mm of the side of the partial plate field according Table 2, BLC 3 - 10 In accordance with these definitions of a and b the definition of the reference stress S_e of the CSR for Bulk Carrier 2006 is correct. We will reject the definition, given in the Corrigenda 1. *"Note: IACS Council expediated the rrule change required as a result of this question and on 19 July 2007 agreed that the correction in the attached file should be made to Ch.6, Sec.3 Symbols."* **Also Included in Corrigenda 5**	Y
367	6/1.3.1.5 & 6/2.3.1.5	Question	Flooding Requirement s	2009/9/4	The definition of sig-x is unclear for longitudinal members in flooding condition. The MSW,F in Ch 4 Sec 3 [2.4] assumes flooding of individual cargo hold and is required only for BC-A and BC-B ships. Does the same MSW,F apply to any dry compartment, for instance, inner side and duct keel in double bottom space? How do we apply MWH,F and any of the load combination factors?	1) When hold flooding is considered for local scantlings check of a plate or a stiffener, MSW,F, MWV,F and MWH,F are to be used in lieu of MSW,MWV and MWH respectively for calculating sigma_x by the formulas in Ch.6 Sec.1 [3.1.5] and Ch.6Sec.2 [3.1.5], where MWH,F=0.8MWH. However in this case the same load combination factors CSW, CWV and CWH as those for intact condition are to be used. Notwithstanding the above, for a ship of length Ls <150m the sigma_x is to be calculated by the same formula as that in Ch.6 Sec.1 [3.1.5] or Ch.6 Sec.2 [3.1.5], as applicable." 2) When flooding of the compartment other than a hold is considered, sigma_x is to be calculated by the same formula as that in Ch.6 Sec.1 [3.1.5] or Ch.6 Sec.2 [3.1.5], i.e, only intact conditions should be used to determine Sigma_x, as applicable. This interpretation will be included in the Rules at a future revision.	
368	Ch 6 Sec1.3.1.5 & Sec2.3.1.5	Question	Calculation	2007/3/20	In order to calculate sig-x for BC-C ships and ships with length less than 150 m, do we have to calculate MSW,F by flooding individual cargo holds which is not required for longitudinal strength?	Sigma x for intact condition is used.	
369	Ch 6 Sec 1.3.2.2 and Sec 2.3.2.5	Question	corrugated BHD	2007/3/20	We assume that these requirements apply to stools of corrugated bulkheads with the design load as given in Ch 4 Sec.6 [3.2.1]. Flooding load given in [3.3] does not apply to the bulkhead stools. Please confirm.	Yes, your interpretation is correct.	

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370	6/1.3.2.2 & 2.3.2.5	Question	Flooding Requirement s	2009/9/4	The MSW,F is defined in Ch 4 Sec 3 [2.4] by flooding individual cargo holds. If the same design moment is applied to any dry compartment such as duct keel, the flooding requirements may, according to our calculation, give heavier scantlings than the intact requirements. This means that the flooding requirements may have to be applied to all structural boundaries as minimum. Please explain.	When flooding of the compartment other than a hold is considered, sigma_x is to be calculated by the same formula as that in Ch.6 Sec.1 [3.1.5] or Ch.6 Sec.2 [3.1.5], i.e, only intact conditions should be used to determine Sigma_x, as applicable.	
372	6/3.6	Question	corrugated BHD	2007/3/9	Shear buckling of vertical corrugated bulkhead is required for BC-A and BC-B only. The same limitation is stated in [1.1.2 b)]. This is inconsistent to other requirements for corrugated bulkheads which apply to all ships. Does this requirement apply to all ships as well, same as Sec 1 [3.2.3] and Sec 2 [3.2.6]? Please explain.	It is typo. The wordings "for BC-A and BC-B ships" are delted from the text in Ch. 6 Sec 3 [1.1.2] and the title of [6]should be deleted. This editorial corrrection is included in "Corrigenda 2".	
373	6/4.1.3.1	Question	direct calculation	2007/3/5	In addition the primary supporting members for BC-A and BC-B ships are to comply with the requirements in (3) and (4)" The Sub-Section (4) is about buckling strength of pillars is this typo error?.	Yes, it is a typo error. The text of this requirement should be read as: For primary supporting members for ships having a length of 150 m or more, the direct strength analysis is to be carried out according to the provisions specified in Ch 7, and the requirements in [4] are also to be complied with. In addition, the primary supporting members for BC-A and BC-B ships are to comply with the requirements in [3]. **Also Included in Corrigenda 5**	
374	6/4.	Question	Flooding Requirement s	2009/9/4	This section applies to primary supporting members in intact condition only. Do we not check primary supporting members on the boundaries of dry compartments against flooding load, such as those on a plane bulkhead at forward of foremost hold or aft bulkhead of aftermost hold? This is inconsistent to flooding requirements for local plates and stiffeners in Ch 6 Sec 1 and Sec 2 covering all ships. Please explain.	Your comments have been noted and further studies have been made to consider extending the requirements for flooding conditions, the outcome of which will be included in a future revision of the Rules.	
380	6/1.2.7.3	Question	Holds loaded with steel coils	2009/10/6	The results currently obtained show an important increase of the gross thickness for plating of hopper and inner hull when applying the formulas of Ch.6 Sec.1 [2.7.3] under steel coils loads. Should this calculation of hopper sloping plate and inner hull plating for steel coils loads be performed?	Your comment has been noted and this issue has been addressed in RCN No.1-3 to the July 2008 Rules.	

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382	6/2.3.1.5	Question	stiffeners	2007/3/9	Could you please confirm how to determine the reference point of Z cordinates of stiffeners when calculating the normal stress sigma_x of stiffeners which contribute to the hull girder longitudinal strength? Is it the same as JTP?	The reference point for stresses and loads calculations is at the bottom and middle of its web, ie. where the stiffener joins the attached plating. This is different to the CSR Oil choice which base the reference point at the top.	
383	6/3.4.2.1	Question	The Normal Stress Sigma_n	2007/10/24	Could you please confirm how to determine the normal stress sigma_n which is based on the axial stress calculated at the attachment point of the stiffener to the plate? Is it the same as JTP?	We confirm that: 1)the normal stress sigma_n is the axial stress of longitudinal stiffener which is calculated at the attachment point of the stiffener to the plate, 2)it is the same way as JTP.	
389	Table 6.3.2	Question	Shear Buckling	2007/5/14	Case 6 of Table 2 for shear buckling is applicable only for da/a<=0.7 and db/b<=0.7. Then, how to calculate shear buckling where da/a>0.7 or db/b>0.7? Please advise particularly on the following points: 1) Presume that the formua of "r" yields conservative results. If so, is it acceptable to use the formula of "r" also for the case of da/a>0.7 or db/b>0.7? 2) In case of the panel with large aspect ratio with opening of da/a>0.7 or db/b>0.7, please advise any guidance/criteria of shear buckling calculation for the panel with one edge free (similar to Case 3 and Case 4 for axial compression).	If a cut out has a size beyond the limits of d_a/a<=0.7 or d_b/b<=0.7 only small stripes are left beside the opening. The whole shear is transformed in a S-shape deformation of the stripes. This behavior is not comparable to the assumption, that the elementary plate field acts as one buckling field. An extrapolation of the formulae of BLC 6 is not designated. Up to now we are not able to provide user of the CSR for BC with such an additional buckling load case.	
402 attc	6/1.3.1.3, 6/1.3.2.2, 6/2.3.1.3, 6/2.3.2.5	CI	Flooding Require-ments	2007/7/12	3 Questions related to flooding requirements in Ch.6, Sec.1 1 and 2	Question Q1: Your understanding is correct: Ch 6, Sec 1, [3.1.3] and Sec 2, [3.1.3] will be revised, as editorial correction to "The lateral pressure in flooded conditions pF is defined in Ch. 4 Sec. 6 [3.2.1]". Question Q2: Ch 6, Sec 1, [3.2.2] and Sec 2, [3.2.6] are requirements coming from UR S18. The reference to the design resultant pressure in Ch 4, Sec 6, [3.3.7] only is fully in line with UR S18. Consequently, there is no need to add any reference to [3.3.6]. Question Q3: Your understanding of the summary of flooding requirements should take into account the answer to question Q2 above. **Also Included in Corrigenda 5**	Y
408	6/1.2.2.1	Question	scantling determina-tion	2007/3/12	In the determination of the minimum net thickness of side shell plating in paragraph [2.2.1] of Chapter 6, Section 1, which draught is to be used in the formula ? The moulded draught or the scantling draught ?	Since the moulded draught can change during the ship's life, the draught to be used in the formula is the scantling draught.	
409	6/1.2.2.1	Question	formula	2007/3/2	In the determination of the minimum net thickness of side shell plating in paragraph (2.2.1) of chapter 6, section 1, can you recdefine more clearly the extent of side shell where the formula is to be applied.	The formula is to be applied from the minimum design lowest ballast waterline amidships to 0.25 Ts (minimum 2.2m) above Ts.	

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418	6/2.4.1.2	CI	Net Sectional Modulus of web Stiffeners	2007/1/14	Ch.6 Sec.2 [4.1.2] Net sectional modulus of web stiffeners of primary supporting members. Should the net sectional modulus be calculated with or without attached plating? If the answer is "with the attached plate", then what is the effective width to be considered? Please consider clarifying the section.	The net section modulus of web stiffener of non-watertight primary supporting member should be calculated without the attached plating.	
419	Ch.6 Sec.2	Question	Ordinary Stiffiners	2007/4/25	What is the definition of “ordinary stiffener”? Are web stiffeners of primary supporting members to be considered “ordinary stiffener”?	Web stiffeners of primary supporting members are not to be considered as "ordinary stiffeners".	
425 attc	6/1.2.7.3 & 2.2.5.3	CI	Steel coil loading	2009/10/6	Please see enclosed document "Ch6. Sec. 1 [2.7.3] Steel coil loading on hopper plate.doc" regarding steel coil loading on inner side/hopper plate. Q1: Please comment on enclosed document regarding acceleration formulation for steel coil on hopper sloping/inner side. Please note that the hopper normal acceleration calculated directly based on the fundamental accelerations is smaller than the rule accelerations. Dependent on the term sin(alpha-theta2) , the roll acceleration will work towards the gravity acceleration. Please note that the acceleration is sensitive to the definition of COG. The procedure to define COG should be clearly defined in the rules. With reference to IACS KC #380 please consider above acceleration calculations. Q2: DNV have noted that the results of eq. [2.7.3] give very strict results for the hopper sloping plate. The thickness of the hopper sloping plate is in many cases in excess of the requirement of the inner bottom. The force on the hopper is larger than the force for the inner bottom. This is caused by the Ck factor which is 4 for 2 tiers stowage. Could you please give details regarding the background of this term. According to our steel coil experts the stowage is, even though it is shored, quite flexible. Have there been attempted any test to account for the amount of force taken by the hopper plating?	Your comment has been noted and this issue has been addressed in RCN No.1-3 to the July 2008 Rules.	Y

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
457	6/2.3.2.3	CI	Formula	2007/7/16	According #356 the span "l" in the formula of CH6, Sec3, 3.2.3 has to be calculated taking the brackets into consideration according CH3, Sec6, 4.2. In case of a ballast cargo hold frame of a SSS-BC the side frame brackets are not comparable to the ones shown in Fig. 3 of CH3, Sec6, 4.2.1. The brackets of a side frame elongate the side frame more than that they shorten it. How should we take the brackets of a side frame in a ballast cargo hold into consideration?	For the application of Ch6, Sec2, 3.2.3 in case of a ballast cargo hold frame of a SSS-BC, the way to consider the brackets is clearly defined in the fourth sketch of Fig 2 of Ch3, Sec6, 4.2.1.	
460	6/3, 5/2	CI	Ordinary Stiffeners & Stiffened Panels	2007/7/13	Ch. 6 Sec. 3 Bucking & ultimate strength of ordinary stiffeners and stiffened panels. According to [1.1.2] buckling assessment of longitudinal material is not required for flooding conditions. According to URS 17 buckling check is required for flooding condition. Quote: S17.5 - Strength criteria The damaged structure is assumed to remain fully effective in resisting the applied loading. Permissible stress and axial stress buckling strength are to be in accordance with UR S11.Unqoute. The Ch. 5 Sec. 2 HULS is calculating axial stress buckling of hull girder due to flooding bending moment. Q1. We assume that CSR fulfils URS17.5 by HULS check of Ch. 5 Sec.2. Please confirm Q2. We assume that buckling according to Ch. 6 Sec. 3 need not be calculated in flooding condition as outlined in [1.1.2]. Please confirm.	1)Yes. Your assumption is correct. 2)Yes. Your assumption is correct.	
470 attc	6/3.3.2.4	Question	Compression Stress	2008/7/2	What kind of compression stresses have to be used in the buckling check formulae for the individual compression stresses in 3.2.4 of CH6, Sec3?	We will consider the rule change proposal.	Y
475	6/1.2.3.3	CI	Net Thickness of the Bilge plating	2007/7/27	Ch. 6 Sec. 1 [2.3.3]: This section requires that the “net thickness of the bilge plating is to be not less than the actual net thicknesses of the adjacent 2 m width bottom or side plating(..)” Is this requirement referring to: 1. As built thickness; 2. Thickness required by Ch. 6; 3. All thickness requirements in CSR. (Ch. 7 FEM requiremtns, 9 sec. 1 Strengtheing of bottom forward etc). Please advise.	This requirement is referring to the net thickness offered of the adjacent bottom and side plating.	
483 attc	Table 6.3.3	RCP	Buckling and reduction factors for curved plate panels	2007/8/28	Regarding the buckling and reduction factors for curved plate panels in Ch 6, Sec 3, Table 3, there is a partition line in the first column between buckling load cases 1a and 1b. However, in the original GL rules, there is no such line, see attached. This partition line is likely to cause incorrect values of Sigma x, hence should be deleted.	Yes. This is typo. We will issue the "corrigenda" soon. **Also Included in Corrigenda 5**	Y

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
493 attc	6/2.4.1.1	CI	Correct application of the formula with respect to pressure on ordinary stiffeners.	2008/1/9	Ref. Ch. 6 Sec. 2 [4.1.1] Q1: Please advice what is the correct application of the formula with respect to pressure on ordinary stiffeners: a.External and internal pressures are to be considered separately. b.Combined effect of pressures to be considered. In case of b.) please advice how to combine pressures (see attached drawing) Q2: We assume correct interpretation of "Web stiffener mid height" is "Web stiffener mid length" . Please advise.	A1. The requirement of Ch 6 Sec 4 [4.1.1] is provided for checking the scantling web stiffener and web connection with ordinary stiffener. Therefore, the checking formula is provided as a function of the pressure acting on the ordinary stiffener with coefficient depending on the web connection with ordinary stiffener. In case of web stiffener attached to floor in double bottom which is used for water ballast, the pressure p is to be calculated as follows: A: Web stiffener and the web connection with the bottom longitudinal: The considered pressure is the greater of: (1) Pressure acting on bottom longitudinal due to external sea water in full load condition, or (2) Pressures acting on bottom longitudinal due to internal pressure due to ballast water in double bottom tank and external sea water in ballast condition, in line with Ch 6 Sec 2, 1.3.1 B: Web stiffener and web connection with the inner bottom longitudinal: The considered pressure is the greatest of: (1) Pressures acting on inner bottom longitudinal due to bulk cargo in full load condition, or (2) Pressures acting on inner bottom longitudinal due to ballast water in ballast condition, or (3) Pressure acting on inner bottom longitudinal due to ballast water in ballast hold, if applicable, in heavy ballast condition. The required net sectional areas of web stiffener are to be calculated independently for the foregoing connections A & B. The final required net sectional area of the web stiffener is the greater the calculated areas for A & B. A2: "Web stiffener mid height" means "Web stiffener mid length".	Y
497 attc	6/1.1.5	Question	Pressure point for scantling check of corrugation web	2007/10/9	Where is the pressure point in the attachment to be used for scantling check of corrugation web ? Please note that option 1 is inside the gusset/shedder. Therefore, eventually there is no pressure.	For the determination of the net thickness of the web plate according to Ch 6, Sec 1, [3.2.1], the load point for the pressure is taken at the bottom of corrugation (e.g., Option 1 in the attached sketch). The reason is that the effect of shedder and gusset plates is not considered to insure that the calculation is conservative.	Y

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
516	6/3.1.1.3	Question	elementary plate panels	2007/7/26	Regarding to Ch 6 Sec 3/1.1.3, "The boundary condition for elementary plate panels". We normally consider that cases 3, 4 and 7 to 10 of Table 2 are applicable where one or two plate edges are supported by solid floors, bottom girders, non-tight/tight bulkhead plates (bottom/inner bottom plate), side web frames, side stringers, deck plates, non-tight/tight bulkhead plates (side shell) and Transv. webs, deck girders, non-tight/tight bulkhead plates (deck plate). Please advise an example of structures for the application of case 3.4., and 7 to 10 of tables 2 for clarity of the requirement in 1.1.3	BLC3 and BLC 4: These BLCs can be applied for a typical plate field, where the plate is not continuous at one side. This side may be stiffened with a profile without flange (e.g. Flat bar) or not stiffened. Structural examples are plate fields located at manholes or plate fields of the hopper transverse web frame. BLC7: The edge of an elementary plate panel can only be treated as a clamped edge, when the rotation about its axis is prohibited. Therefore, this BLC can be applied for in a web buckling check of stiffeners without flanges which are attached to a very thick plate, e.g. a Flat Bar 400*20 mm attached to a 50mm thick plate. BLC8 to BLC 10: These BLCs are mostly theoretical cases included for the sake of completeness of the Table. There is no case to be applicable for an actual structure.	
518	6/1.2.5.3	CI	Definition of the length of "long superstructures"	2007/8/30	Please advise the definition of the length of "long superstructures" specified in Ch6 Sec1, 2.5.3 .	Long superstructures are effective superstructures as defined in Ch.9 Sec.4 [1.1.5], i.e. located within 0.4L amidships and having a length greater or equal than 0.15L or 12 m. **Also Included in Corrigenda 5**	
522	6/2.1.4.2	CI	Pressure calculation positions	2007/8/28	The pressure calculation positions would be clearly defined for vertical stiffeners where spans are corrected according to Ch3 Sec6 4.2.1. Positions for pU and pL need not to be considered the corrected upper and lower points of the span. Or positions for pU and pL should be also corrected 4.2.1. According to Sec3 5.2.2.3 of Tanker CSR, corrected span need not to be considered.	The pressures pU and pL are to be calculated at the ends of the vertical stiffener - i.e. without considering any correction of span - as it is stated in the definition of pU and pL in Ch 6 Sec 2 [1.4.2] and in accordance with the practice.	
525	6/4.1.1.1	RCP	Primary Support Members	2007/10/2	Regarding Ch.6, Sec.4-1.1.1 (Primary supporting members - Application), the conjunction 'and' in the passage quoted below is equivocal hence it is requested to change it to 'and/or' to be such that transverse members to be also applied are cleary referred to. Quote; 'subjected to lateral pressure and hull girder normal stresses' Unquote; Without the proposed change, there would be a risk of being read that the requirement can be applied only to longitudinal primary supporting members (PSM) such as bottom girders. The requirement, in particular minimum net thickness of webs of primary supporting members (Ch.6, Sec.4-1.5.1), should be applied to transverse PSM as well such as transverse web in hopper tank.	The requirements of this Section apply to the strength check of pillars and primary supporting members,subjected to lateral pressure and/or hull girder normal stresses for such members contributing to the hull girder longitudinal strength. **Also Included In Corrigenda 5**	

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
529 attc	6/3.4.2.2 & 6/3.5.1.1	RCP	Buckling requirement for longitudinal and transverse stiffeners	2008/6/19	Regarding the buckling requirement for longitudinal and transverse stiffeners (6/3.4.2.2, 6/3.5.1.1), it is requested that the Rule sub-paragraphs below are given editorial review in respect of the comments/questions attached thereto. If these be found justifiable, a corrigendum would be considered necessary. 1. Nominal lateral load (Pzy) for transverse stiffeners (6/3.4.2.2): In the equation, sigma_xl should be changed to sigma_x , since the sigma_x in this case is not axial stress of the transverse stiffeners and hence the attached area will not be necessary. 2. Elastic support provided by the stiffener (cf) for transverse stiffeners: (6/3.4.2.2): Cs depends upon a degree of fixity at the ends of the stiffener sustaining lateral pressure and is independent of any elastic support due to in-plane stresses working in the attached plate. The Cs should therefore be deleted in the relevant equation. 3. Effective width of attached plating for transverse stiffeners (6/3.5.1.1): The effective width of the attached plate is considered part of the stiffener space and depends upon working stress along the stiffener. In this connection, kappa_y in the formula should read kappa_y' which is calculated in Ch. 6, Sec. 3, Table 2 as kappa_x in Buckling Load Case 1 with a in place of b. It should be noted that kappa_y itself in Buckling Load Case 2 depends upon the stress working normal in the case of application to transversely stiffened stiffeners.	A1 - It is agreed that in the equation giving the nominal lateral load (Pzy) for transverse stiffeners (6/3.4.2.2), sigma_xl should be changed to sigma_x. A2 The parameter c_s defines the degree of fixation for the transverse stiffener. In case of a structure as defined in Fig. 1 the transverse stiffener will collapse between the longitudinal girder and not between the longitudinal stiffeners. In this case c_s reduces the buckling length of the stiffener according the Euler buckling case (partially restrained). If it can be assumed that the transverse stiffener will collapse between the ordinary longitudinal stiffener c_s =1. Therefore no modifications of the formulas are necessary. A3 The effective breadth has to be calculated under the assumption that the neighbouring elementary plate field is buckled under loads, acting parallel to the stiffener. Therefore the effective plate breadth has to be reduced to the effective width. The formulae in 4.2.2 are connected to the co-ordinate system, defined in Figure 1. In this figure a transverse ordinary stiffener (n=1) is located on the shorter edge of the elementary plate panel. In case of an ordinary stiffener, located normal to the ship's x-axis, but at the longer side of the attached elementary plate field, this stiffener is a LONGITUDINAL stiffener in terms of buckling! Therefore the formula for p_zx has to be used with the effective with a_m and S_x= transverse stress is ship co-ordinate system. But this translation has not to be done in the rules text. Therefore no modifications of the formulas are necessary.	Y
546	6/1.2.7.4 & 6/2.2.5.4	CI	Weight of the Steel Coil	2008/2/7	JBP rules Chapter 6,Section 1.2.7.4 and Chapter 6,Section 2.2.5.4 (steel coil). In this requirement it is stated that where the number of load points per element plate panel n2 is greater than 10 and/or the number of dunnages n3 is greater than 5, the inner bottom may be considered as loaded by a uniform distributed load. The question is how to calculate the above uniform distributed load. Is it the weight of the steel coil divided by the diameter and length of the steel coil as the uniform load, or the weight of the steel coil divided by the length of the steel coil only?	A similar question was asked under KC ID #331. The approved answer (on 12/01/2007) was "A definition of uniform loads on inner bottom will be included in CSR for bulk carriers. Considering your specific proposals, the interpretation is that the uniform load is the weight of the steel coil divided by the diameter and length of the steel . We will consider the rule change proposal based on the output of the Hull Panel.	

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
547	6/3.1	CI	The Sequence of Buckling Assessment	2008/1/9	What is the right sequence of performing the buckling assessment according CH6, Sec3?	The sequence of the buckling checks follows the arrangement of Chapter 6, Section 3. In case of the buckling check for a typical ship structure (e.g. longitudinal stiffened bottom) the elementary plate panel has to be dimensioned first according the plate buckling criteria. In the following lateral buckling check of the stiffeners the net moments of inertia is derived including the effective width of the attached plating. This effective width depends on the thickness of the plate field. If this thickness is not sufficient for plate buckling, the effective width and also the moment of inertia of the stiffener is too small. As a result a larger stiffener would be required to pass the lateral buckling check. And this larger stiffener gives no bonus for the plate buckling check. Therefore it is important to make the plate buckling check before performing the lateral buckling check.	
551	Symbol 6.1	Question	Countermeasure for panel buckling	2007/10/24	As a countermeasure for panel buckling, a carling with snipped ends is fitted on a slender panel so as to reduce the aspect ratio of the panel. Can the reduced aspect ratio of the panel which is calculated by (s/l) be used in determining the thickness of such panel according to Ch 6 Sec 1? Where s and l are defined in "Symbols" in Ch 6 Sec 1.	Yes, the reduced aspect ratio of the panel which is calculated by (s/l) may be used in determining the thickness of such panel according to Ch 6 Sec 1.	
557 attc	6/1.2.3.2, 6/1.3.2.1, & 6/1.3.2.4	Question	Bilge Plate Thickness	2008/1/28	Regarding bilge plate thickness, Q1: Is always C6/S1/[2.3.2] to be applied regardless of the spacing (sb) of floors or transverse bilge bracket vs chord length (l)? Q2: Is C6/S1/[3.2.1] to be applied regardless of the spacing (sb)of floors or transverse bilge bracket vs chord length (l)? Q3: Is C6/S1/[3.2.4] to be applied regardless of the spacing (sb)of floors or transverse bilge bracket vs chord length (l)? Q4: If C6/S1/[3.2.4]is to be applied,is cr to be calculated as follows; (a) when sb < l: cr=1-0.5sb/R=1.0 assuming that R=infinitive, (b) when sb>=l: cr=1-0.5l/R?	A1: The requirement of Ch6 Sec 1 2.3.2 applies only to bilge plating which are transversally framed. A2: The requirement of Ch 6 Sec 1 3.2.1 is applied to bilge plating regardless of the framing system. A3: The requirement of Ch 6 Sec 1 3.2.4 is applied to bilge plating regardless of the framing system. A4: The additional stiffness of a panel due to curvature is given by the parameters radius and chord length. If sb>=chord_length, the elemenatry plate panel is longitudinal stiffened, hence cr=1-0.5*s/r. If sb<chord length, the elementary plate panel is transversally stiffened, Cr is taken equal to 1.	Y

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
563 attc	3.6.19, 6/2.3.3.3 & 6/2.3.3.4	Question	Modulus of the Lower or upper Bracket	2008/2/7	According to Ch.6 Sec.2 [3.3.3] and [3.3.4], section modulus of side frame+bracket is required at the level of lower or upper bracket as shown in Ch.3 Sec.6 Fig.19. According to the Fig.19, it is unclear how to measure the height of the bracket for the purpose of section modulus calculation. For the purpose of hLB/tLB ratio the height of the bracket is defined in Ch. 3 Sec. 6 figure 22, which is also unclear. We assume hLB for section modulus and hLB for hLB/tLB ratio is calculated in the same way. Please confirm. Attached please find two alternative approaches for calculation of hLB. A. hLB is measured perpendicular to bracket flange. B. hLB is measured perpendicular to the projection of the lower bracket slope. Please confirm correct approach for measuring bracket height hLB.	In Ch 6, Sec 3, [3.3.3] and [3.3.4], for the purpose of calculating the actual section modulus of the lower (respectively upper) bracket, the web height is to be measured at section noted "lOWER BRACKET" (respectively "UPPER BRACKET") on Fig 19 of Ch 3, Sec 6. In Ch 6, Sec 3, [3.3.3], for the purpose of hLB/tLB ratio the height hLB of the bracket is measured according to the definition in [3.3.3] and so according to Ch 3, Sec 6, Fig 22. It is corresponding to the Figure B of your attached document.	Y
567 attc	6/1.2.3.3	Question	Net thickness offered of the adjacent bottom and side plating	2007/10/26	Reference is made to IACS KC#475. Quote This thickness requirement is referring to the net thickness offered of the adjacent bottom and side plating. Unquote Please advise how to define the bilge plating for fwd and aft parts of the cargo hold region. E.g. - attached sketch is showing a cross section in the fore part of a bulk carrier. - Bottom is strengthened for bow impact - bilge plating is to comply with KC#475. Please advise bilge extent.	Within 0,4L amidship the definition of bilge plate is the same as defined in Table 4.1.1 of Section 4, CSR for DH oil tanker. That is: “The area of curved plating between the bottom shell and side shell. To be taken as follows: From the start of the curvature at the lower turn of bilge on the bottom to the lesser of, the end of curvature at the upper turn of the bilge on the side shell or 0.2 D above the baseline/local centerline elevation.” Outside of 0.4L amidships the bilge plate scantlings and arrangement are to comply with the requirements of ordinary side or bottom shell plating in the same region. Consideration is to be given where there is increased loading in the forward region.	Y
579	6/3.2.1.3	Question	Shear force for buckling	2008/5/30	Total shear force for buckling check is to be obtained by following formula Q = Q_SW + C_QW x Q_WV. Then the distribution of total shear force is discontinuing at midship since the sign of C_QW is to be change at midship according to the foot note of Table 3 in Ch4 Sec 4. This discontinuity will cause scantling change between midship, especially for H1, H2, F1 and F2 load cases. Is it correct and expected?	Yes, it is correct but the scantling discontinuity is not expected. We will consider the rule change proposal in order to eliminate or minimize the scantling discontinuity, considering the answer in KC 685.	

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
580 attc	6/2.3.2.4	CI	The line Supported by girders or welded directly to decks or inner bottoms	2007/10/26	In Ch 6, Sec 2, [3.2.4], it seems that in Table 4 (case with lower stool), the line "Supported by girders or welded directly to decks or inner bottoms" should not be mentioned in the table since this case is a case without any lower stool. Please confirm our interpretation. Furthermore, both Table 4 and Table 5 should not mention the column "Supported by girders" since it is not applicable to bulk carriers.	We agree with your interpretation: in Table 4, the only case to be taken into account is the "Welded to stool efficiently supported by ship structure" one. Also, the "supported by girder ends" do not correspond to bulk carriers but other type of ships. Consequently, the column "Supported by girders" should be deleted in Table 4 and 5. Corrected table 4 and 5 are given in attached file.	Y
581	6/2.3.2.4	Question	Span "l" to be considered for the calculation of pressures	2007/10/25	In Ch 6, Sec 2, [3.2.4], what is the span "l" to be considered for the calculation of pressures (p_mid-span, p_u , P_L)? Is it the span defined in figure 6 or the span between upper level of lower stool and lower level of upper stool?	The span "l" to be considered for the calculation of pressures (p_mid-span, p_u, p_L) is the span as defined in figure 6.	
584	6/4.4.1.1	CI	Compressive stress of pillars	2007/10/23	We understand that the compressive stress of pillars mentioned in 6-4/4.1.1 is the stress by the static loads and the dynamic loads. However, there is no clear statement in CSR how to calculate the loads on pillars. The clear interpretation on this is to be developed. As an alternative, we think that the current Class Society Rules may be used for determine the pillar scantlings. Please confirm.	Yes, the stress to be checked is the one induced by the static and dynamic loads that are acting onto the decks above the considered pillar. These loads are to be calculated accordingly to chapter 4.	
594	6/1.2.3.3	Question	The Thickness of the Bilge Strake	2008/2/7	The thickness of the bilge strake is determined according CH6, Sec1. The scantling check includes also a buckling check of the longitudinal or transverse framed curved plating. Nevertheless it is required, that the thickness of the bilge strake is not less than the greater thickness of the bottom and the side shell plating. What is the reason, that the thickness of the bilge strake has to be increased, if the bilge strake with a thickness smaller than the bottom and the side shell passes all design checks (Yield, Buckling, FE-Analyses). The GL-Rules (I-Part 1, Sec6, 4.1) allows a smaller thickness, if the shear strength is sufficient and if the bilge plate panels passes the buckling check including buckling of curved panels.	In order to have no large discrepancies in thicknesses for welding, it is a normal building practice to provide a continuity of thicknesses between bottom, bilge and side shell. That is the reason of the requirement that the thickness of the bilge strake is not less than the greater thickness of the bottom and the side shell. However, provided all the design criteria have been fullfilled: - minimum thickness, - yield, - buckling, - FE analyses, a smaller thickness of the bilge strake may be accepted.	

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
609 attc	6/1.2.7.1& 6/2.2.5.4	RCP	Steel Coil Loading	2008/2/7	Reference is made to Ch. 6 Sec. 1 [2.7.1] and Sec. 2 [2.5.4] Steel coil loading and related KC# 331 and 546. Ch. 6 Sec. 1 [2.7.1] and Sec. 2 [2.5.4] Quote "Where the number of load points per elementary plate panel n2 is greater than 10/or the number of dunnages n3 is greater then 5, the inner bottom may be considered as loaded by a uniform distributed load. In such a case, the scantling of the inner bottom ordinary stiffeners is to be obtained according to [3.2.3]" Unquote We understand that "distributed load" is sometimes interpreted as P = WCoil/(lcoil x dcoil) where lcoil and dcoil is the length and diameter of coil respectively. DNV have investigated the effect of such interpretation with the stiffener scantling as example. Our conclusion is that such a interpretation is unsafe and should be changed to distributed load over one elementary plate panel as described below. Please find enclosed DNV report and rule change proposal enclosed for your consideration.	This question is identical to KC ID#546, and the answer is that the uniform load of due to steel coil is the weight of the steel coil divided by the diameter and length of the steel . A rule change proposal will be considered based on the output of the Hull Panel.	Y
610	Ch.6, Sec.3 4.2.	RCP	Buckling Assessment of stiffended panel	2008/5/30	1. Lateral buckling assessment of stiffened panel including side frame is treated as longitudinally stiffened panel which has a stiffener arranged on the direction of the longer side of the panel. Please confirm it. 2. In case that shear stress on side shell as attached plate of side frame is large, shear stress is the dominant load of lateral buckling of side frame. It is not understandable for us. Please show the technical background in this regard. Even though the thickness of side shell plates comply with Ch5 Sec1, 2.2 & Ch6 Sec3, 2.1.3, the side shell plate thickness should be increased due to the result of lateral buckling assessment of side frame. It is necessary to reconsider the above requirements which require increase of scantling of hull girder members due to the result of local strength check. 3. We request to reconsider the requirement of lateral buckling assessment for side frame in connection with above 1. and 2.	A1) Confirmed. Comment on 2) and 3) It is obvious, that for transverse members the axial stress component is zero in the formula for the criteria and the equation for p_z (nominal lateral load). The remaining stress component is the hull girder bending stress with its zero crossing and shear. And so shear becomes dominant. We support to reconsider the requirements for lateral buckling.	
621	6/3-4.2 and 5.1	CI	Ultimate Strength in lateral buckling mode of side frames	2008/4/11	Regarding ultimate strength in lateral buckling mode of side frames of single side bulk carriers in Ch.6, Sec.3-4, our interpretation is that 'transversely arranged' side frames should be treated as 'longitudinal stiffeners' in Ch.6, Sec.3-4.2 and -5.1 since the ends of side frames can be considered as fixed ends taking account of the requirements of upper and lower connections of side frames as stipulated in Ch.6, Sec.2-3.4. Confirmation is requested as to whether the above interpretation is correct or not.	Yes, side frames of single side bulk carriers are longitudinal frames in context of CH6, Sec3. The definition "longitudinal" is given in CH6, Sec3, Symbols and Fig. 1. This is independent from the fixation of the ends of the frames.	

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
623 attc	6/A1.1.3.2	RCP	Buckling Panel idealization for d) General Triangle	2008/4/24	Regarding the buckling panel idealization for d) General triangle in Ch 6, Appendix 1, 1.3.2, it is mentioned that general triangle is treated according to a) "Quadrilateral panels" above. However, in the case of a triangle with all acute angles, a rectangle with the smallest area cannot be specified as the three rectangles that completely surround the general triangle have the same area, see attached. Just the original paragraph cannot result into a final rectangular panel with the smallest area represented by the dimensions, a, b and panel angle Theta. As such, an alternative stipulation covering both obtuse triangles and acute triangles is requested.	Neither the DIN18800 nor the GL-buckling rules, which are the basis for CH6 Sec3 of the CSR-BC, consider triangular elementary plate panels as described above. The appendix of CH6 describes general approaches for an engineer to evaluate non standard geometry. Remeining items are up to engineering judgement.	Y
624 attc	Symbol 6.3 & 6/3.1.1.2	CI	Application of buckling requirements	2008/5/12	This question relates to application of buckling requirement (Ch.6, Sec.3) and SOLAS XII/6.5.3. (A) According to IACS Unified Interpretation of SOLAS XII/6.5.3 (SC209, June 2006), safety factor of 1.15 for buckling requirement should be applied to longitudinal and transverse ordinary stiffeners for the following areas: - hatchway coaming, - inner bottom, - sloped panel of topside tanks and hopper tanks (if any), - inner side (if any), - top stool and bottom stool of transverse bulkhead (if any), - stiffened trasnverse bulkhead (if any), and - side shell (if directly bounding the cargo hold). (B) According to Symbols in Ch.6, Sec.3 of CSR-BC Rule, safety factor (S) for buckling requirement refers to the same members as stated in above (A) except stiffened transverse bulkhead, e.g. collision bulkhead and aft bulkead in an aftermost cargo hold. (C) According to Ch.6 Sec.3-1.1.2 (a) of CSR-BC Rule, the application of the buckling requriement is to 'ordinary stiffeners in a hull transverse section analysis'. We think the interpretation of 'hull transverse section analysis' is 'longitudinal members and hold frames'. If the interpretation is correct, locations to be checked are the same as stated in above (A) except stiffened transverse bulkhead and top/bottom stools. Considering the above situation, it is considered necessary that the following elements be inserted: in Safety factor (S) in Symbols in Ch.6, Sec.3, 'stiffened transverse bulkhead, if any', in Ch.6, Sec.3-1.1.2(a), 'ordinary stiffeners on stiffened transverse bulkhead and on top and bottom stools, if any'.	Your interpreation (A) to (C) is correct. We will consider the Rule Change proposal or Edditorial correction for clarification of the application.	Y

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
629	6/1.2.5.1	CI	Net thinkness of a welded sheerstrake	2008/5/9	Regarding the requirement of welded sheerstrake (Ch.6, Sec.1-2.5.1, 'The net thickness of a welded sheerstrake is to be not less than the actual net thickness of the adjacent 2 m width side plating, taking into account higher strength steel corrections if needed'), it is noted that there is the relevant Q&A (KC ID No.212). However, the answer does not seem clear hence it would be appreciated if the following proposal be considered. The answer of KC ID No.212 says, 'Generally, when the side shell plating adjacent to sheerstrake includes single side part and is increased due to the buckling and hull girder shear strength, it is also the case for the sheerstrake, which is located above. Consequently, we see no reason to modify this requirement'. This will be the case when the sheerstrake covers part of single side skin (SSS) area. However the fact is that almost all sheerstrakes do not cover the part of single side skin area, i.e. they are located within top side tank (TST). Generally speaking, hull girder shear strength is occasionally critical to the scantling of single side skin, while it is not to the scantling of sheerstrake within TST area since the relevant shear flow calculation shows that the shear stress in SSS is considerably bigger than that in TST area. Such being the case, the requirement should be interpreted as follows: 'The net thickness of a welded sheerstrake is to be not less than the net required thickness of the adjacent 2 m width side plating, which is calculated according to the relevant requirements in Ch.6, Sec.1'.	We agree to the interpretation that the net thickness of a welded sheerstrake is to be not less than the net required thickness of the adjacent 2 m width side plating, which is calculated according to the relevant requirements in Ch.6, Sec.1	
631 attc	6/1-2.7, 6/2-2.5	CI	Steel coils	2008/4/11	Regarding Ch.6, Sec.1-2.7 and Sec.2-2.5 about steel coils, it would be appreciated for KC to reply to the following comments. 1. The requirement for plates and ordinary stiffeners on hopper sloping and inner hull plating (Ch.6, Sec.1-2.7.3 and Sec.2-2.5.3) seems to require considerably severe scantlings as compared to that in pre-CSR BC. In this connection, it is requested that a background document be supplied to users. 2. It is understood that the requirements of Ch.6, Sec.1-2.7.3 and Sec.2-2.5.3 are based on the assumption that the steel coils are in uniform contact on the hopper sloping or inner hull plating. In aft and forward cargo holds, however, there are some cases where the steel coils do not uniformly touch on them. Attached is the example. Hence it is necessary that a procedure of how to deal with it in that case be provided. 3. Regarding Ch.6, Sec.1-2.7.4, it is noted that an answer of KC ID.331 says that a definition of uniform load will be included in CSR BC Rules. In the meantime, it is requested beforehand to be confirmed that the 'uniform load' is not uniform load over the inner bottom plate but uniform line loads.	A1: A Rule Change Proposal with associated Technical Background is presently under preparation. A2 and A3: Please, refer to the answer of KC ID#546 and 609.	Y

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
639	6/4.2.2 and 4.2.4	Question	Net Web thickness requirements	2008/7/16	With respect to Net Web Thickness requirements for centre girders, side girders, floors, stringer of double side structure and transverse web in double side structure for ships of less than 150m in length, it is requested to confirm whether our interpretation below is correct or not. 1. Ch6/4.2.2.1, 1.1 pS,IB and pW,IB are Cargo pressures from Cargo Hold or Ballast pressures from Ballast Hold. These still water and wave internal pressures are to be reduced from the corresponding Ballast pressures from Water Ballast Tank. 1.2 pS,BM and pW,BM are External sea pressures. These still water and wave internal pressures are to be reduced from the corresponding Ballast pressures from Water Ballast Tank. 2. Ch6/4.2.4.1, 2.1 pS,SS and pW,SS are External sea pressures. These still water and wave internal pressures are to be reduced from the corresponding Ballast pressures from Water Ballast Tank. 2.2 pS,LB and pW,LB are Cargo pressures from Cargo Hold or Ballast pressures from Ballast Hold. These still water and wave internal pressures are to be reduced from the corresponding Ballast pressures from Water Ballast Tank. In this requirement, Cargo pressure from Cargo Hold is to be ignored.	1.1 When the water ballast tank of the double bottom is filled up to the tank top, the static and dynamic pressures due to dry cargoes or heavy ballast are to be reduced from the corresponding ballast pressure of the water ballast tank. 1.2 When the water ballast tank of the double bottom is filled up to the top, the external still water and hydrodynamic pressures are to be reduced from the corresponding ballast pressure of the water ballast tank. 2.1 When the water ballast tank of the double side is filled up to the top, the external still water and hydrodynamic pressures are to be reduced from the corresponding ballast pressure from water ballast tank. 2.2 When the water ballast tank of the double side is filled up to the top, the static and dynamic pressures due to dry cargoes or heavy ballast are to be reduced from the corresponding ballast pressure from water ballast tank. It should be noticed that the static and dynamic pressure combination of each load is not to be negative (see CH4, Sec5, 1.1.1)	
659	6/3.3.1.1	Question	Bilge strake or other curved panels	2008/7/2	Application of the requirement "t>b/100" The formula does not seem applicable to bilge strake or other curved panels	This is right. This requirement is only applicable to planar plate panels. A rule change will be considered.	
664	6/1.3.2.3	Question	thickness for corrugated bulkhead plate	2008/10/10	Required thickness for corrugated bulkhead plate Ref. CSR for Bulk Carriers Ch6 Sec.1 2.1.1, 3.2.1 and 3.2.3 When calculating the required thickness for build-up corrugation bulkheads in intact condition by 3.2.1 of Ch.6 Sec.1, should s of the formula be taken greater width of flange or web according to 2.1.1? We understand that the requirements of 2.1.1 are come from UR S18 and only applicable to the requirement of flooding condition. Please clarify. According to UR S18.4.7, s of the formula for obtaining tN is taken narrower plate width. Can we use narrower width for tN in CSR? Please clarify.	1. Ch 6 Sec 1 [3.2.1] and [3.2.4] “s” is to be taken equal to the value defined in [2.1.1]. For built up corrugation, when the different thickness of flange and web are designed, “s” is to be taken equal to the flange and web of corrugation respectively. 2. Ch 6 Sec 1 [3.2.3] 1) “s” and “p” of the 1st formula should be selected respectively for web and flange in general, (e.g., applied to also for cold forming corrugated bulkhead), 2) “s” and “p” of the 2nd formula should be selected for narrower plating, 3) “s” and “p” of the 3rd to 5th formulas should be selected for wider plating. In order to clarify these requirements, we will conisder the RCP. Regarding the answer of KC 553 The answer seems to be vague but not to be incorrect because it is obviously that the elementary plate panel for built-up corrugated bulkhead is divided into the flange and web of corrugation.	

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
681 attc	6/2.3.3.3	RCP	Gross Thickness and Net Thickness Scantling	2008/4/11	It is proposed that the paragraph in CSR-BC, Ch.6, Sec.2, 3.3.3 be changed in part to eliminate the equivocality as shown in the separate attachment.	IACS UR S12 Rev. 4 is based on the gross thickness. CSR is based on the net thickness scantling. According to Ch 3 Sec 3, the total corrosion addition for webs and flanges of lower brackets of side frame is 5.0mm, and the total corrosion addition of side frame other than lowe brackets and upper brackets is 4.5mm. According to the current requirement of 3.3.3, the gross thickness of lower bracket is greater than 2.0mm of the thickenss of web of side frame. Therefore, as the current rule of Ch 6 Sec 2 3.3.3 is in line with IACS UR S12, the text is kept as it is	Y
682	6/3.4.2 & 6/3.4.3	Question	stiffeners	2009/3/3	Are Ch.6, Sec.3, [4.2] and [4.3] applicable to stiffeners on watertight transverse bulkheads in lower/upper wing tanks and double side and on watertight floors ?	Ch.6, Sec.3, [4.2] and [4.3] are applicable to the stiffeners on watertight transverse bulkheads in lower/upper wing tanks and double side and on watertight floors. In case of hull transverse section analysis, the axial stress for stiffener and shear stress in attached plate are not to be considered.	
685	6/3.2.1.3 & 5/1.2.2.1	Question	Shear force for buckling assessment	2008/5/30	Ch.6,Sec.3,[2.1.3] defines the shear force for buckling assessment as follows: Q=Q_SW + C_QW x Q_WV. There seems to be no limitation to the signs of Q_SW and Q_WV for their combinations. On the other hand Ch.5, Sec.1, [2.2.1] reads: "When they are combined, vertical shear forces Q_SW and Q_WV in intact condition are to be taken with the same sign." Which way should be taken when calculating Q in Ch.6, Sec.3, [2.1.3]: a) Q to be calculated only for the combinations where Q_SW and Q_WV are of same sign, or b) Q to be calculated for all combinations where Q_SW and Q_WV are of either same sign or opposite signs ?	Hull girder shear stress check should be performed at the maximum absolute shear force. Such case occurs at the combination of either (1) Q_SW_pos +(C_QW_pos x Q_WV), or (2) Q_SW_neg +(C_QW_neg x Q_WV), where, C_QW_pos , C_QW_neg : positive and negative load combination factors according to load cases as defined in Ch.4, sec.4,Table 3. The sentence in Ch.5, Sec.1, [2.2.1], which is quoted in the question, reflects this interpretation. Therefore we will consolidate the paragraphs referring to shear force combination into CH5, Sec1 [2.2.1] and replace CH6, Sec3, [2.1.3] with a note referring to CH5, Sec1.	
697 attc	6/2.1.4.2	Question	The pressure P	2008/7/16	The attachment contains four pressure distibutions, where the pressure p can not be derived according to the formulae in Ch.6 Sec.2 1.4.2 How to calculate the pressure p, used in Ch.6 Sec.2 3.2.3 for examples	(1)The pressure distributions shown in cases (c) to (f) may effectively occur when differential pressures are to be considered, i.e. only for vertical stiffeners of the outer shell. However, the scantling of such stiffeners is quite always governed by the case "still water and wave external pressures" to be applied independently of the differential pressures (see Ch 6, Sec 2, [1.3.1]). (2)In addition, such distribution of presssure may be approached by one of the two "standard cases" defined in [1.4.2]. This gives wrong results, but regarding the comment in (1), it doesn't affect the scantling. (3)Of course, some definition of "p" for these distributions may be developped, but no effect on scantlings will occur (see comment in (1)above).	Y

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
708 attc	6/2.4.1.3 & Figure 6.2.9	CI	Web stiffeners of primary supporting members	2008/5/28	Ch.6, Sec.2, [4.1.3] says that this requirement is applicable to the web stiffeners of primary supporting members in water ballast tanks when no bracket is fitted. On the other hand Fig.9 shows, at its left end, the stiffener with integrated bracket at toe to which the subject requirement is applicable. What is meant by "when no bracket is fitted". Please advise if the interpretation on applicability of the requirement is as per the attached cases of stiffener.	It is obviously that Case 1 and Case 3 is applicable to this requirement because the bracket is not fitted as shown in the attached file. For Case 4 to Case 6, as the bracket is fitted to the web stiffener and the value "h'" becomes large, the stress range delta-sigma is small, then such cases are always complied with this requirement. Therefore, although Case 4 to Case 6 shown in the attached file is applicable to the requirement, it is not considered that the check according to this requirement is necessary for such cases. For Case 2 shown in the attached file, although the bracket is fitted, the smallest breadth of such case depends on the bracket size and shape and is similar to that of Case 3. Therefore, this case should be applied to the requirement of Ch 6 Sec 2 [4.1.3] as mentioned in the attached file. As a conclusion, the interpretation specified in the attached file is correct. In order to clarify this interpretation, the editorial correction will be considered as "Corrigenda".	Y
717 attc	6/3.3.2.4	CI	buckling check	2008/9/10	Chapter6_Sec3_[3.2.4] Does tensile stress need to be considered for buckling check? Regarding the tensile stress , there is still different view point on whether it need to be considered for buckling check or not. There would be a solution that, 1) For check the resultant buckling utilization factor, combined by sigma_x, sigma_y and tao, the tensile stress need to be considered as the actual values but with negative sign. 2) For check the individual buckling utilization facor, the factor would be taken as 0. Please be kindly request to provide clarification or confirmation.	1) Even if the estimated stress is negative (tensile stress), the buckling check should be carried out according to the first formula specified in Ch 6 Sec 3 [3.2.4] using the actual values. 2) No individual buckling checks have to be performed for tensile stresses. It is clearly stated, "In addition, each COMPRESSIVE STRESS ... are comply with the following formulae."	Y
722	6/4.4.1.1	Question	Pillars	2009/6/2	Please clarify the design load for pillar scantling calculation.	The design loads acting on the pillar are the static and dynamic loads that are acting onto the decks above the pillar under consideration. These loads are to be determined according to Chapter 4 considering the relevant loads on the decks above.	
748	6/A.1.1.2.2	CI	elementary plate panels	2008/9/10	It seems that the 2nd & 3rd sentences in Ch 6, appendix 1, [1.2.2] such as "The effective width ... in accordance with Ch6, Sec 3 [5]. A constant stress... adjacent elementary plate panels." could be interpreted as follows: 1) When a width of the attached plate is calculated a constant compressive stress to be assumed, accordingly always psi=1.0 both for longitudinal and transverse stiffeners. 2) Sigma_a in Ch 6, Sec 3 [4.2.1] and sigma_x in [4.3.1] for longitudinal stiffener are to be taken as the greater of the following hull girder bending stresses: (a) stress at half length of the stiffener, and (b) 0.5 of the maximum compressive stress of the adjacent elementary plate panels. Please advise if the above interpretation is correct.	1) Your interpretation is right. Regardless of the actual stress distribution of the adjacent plates, psi equal to 1 is assumed for the calculation of the effective width according to CH6, Sec.3, 5. 2)sigma_a is the axial stress of the stiffener. In the transverse section analysis this stress is a constant value, which is equal to sigma_n for a stiffener in ship length direction. sigma_x, sigma_y (in EPP co-ordinate system) and tau are stresses in the adjacent plates, acting at the position of the stiffener, which causes additonal vertical forces on the stiffener. In case of the transverse section analysis normal stresses in other directions than in ships longitudinal direction may be set to zero. We will consider the RCP in order to clarify these interpretation.	

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
764	6/2.4.1.3	RCP	Corrosion Formula	2008/10/27	With reference to the Technical Background, Ch6 Sec2, 4.1.3 is based on NK Rules. The coefficient, 1.1, of the stress formula in Ch6 Sec2, 4.1.3 is also shown in NK Rules as “correction coefficient for corrosion”. However, CSR adopts a net scantling approach and the scantling considered in the calculation formula is the net scantling, excluding corrosion additions. Accordingly, the formula in Ch6 Sec2, 4.1.3 incorrectly counts corrosion twice. Please reconsider the way to consider corrosion in this formula.	Considering the original rules and the background, it is not considered that the constant value 1.1 used in the formula of CSR based on the net scantling approach is necessary. We will consider the RCP because the correction of the formula will give the scantling impact.	
767	6/3.1.1.2	Question	Buckling Assessment	2009/3/3	1. It has come to our notice that there is an inconsistency between the CSR BC and IACS UR S17 about assessment of the buckling capability of the hull structure in flooded condition. 2. S17.5 requires buckling assessment for elementary plate panels and ordinary stiffeners in a hull transverse section stating that “Permissible stress and axial stress buckling strength are to be in accordance with UR S11”. 3. However, Paragraph 1.1.2 of Chapter 6, Section 3 of the CSR BC requires buckling assessment only for transverse vertically corrugated watertight bulkheads in flooded condition. 4. Both are IACS documents and are to be consistent for buckling assessment for the elementary plate panels and ordinary stiffeners.	With the additional ultimate strength check according to CH5, Sec2 for flooded condition, the requirements of UR S17 and UR S11 for the buckling assessment in flooded conditions are fulfilled.	
768 attc	6/3.4.2.2	RCP	stiffeners	2009/11/3	Please see the Rule Change Proposal in the attached file.	For continuous stiffeners, the bending moment due to the deformation of stiffener (M0) always takes the same sign as the bending moment due to the lateral load (M1), i.e. since Mo can act in any direction. However, for a sniped stiffener, the eccentricity of the compressive load and the neutral axis of the plate-stiffener combination means that M0 can only act in one direction (i.e. plate in compression). Accordingly, Mo and M1 should have the same sign when the lateral pressure is acting on the plate side, but different signs when the lateral pressure is acting on the stiffener side.	Y
771	Ch. 6, Sec. 1	CI	carlings	2009/5/27	It seems that the answer in KC551 is applicable when fitted with carling effective enough to prevent buckling. Please show the conditions such as minimum scantlings of the carling which are effective enough to prevent buckling.	We will make a rule change proposal to establish minimum scantling requirements for such carlings.	

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
800	6.3.4.2	RCP	lateral buckling of longitudinal stiffeners	2009/3/3	We have checked both criteria given in Ch 6, Sec 3 for lateral buckling of longitudinal stiffeners not subjected to lateral pressure: criteria in [4.2.1] and [4.2.2] on one side and criteria in [4.2.3] on the other side. These criteria were checked in case of longitudinal stiffeners (flat bars) of non watertight girders. The conclusions are: (1) - When considering ends of stiffener not sniped: both criteria are equivalent. (2) - When considering ends of stiffener sniped: both criteria seems equivalent, but it is noticed that there is no convergence when increasing the scantling of the flat bar. The same problem occurs if bulb or T-bar are considered. instead of a flat bar. Consequently, there are some doubts on the application of the formulae for sniped stiffeners and in particular on the default value taken for the assumed imperfection w0. Requirement should be re-considered in case of sniped stiffeners and a technical background should be provided.	In case of longitudinal stiffeners sniped at ends and located on non watertight girders, when applying the criteria for lateral buckling given in Ch 6, Sec 3 [4.2.1] and [4.2.2] on one side and [4.2.3] on the other side, it is right that there is no convergence when increasing the scantling of the stiffener. The requirement Ch 6, Sec 3, [4.2.3] is only applicable for non-sniped ordinary stiffeners. We will make a rule change proposal to clarify this matter.	
820	6/2.2.3.2	Question	Gross Thickness and Net Thickness Scantling	2009/3/3	Regarding the application of Ch6 Sec2 2.3, should hw and bf of the formulae be measured as gross scantling or net scantling? In Tanker CSR Table 10.2.1, it is clearly defined that the breadth and depth of stiffeners are based on gross scantling. But, in Bulker CSR, there is no clear definition for the calculation of the net dimensions of ordinary stiffeners given in Ch6 Sec2 2.3. Please clarify.	It is clearly mentioned in the text of [2.3] that all scantling is the net dimensions.	
831	6/1.2.4.1	CI	FE and local requirements	2009/3/3	Please explain the technical background of this requirement. Does this requirement refer to a) only the thickness required by local requirements? b) both the thickness required by FE and local requirements? Typically, we have pipe duct in way of the keel plating, and the length of the elementary plate panels are smaller than outside the pipe duct. The required thickness obtained from the bi-axial FE buckling in way of the pipe duct may then be smaller than outside the pipe duct. Can we accept this smaller thickness?	This requirement refers to both the thickness required by FE and local requirements, as it refers to "actual" thickness, for a matter of continuity of strength, and enough strength for docking.	
833	6/4.3	Question	Primary Support Members	2009/3/10	Reference is made to Ch. 6 Sec. 4 [3] “Additional requirements for primary supporting members of BC-A and BC-B ships.” The section is referring to net dimensions. Please advice how to obtain the net dimensions: a) deduct 0.5tc from gross scantling (In line PSM scantling applied in FEM) b) deduct tc from gross scantling. (In line with scantling applied in local checks) Please consider specifying this in Ch.3 Sec.2	The full corrosion addition is to be considered when applying Ch.6 Sec.4 [3]. Ch.3 Sec.2 [2.1.1] and [3.2] define the cases where other corrosion values are to be used for determining the net dimensions.	

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
849	Text 6/A1.1.3.4	Question	corrugated BHD	2009/6/16	Regarding the buckling assessment of corrugated bulkhead plates, the edge stress ratio for their web plates is defined as 1.0 according to Ch.6 App.1 [1.3.4(b)]. This means that the stress distribution of such web plates is assumed to be uniform. However, due to bending, the actual stress distributions of these web plates are not uniform. Therefore, the edge stress ratio,ψ, should be -1.0 in case where applying buckling case1. Please confirm that ψ=1.0 is correct or not.	The correct value of psi is -1.0. We will consider a Rule Change Proposal.	
852 attc	6/2.4.1.1 & 6/2.2.5	Question	Steel Coil Loading	2009/9/4	Ch.6 Sec.2 [4.1.1] defines the required net sectional area of web stiffeners. 1) Please confirm the requirement is not applicable in case of steel coil loading as specified in Ch.6 Sec.2 [2.5]. 2) If 1) is not the case please advise how to calculate the pressure "p" in case of steel coil loading.	1. The requirement of Ch 6 Sec 2 [4.1.1] is applicable in case of steel coil loading becasue the load due to steel coil is acting on the ordinary stiffener. 2. Please find the attached document. We will conisder the RCP.	Y
856	Text 6/1.2.3	Question	bilge plating	2009/6/16	Clarification of the criteria of the application of any increased thickness required for the bilge plating to the adjacent bottom and side shell plating. In case the straight plate of bottom or side shell shares a transversely framed and curved EPP with the bilge plating, should the required thickness of the bilge plating be applied to the adjacent bottom or side shell plating? Regarding this, in Tanker CSR Corrigenda 3 Section 8/ 2.2.3.2, the criteria have been defined clearly for the application of the required thickness of the bilge plating. However, in Bulker CSR Ch 6, Section 1 [2.3], there is no clear guideline. Please clarify.	The text of Ch 6 Sec 1 [2.3.3] says: The net thickness of the bilge plating is to be not less than the actual net thicknesses of the adjacent 2 m width bottom or side plating, whichever is the greater. Therefore, the required thickness of the bilge plating should not be applied to the adjacent bottom or side shell plating	
866 attc	Figure 6.2.10	RCP	web stiffener end connections	2009/8/3	In the estimation of web stiffener connection ends, the definition of the parameters is to be clarified. When fitting with large collar plate supporting stiffener flange as attached figure, the parameters, l_1 and l_2 as defined in the left figure of Fig. 10, are not clear. Please clarify the above.	In case that Ch.6 Sec.2 [4.1.3] is applied to the design in question, "scallop width" and "slot width" in the attached figure may be treated as the parameters l1 and l2.	Y
878	6/1.2.6.3 & 6/1.2.6.2	Question	effective structure	2009/3/10	In corrigenda 5, the “long superstructure” and “short superstructure” are modified into “effective structure” and “non-effective structure” in Ch 6, Sec 1, [2.5.3] and [2.5.4]. We think Ch 6, Sec 1, [2.6.2] and [2.6.3] should also be modified.	To be in accordance with Ch.6 Sec.1 [2.5], terms "long superstructure" has to be change to "effective superstructure" in Ch.6 Sec.1 [2.6.2], and "short superstructure" to "non-effective superstructure" in Ch.6 Sec.1 [2.6.3]	

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879	Text 6/2.2.5.3	question	hopper sloping tanks	2009/6/16	Ch 6, Sec 2, [2.5.3] ordinary stiffeners located on hopper sloping plate or inner hull plating [quote] l' : Distance, in m, between load points per elementary plate panel of inner bottom plate in ship length, sloping plate or inner hull plating, as defined in Ch6, Sec 1, [2.7.2]. [unquote] The title of Subsection [2.5.3] concerns hopper sloping panel and inner hull plate, excluding inner bottom plate, so the definition of l' should be modified.	Your observation is correct. The definition of l' is related to the factor K3 and hence valid for both [2.5.2] and [2.5.3]. We will consider to move the definition to Symbols or Table 1 for K3 in a corrigenda.	
880	6/4.2.2.1, 6/4.2.3.1, 6/4.2.4.1 & 6/4.2.5.1	Question	Scantlings of primary supporting members for ships of less than 150m in length - definitions	2010/3/30	With respect to Ch 6, Sec 4, we have the following questions: 1.Subsection [2.2.1] and [2.3.1] define BDB as distance between the toes of hopper tanks at the midship part, and define Ps, IB, Pw, IB, Ps, BM, Pw, BM as pressures at the center of the double bottom structure. We think the position to calculate BDB should also be the center of the double bottom structure as that of Ps, IB, Pw, IB, Ps, BM, Pw, BM. Please consider. 2.Subsection [2.4.1] and [2.5.1] define hDS as height of the double side structure between upper end of hopper tank and lower end of topside tank, and define Ps, SS, Pw, SS, Ps, LB, Pw, LB as pressures at the center of lDS which is length of the double side structure between the transverse bulkheads under consideration. We think that the position of hDS should also be at the center of lDS as that of Ps, SS, Pw, SS, Ps, LB, Pw, LB. Please consider.	We agree to your opinion that B_DB and h_DS should be calculated at the center of double bottom and double side of the considered hold respectively. On the other hand, it is necessary to note that B'_DB is separately defined as the breadth at the position of the floor in Ch6 Sec4, 2.3.1. In addition, it is necessary to define h'_DS separately as the height at the position of the side transverse web in 2.5.1. Accordingly, the second h_DS in the formula of t1 is changed to h'_DS in 2.5.1. We will consider a Corrigendum.	
832	6/2.4.1.3	Question	Connection ends of web stiffeners - differences between NK rules & CSR	2010/8/6	According to TB, the requirement originates from NK Rules. However, the requirement in CSR seems conservative on the following items: 1.The factor Cship in NK is depending on ship length. In CSR this dependence is deleted. This means that we obtain stricter results for L<200m. 2.In NK, Klongi is 1.0 for bulbs. In CSR Klongi is 1.3. This seems conservative, because skew bending moment for bulbs is much less than for angle bars. 3.In NK, the pressure is clearly only considering vertical acceleration. This means that the stress induced by the dynamic load is under the assumption that the vessel is under maximum vertical hull girder bending moment. In CSR, there is no specification about which wave the dynamic pressure is based on. R and P waves will give high dynamic pressure in top wing tank. However, R and P wave will not give highest vertical hull girder bending moment. CSR should clearly state the dynamic pressure is under H or F wave. Are the above differences between NK and CSR Rules intended? If they are not intended, please advise how they should be handled.	1. Design philosophy underlying CSR is based on the "North Atlantic Navigation" and service life of 25 years. This is different from NK rules. The factor "Cship" is intentionally deleted. 2. We agree with you. This is not intended. We will consider a corrigenda to clarify this. 3. We have noted your comment and we will send it to the Harmonization Team.	

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
845	6/3.3.1.1	Interpretation	Minimum thickness of elementary plate panels	2010/9/7	Please specify where the requirement Ch.6 Sec.3 [3.1.1] applies. Does it only apply to the cargo area, or also to other areas, such as the aft and fore parts and machinery spaces? If it applies also to the latter areas, we will get significant increases in plating thickness for some structures, such as wash bulkheads, platform decks, etc..	Ch6, Sec3 applies to the central part as defined in Ch1, Sec1, [2.1.3]. It also apply to machinery space as stated in Ch9, Sec3, [1.2.2] with respect to requirements of Ch9, Sec3. However, the minimum thickness requirement based on space in the first sentence of Ch6, Sec3, [3.1.1] was made as the first approach at the initial design stage so that initial scantling has certain stiffness. Less scantling may be accepted on members under little load. We will consider a rule change to delete this requirement	
883 attc	Text 6/A1.1.3.3	question	buckling assessment	2009/6/16	Ch6 App1, 1.3.3 requires treatments on buckling assessment of side shell plates which are stiffened vertically in the following two cases; Case 1: with approximately constant stresses Case 2: with distributed stresses According to the Rules, Case 2 is applicable to side shell panel under distributed stress over the panel height. In general, the panels in way of side frames are such stress and Case 2, therefore, is applied to them. On the contrary, regarding side shell panels in way of brackets above/below side frames as shown in the attached sketch, it is considered that the stress distribution in the panels is approximately constant. So the treatment of above Case 1 is applied to the buckling assessment of the panels. Please confirm the above.	Your understanding is correct.	Y

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
896	Text 6/4.1.5.1	question	primary supporting members	2009/6/26	Ch.9 Sec.2 [4.3] specifies scantling requirements of primary supporting members in aft part. The minimum thickness of floors is defined in [4.3.1]. However for other PSMs such requirement is not so clear. Please advise on the following questions: [A] [4.3.4] refers to Ch.6 Sec.4 requirements for deck PSMs. Do these requirements include Ch.6 Sec.4 [1.5.1]? [B] Please confirm that: (1) there is no requirement to minimum thickness for PSMs other than for floors, i.e., there is no minimum thickness requirment for deck PSMs, side transverses, side girders, etc.; or (2) there is no requirement to minimum thickness for PSMs other than for floors and deck PSMs, i.e., there is no minimum thickness requirements for side transverses, side girders, etc.	A1) Yes, deck PSM have to fulfill the requirements of Ch.6 Sec.4 considering the loads defined in Ch.9 sec.2 [2.2], and in particular the minimum web thickness defined in Ch.6 Sec.4 [1.5.1]. A2) No, the requirement for a minimum web thickness defined in Ch.9 Sec.2 [4.3.1] applies to all the PSM except those of the deck (see answer A1 herein). A rule change will be issued for clarifying this.	
911	6/1.2.3.2	RCP	bilge plating thickness	2009/8/3	Ch6 Sec1 [2.3.2] Our understanding is that the for formula net thickness of bilge plating is based on buckling of thin cylindrical shells subjected to external pressure. Hence, please specify that only the external pressures are to be considered in the formula.	Your understanding is correct, and we will make an editorial correction to clarify this.	
914 attc	Text 6/2.3.3.1	RCP	Requirements for side frames in ballast holds	2010/10/20	Ch6 Sec2 [3.3.1] Side frames in ballast holds Please consider the attached Rule Change Proposal regarding requirements to side frames in ballast holds.	As notified in the Technical Background, the requirement Ch.6 Sec.2 [3.3.1] is based on requirement S12.4.1 of the draft text of IACS UR S12 Rev.4 agreed at the WP/S meeting of 8-10 April 2003. In order to agree with URS12, the m-factors must be adjusted. The new m-factors will be presented to the Hull Panel and to the Harmonization Team in a CI. Once the new m-factors approved, they will be modified in CSR BC.	Y

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
918	6/1.3.2.3bis2	CI	Thickness of supporting floor of corrugated bulkhead	2010/5/12	With regard to required net thickness of supporting floor of corrugated bulkhead (Corr.BHD.) with lower stool, please reply to the following questions. 1.In 6/1.3.2.3 bis2 of RCN No.1-8, the wording of "by the first sentence" in the second sentence should be deleted because there is no relevant sentence in 6/1.3.2.2. 2.It is noted that the requirement of 6/1.3.2.2 (required plate thickness in flooding) is not applicable to lower stool side plating in ballast hold because it is only applicable to the plating which constitutes the boundary of compartments not intended to carry liquids. According to 6/1.3.2.3 bis2 of RCN No.1-8, on the other hand, required thickness of supporting floor in way of ballast hold is to be based on the required thickness of 6/1.3.2.2. Our understanding is that imaginary required thickness of lower stool side plating in ballast hold needs to be calculated in accordance with 6/1.3.2.2 in order to obtain required thickness of the supporting floor in way of ballast hold because the concept of 6/1.3.2.3 bis2 comes from UR S18 (Flooding requirement of Corr.T.BHD). But please confirm.	1: Your observation is right: The wording of "by the first sentence" in the second sentence should be deleted because there is no relevant sentence in 6/1.3.2.2. 2: Yes, you are correct. Required thickness of supporting floor in way of ballast hold is to be based on the required thickness of 6/1.3.2.2. Imaginary required thickness of lower stool side plating in ballast hold needs to be calculated in accordance with 6/1.3.2.2 in order to obtain required thickness of the supporting floor in way of ballast hold.	
962	6/3.6.1.1	Question	Buckling check of corrugated bulkheads	2009/9/4	Shear buckling check of bulkhead corrugation webs When Ch.6, Sec.2, [3.2.6] was moved to Ch.6, Sec.2, [3.6.1] by RCN1 (1 July 2008 Consolidated edition), shear force Q which was used for the shear buckling check of bulkhead corrugation webs was clarified as "Shear force at the lower end of a corrugation" as defined in original requirement, UR S18, [3.2]. We understand that shear buckling check of bulkhead corrugation webs in Ch 6, Sec.3, [6.1.1] is also applicable only to the lower ends of corrugation. Please confirm the above.	Your interpretation is correct. We will consider a Corrigendum to clarify it.	
963	Table 4.6.1, Text 4/6.3.3.2, 6/1.3.2.1, 6/1.3.2.3, 6/2.3.2.3 & 6/2.3.2.6	Question	Design with non-homogeneous loading condition	2009/12/16	Please advise the answer to the question on the design with the following non-homogeneous loading conditions in the loading manual: - cargo density is 3.0 and cargo hold is not loaded up to upper deck, - cargo density is lighter than 1.78 (for instance 1.7) and cargo hold is loaded up to upper deck. For this design is local strength check required for intact condition and flooded condition for the above loading conditions according to Ch.6 Sec.1 [3.2.1] & [3.2.3] and Ch.6 Sec.2 [3.2.3] & [3.2.6] (or [3.6] by RCN1-8)?	This question is considered together with KC 851, 859 and 972	

KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
968	6/3.1.1.2	Question	Flooding requirements of CSR bulker	2010/9/2	Buckling check is required for longitudinal members in intact condition only. Please explain how the buckling requirement of URS17 (axial buckling according to URS11) is satisfied for at lease BC-A and BC-B ships.	According to KC 460, the buckling check is covered by HULS. Further consideration including the necessity of additional buckling check in flooded condition will be requested to the Harmonization Team.	
972	6/4.4.1.1	Question	Loads on pillars	2010/3/8	There is only the formula about critical column buckling stress of pillars but no clear interpretation on how to calculate the loads on pillars in CSR BC 6/4.4.1. According to our experiences, the loads on pillars are similar between BC and OT, so we think a similar design load for pillar scantling calculation as 8/3.9.5 in CSR OT should be provided.	We will consider a Rule Change to include a design load for pillar scantling calculation similar to CSR OT	
974	6/1.3.2.3 bis1	Question	Net thickness of stool side plating	2010/3/8	Our understanding is that the following sentence in 6/1.3.2.3 bis1 of CSR BC is only applicable to upper stool, please confirm. [QUOTE] The net thickness of the lower portion of stool side plating is to not be less than 80% of the upper part of the bulkhead plating required by [3.2.3], as applicable, whichever is the greater, where the same material is used.[UNQUOTE]	Yes, your understanding is correct. We will consider a corrigenda to clarify this.	
975	6/1.3.2.3 bis2	Question	Thickness & material requirements for corrugated bulkheads	2010/3/8	Rule Ref.: CSR BC 6/1.3.2.3 bis2 [QUOTE] The net thickness and material of the supporting floors and pipe tunnel beams of corrugated bulkhead, when no stool is fitted, are to be not less than those of the corrugation flanges required by [3.2.3]. When a lower stool is fitted, the net thickness of supporting floors are to be not less than that of the stool side plating required by the first sentence of [3.2.2]." [UNQUOTE] [3.2.2] and [3.2.3] are requirements of flooding condition, which are inconsistent with KC ID210 as followers: QUOTE: KC ID210 In applying this requirement 6.4.2, the net thickness and. material properties required for the bulkhead plating, or when a stool is fitted, of the stool side plating mean that they are required by the scantling requirement except for the grab loading and under flooded condition. UNQUOTE Please clarify above.	We agree that the reply to KC 210 is inconsistent to the original requirements of IACS UR S18 which reads; "the thickness and material properties of the supporting floors are to be at least equal to those provided for the corrugation flanges." Only requirement for GRAB notation should be excluded. It was also the original intention of KC210. Reference is made to KC 918 for additional information	

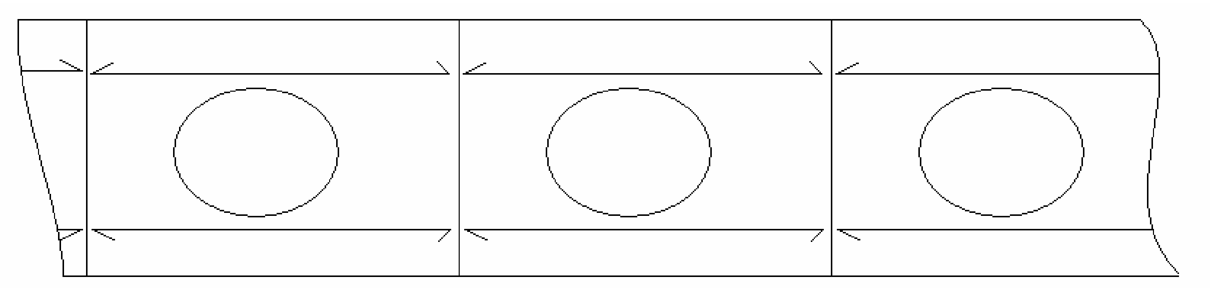
KCID No.	Ref.	Type	Topic	Date completed	Question/CI	Answer	Attach ment
1005	6/1	Question	Yield strength of non-rectangular EPP	2010/10/20	When assess the yield strength of non-rectangle EPP, such as EPP of watertight transverse webs of wing tanks, how to measure the longer or shorter side of EPP?	Since this issue involves both CSR BC and OT, it will be submitted to the harmonization team.	
1040	6/4.3.1.2	RCP	Allowable stress factors for floors adjacent to stools or transverse bulkheads	2010/5/5	According to UR S20.3.1, allowable shear stress for floors adjacent to the stools or transverse bulkheads may be taken sigma_F/3^0.5. On the other hand, in CSR-B of Ch.6, Sec.4, [3.1.2], there is no description about this treatment. It seems that to apply this treatment to CSR-B is rational because this requirement has come from UR20. Please consider a RCP to add this treatment into CSR-B.	In CSR-B of Ch.6, Sec.4, [3.1.2], the following treatement will be added: allowable shear stress for floors adjacent to the stools or transverse bulkheads may be taken sigma_F/3^0.5 as notified in UR S20.3.1. A corrigenda will be issued.	
1055 attc	Text 6/1.2.4.1	Interpretation	Measurement of adjacent plate width	2010/10/20	Keel Plating The following requirements for keel plating can be found: Ch3, Sec6, 6.2.1. Minimum breadth of the keel "b". Ch6, Sec1, Table 2 Minimum thickness of keel Ch6, Sec1, 2.4.1 The net thickness of the keel plating is to be not less than the actual net thickness of the adjacent 2 m width bottom plating. It is not mentioned, if the adjacent 2 m width bottom plating has to be measured from the edge of the actual keel strake or from b/2. Some current ship designs have an actual keel plating width of more than 3 times the size of b (see attachment). If Ch6, Sec1, 2.4.1 is interpeted in a way that the adjacent plate width has to be measured from the edge of the actual keel strake, the width of affected bottom plating and the potential increase of the thickness depends on this arbitrary strake width. We propose to initiate a Common Interpretation (CI) or to include the outcome of this question in next RCP to clarify that the adjacent plate width has to be measured from b/2 of CL.	Firstly, we do not agree with your interpretation: as for bilge plating, the adjacent 2m are to be considered from the edge of the keel strake, this is in order to avoid large discrepancies in thicknesses for welding. In addition, considering the adjacent 2m starting from b/2 will in most case include the keel strake which may lead to misinterpretations. Consequently the rules are kept as they are and no interpretation is emitted.	Y

KC#204

Sniped stiffeners, requirement to buckling capacity.

The CSR Ch. 6 Sec. 3.4 gives requirement to the buckling capacity of "longitudinal and transverse ordinary stiffeners of partial and total plate panels". According to Ch. 3 Sec. 6 we understand that "ordinary stiffeners" does not address sniped buckling stiffeners of primary supporting members.

a) Please explain whether Ch. 6 Sec. 3.4 is applicable to e.g. the sniped flat bars of a longitudinal double bottom girder as shown below.



b) Ch. 6 Sec. 2 is giving minimum requirements to ordinary stiffeners. Please advice if this requirement is applicable to sniped buckling stiffeners as shown above.

If above items a) and b) are not applicable for buckling stiffeners, please comment on the following interpretation.

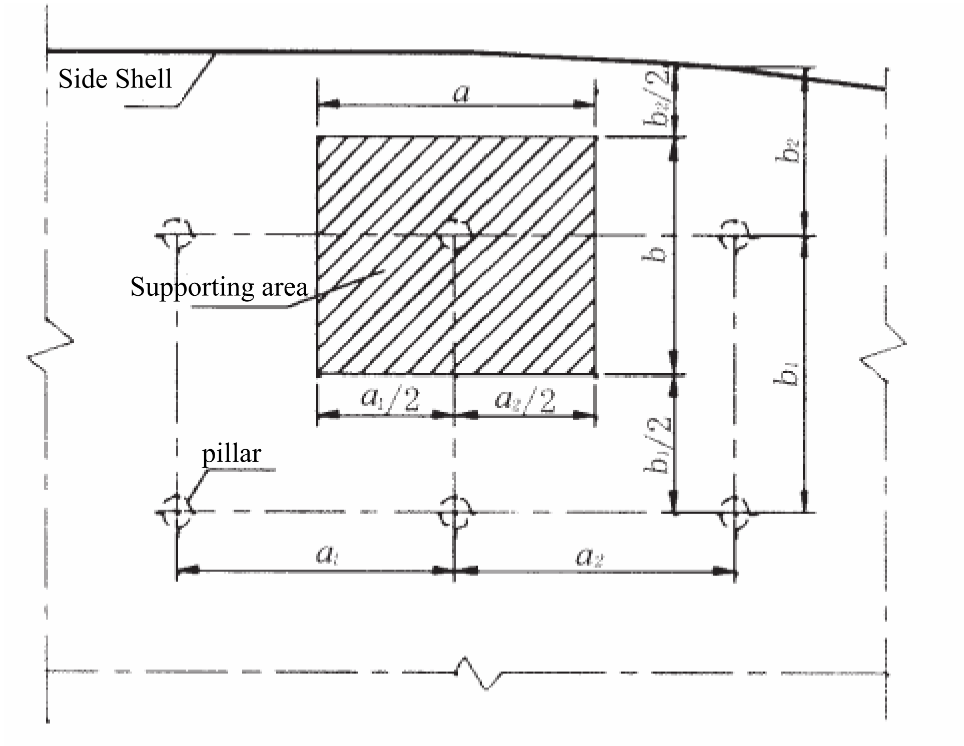
Buckling stiffeners are subject to the following requirements in CSR Bulk:

1. Ch. 3 Sec. 6 Sec. 5.2.1. $h_{stiffener} > l_{stiffener}/12$ and $t_{netStiffener} > t_{minimumGirderWeb}$.
2. Ch. 6 Sec. 2 4.1.2 "Net section modulus of web stiffeners of non-watertight primary supporting members"

Please advise if the above item 1 is referring to the minimum thickness of the girder web or the load thickness of the girder web.

Please also explain what is meant by the unclear expression; "web stiffener mid-height" as stated in Ch.6 Sec.2 4.1.1 which reads; "their net sectional area at the web stiffener mid-height is to be not less than ---".

KC#311



Side Shell
a
$b_2/2$
b_2
b
Supporting area
b_1
$a_1/2$
$a_2/2$
$b_1/2$
pillar
a_1
a_2

KC#319

Computation of upper and lower connection of side frames of single side bulk carriers

The following note is extracted from the WP/S background document for UR S12 revision 4. This version of the UR was neither officially released, but is the basis for the requirements of the IACS Common Structural Rules for bulk carriers.
This note is related to the calculation of the longitudinals that support the lower and upper connecting brackets of the side shell frames in hopper and topside tanks.
The relevant requirements are provided in Ch 6, Sec 2, [3.4] of IACS CSR for bulk carriers.

The technical background document has been modified to adopt the symbols and notations of the Common structural rules for bulk carriers Chapter 6, Section 2, in order to facilitate the reading. For the meaning of the symbols not defined hereunder, please refer to the text of the Common Structural Rules.

Checking of section modulus of the longitudinals in Ch 6, Sec 2 [3.4.1]

The section modulus of the longitudinals is required to have sufficient bending strength to support the end fixing moment of the side frame about the intersection point of the sloping bulkhead and the side shell.
The end fixing moment of the side frame is that induced by the external sea pressure acting on the side frame (end brackets excluded) and the deflection and rotation of the end support due to the loading on the hopper and the double bottom.
The sea pressure loading on the end brackets is not included because the sea pressure loading on this and on the connecting structure of the hopper and topside tank are assumed to cancel.

The end fixing moment, M_{ef}, of the side frame about the intersection point of the sloping bulkhead and the side shell in Nm is given as:

$$M_{ef} = \alpha_T \cdot (p_S + p_W) \cdot s \cdot l^2 \qquad (1)$$

The end fixing moment, M_{ef}, gives rise to line loads on the connected side and sloping bulkhead stiffeners, q_{efi}, in N/m such that:

$$\frac{M_{ef}}{s} = \sum_i q_{efi} \cdot d_i \qquad (2)$$

The line load, q_{efi}, gives rise to plastic bending moments in the connected side and sloping bulkhead stiffeners, M_{ci}, in Nm given as:

$$M_{ci} = \frac{q_{efi}\ \ell_l^2}{16} \qquad (3)$$

Hence, assuming an allowable stress equal to yield, the section modulus requirement for a connected side or sloping bulkhead longitudinal in cm^3 becomes:

$$w_i = \frac{M_{ci}}{R_Y} \qquad (4)$$

Injecting the expression of M_{ci} from (4) into (3) and putting q_{efi} in (2), we obtain:

$$\sum_i w_i \cdot d_i = \frac{M_{ef} \cdot l_l^2}{16 \cdot s \cdot R_Y} = \alpha_T \cdot \frac{(p_S + p_W) \cdot l^2 \cdot l_l^2}{16 \cdot R_Y} \qquad (5)$$

The above expression allows the required section modulus of the connected longitudinals to be determined and is given under [3.4.1] of Common Structural Rules for bulk carriers, Chapter 6, Section 2.

Checking of connection area in Ch 6, Sec 2 [3.4.2]

The connecting force Q_{efi} in N is transferred through shear between the brackets and the longitudinals, with:

$$Q_{efi} = s \cdot q_{efi} \qquad (6)$$

Assuming an allowable shear stress equal to 0.5 R_Y, we have, with Ai in cm^2 the connection area between bracket and longitudinal:

$$\frac{R_{Ybkt}}{2} = \frac{10^{-2} \cdot Q_{efi}}{A_i} = \frac{10^{-2} \cdot s \cdot q_{efi}}{A_i} \qquad (7)$$

Injecting q_{efi} from (3) and (4) inside (7), we obtain:

$$A_i = [0.32] \cdot \frac{w_i \cdot s \cdot R_{Y\lg}}{l_l^2 \cdot R_{Ybkt}} \qquad (8)$$

The above expression provides the required connection area and is given with the coefficient 0.32 rounded up to 0.4 and introducing the material factors for bracket and stiffener to replace the yield strengths ratio, under [3.4.2] of Common Structural rules for bulk carriers, Chapter 6, Section 2.

KC#333

Requirements for web stiffeners attached primary supporting members

	Chapter 6		Capter 3	Capter 6
	Section 2		Section 6	Section 4
Type	2.2	2.3	5.2	1.5
Water tight	Apply	Apply	**Apply or N. A. ?**	
Non tight	N. A	N. A	Apply	

Rule			Title
Chapter 6	Scetion 2	2.2	Minimum net thickness of webs of ordinary stiffeners
		2.3	Net Dimensions of ordinary stiffeners
Chapter 3	Section 6	5.2	Stiffening arrangement
Chapter 6	Section 4	1.5	Minimum net thickness of webs of primary supporting members

KC#356

Ch. 6 Sec. 2 [3.3] - Sectional modulus of main frames of single side bulk carriers in way of ballast hold.

The requirement for mid-span sectional modulus is given in [3.3.1]

Quote:

The net section modulus w, in cm^3, and the net shear sectional area A_{sh}, in cm^2, of side frames subjected to lateral pressure are to be not less, in the mid-span area, than the values obtained from the following formulae:

$$w = 1.125\alpha_m \frac{(p_S + p_W)s\ell^2}{m\lambda_S R_Y} 10^3 \qquad \text{(Eq1)}$$

$$A_{sh} = 1.1\alpha_S \frac{5(p_S + p_W)s\ell}{\tau_a \sin\phi}\left(\frac{\ell - 2\ell_B}{\ell}\right)$$

(..)

In addition to the above provision, the net section modulus w, in cm^3, and the net shear sectional area A_{sh} , in cm^2, of side frames subjected to lateral pressure in holds intended to carry ballast water are to be in accordance with [3.2.3].

Unquote.

We assume (p_s + p_w) is all intact pressures as specified in Ch. 6 Sec. 2 [1.3]. Please confirm.

The requirement of [3.2.3] is

Quote

The net section modulus w, in cm^3, and the net shear sectional area A_{sh}, in cm^2, of single span ordinary stiffeners subjected to lateral pressure are to be not less than the values obtained from the following formulae:

$$w = \frac{(p_S + p_W)s\ell^2}{m\lambda_S R_Y} 10^3 \qquad \text{(Eq2)}$$

$$A_{sh} = \frac{5(p_S + p_W)s\ell}{\tau_a \sin\phi}$$

Unqoute

We assume this is applicable for (p_s + p_w) from ballast inside the cargo hold only.

Our experience is that the ballast pressure is normally decisive for these main frames.

For a BCA vessel, the sectional modulus requirement of [3.3.1] can be written as:

$$w_{Eq1} = 1.125\alpha_m \frac{(p_S + p_W)s\ell^2}{m\lambda_S R_Y} 10^3 = 0.47 \frac{(p_S + p_W)s\ell^2}{m\lambda_S R_Y} 10^3 \approx \frac{w_{Eq2}}{2}$$

That is, the requirement from Eq2 is 2 x Eq1.

The requirement at ends are defined in [3.3.3] for Lower End and [3.3.4] for Upper End. Requirement for ends are required as 2 x [3.3.1] equation.

Q1: In the text above Eq1 it is quoted "in the mid span area". Is the sectional modulus of Eq2 also intended to be satisfied in the mid span area?

Q2: The requirement of [3.3.3] and [3.3.4] specifies w_{END} to be two times the section modulus required for midspan area according to [3.3.1]. We assume this is 2 x Eq 1 only and not 2 x max(Eq1, Eq2). Please confirm.

KC#360

Correction:

Reference stress, to be the following for LC 1 and 2:

σ_e : Reference stress, taken equal to:

$$\sigma_e = 0.9E\left(\frac{t}{b'}\right)^2$$

b' : shorter side of elementary plate panel

Reference stress, to be the following for LC 3 through 10:

σ_e : Reference stress, taken equal to:

$$\sigma_e = 0.9E\left(\frac{t}{b}\right)^2$$

IACS
INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES
August 2006
Common Structural Rules Knowledge Centre

Question / Interpretation Request / Rule Change Proposal Form

Please complete this form and submit it to the IACS Senior Technical Officer, Mr. Gil Yong Han,
at gilyonghan@iacs.org.uk and zoewright@iacs.org.uk or fax it to +44 (0)20 7808 1100

Question, Request for Interpretation or Rule Change Proposal (RCP):
Questions related to requirements in Ch. 6 Sec.1 and 2 for flooding:

Q1:
Ref. Ch. 6 Sec. 1 [3.1.3]/ [3.2.2] and Sec. 2 [3.1.3]/[3.2.5]
The item Ch. 6 Sec. 1 [3.2.2] is giving " Net thickness under flooded condition excluding corrugation of transverse vertically corrugated bulkheads separating cargo holds" and Sec.2 [3.2.5] "Net section modulus and net shear sectional area of single span ordinary stiffeners under flooded conditions(..)". The flooding pressure to pF to be used in the formulas is according to Ch.6 Sec. 1 [3.1.3] and Sec. 2[3.1.3] the flooding pressure pF of Ch. 4 Sec. 6 [3].
Ch. 4 Sec. 6 [3] have two definitions of pF:
•[3.2.1] flooding water pressure - static water head including 60% vertical acceleration.
•[3.3.6] flooding water pressure – static water head only
As Ch. 4 Sec. 6 [3.3.6] is referring to "pressure on corrugation in empty hold" we assume [3.2.1] should be used in this context.
Please consider revising Ch. 6 Sec. 1 [3.1.3] and Sec. 2 [3.1.3] to "The lateral pressure in flooded conditions pF is defined in Ch. 4 Sec. 6 [3.2.1]"

Q2:
Ref. Ch. 6 Sec. 1 [3.2.3] and Sec. 2 [3.2.6]
The item Ch. 6 Sec. 1 [3.2.2] is giving "Net thickness of corrugations (..) for flooded conditions" and Sec. 2 [3.2.6] is giving "Bending capacity and shear capacity (..) for flooded conditions." Both items refer to the design resultant pressure and resultant force as defined in Ch. 4 Sec. 6 [3.3.7].
Ch. 4 Sec. 6 [3.3.7] is defining the resultant pressure in combined bulk cargo water flooding. [3.3.6] is defining the pure water flooding pressures on corrugations. This pressure seem to be overlooked in Ch.6. We assume that the reference to [3.3.6] is missing in Ch. 6.
Please consider revising the definition of p in Ch. 6 Sec. 1 [3.2.3] and Sec. 2 [3.2.6] to "(..)either [3.3.6] or [3.3.7] whichever greater".

Q3:
Reference is made to above Q1 and Q2.
A summary of the flooding requirements in Ch. 6 is enclosed below. Please confirm/comment our understanding.

The following is noted with respect to flooding pressures:
Plane boundaries – covering plane bulkheads/stools of corrugated bulkheads etc.
– flooding pressure to be water head + 60% dynamic vertical acceleration
Corrugations of transverse bulkhead – covering corrugations in between stools only
•flooding of cargo and water combined
•flooding of water, static head only.

Use of requirements for flooding and corresponding pressure:

Type	Ch 6 Sec 1 3.2.2	Ch 6 Sec 1 3.2.3	Ch 6 Sec2 3.2.5	Ch 6 Sec2 3.2.6
Corrugations of corrugated bhd	N. A	Ch.4 Sec.6 [3.3.6]/[3.3.7]	N. A	Ch.4 Sec.6 [3.3.6]/[3.3.7]
Stool plating of corrugate bulkheads	Ch.4 Sec.6 [3.2.1]	N. A	Ch.4 Sec.6 [3.2.1]	N. A
Plane bulkheads	Ch.4 Sec.6 [3.2.1]	N. A	Ch.4 Sec.6 [3.2.1]	N. A

Rules: ☐ Tanker ☒ Bulker ☐ Both

Type: ☒ Interpretation ☐ Question ☐ RCP

Rule Reference

EITHER:

Type	Section Name	Sub Section 1	Sub Section 2	Sub Section 3	Sub Section 4
☒ Text ☐ Figure ☐ Table ☐ Symbol *(BC only)*	Ch 6	1 1 2 2	3 3 3 3	2 2 2 2	2 3 5 6

OR:

General Rule Reference (e.g. 2/, or General):

Received (e.g. 12/02/06): Day: Month: Year:

Respondent: Client:

IACS Member (AB, LR, etc.): DNV

Confidential: ☐ Y ☐ N

Answer or Interpretation:

☐ Answer has already been provided to client. ☐ Attachments included. Number of attachments:

KC#425

Steel coil loading on hopper plate

According to Ch. 6 Sec. 1 [2.7.3] Hopper sloping plate and inner hull plating thickness

The net thickness of plating of longitudinally framed hopper sloping plate and inner hull is to be not less than the value obtained, in mm, from the following formula:

$$t = K_1 \sqrt{\frac{\left[g \cos(\theta_1 - \theta_2) + a_Y \sin\theta_1\right]F'}{\lambda_P R_Y}}$$

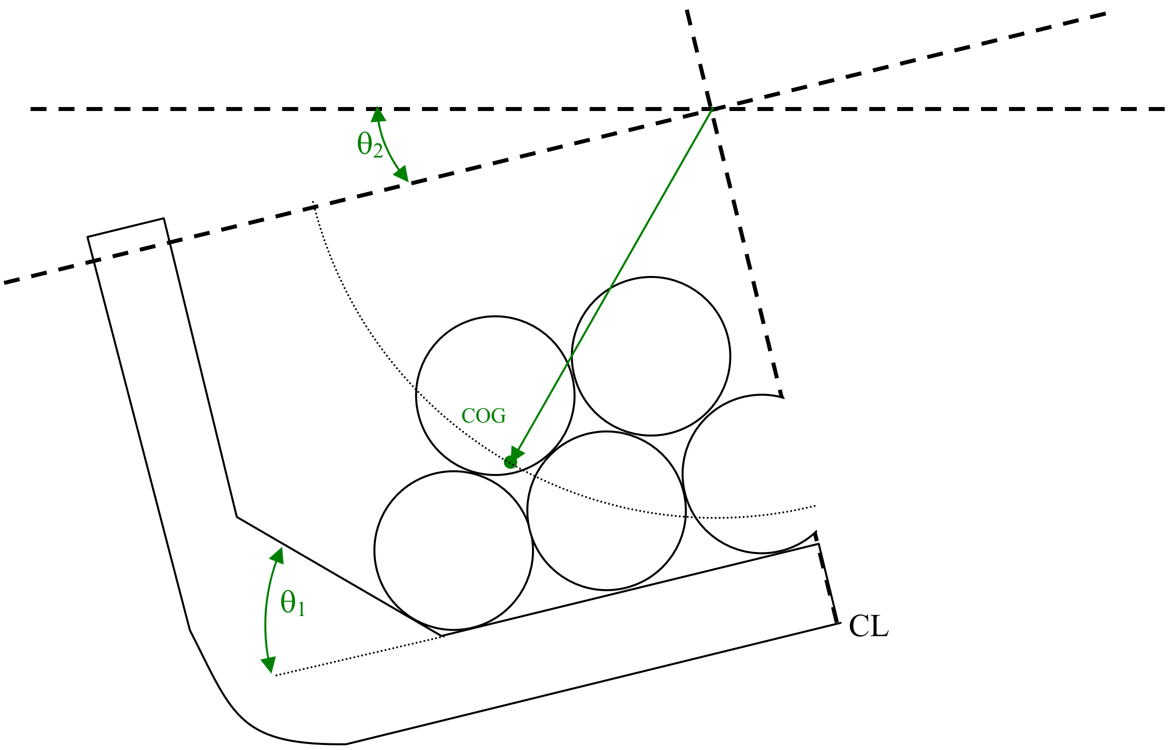
where:

a_Y : Transverse acceleration, in m/s2, defined in Ch 4, Sec2, [3.2]

According to Ch. 4 Sec2 [3.2]

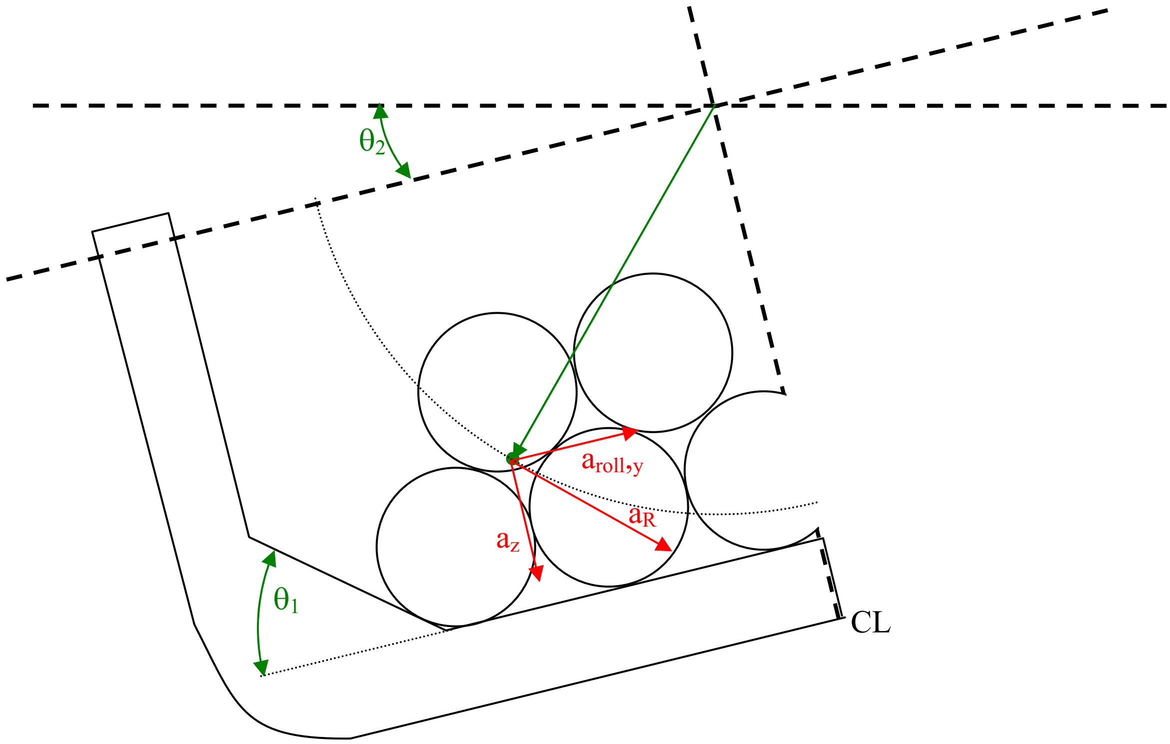
$$a_Y = C_{YG} g \sin\theta + C_{YS} a_{sway} + C_{YR} a_{roll\,y}$$

A typical steel coil loading pattern is shown in the figure below. The θ_2 is denoting the roll angle and COG is indicating the centre of gravity of the coils towards the hopper tank. Please see below calculation of the acceleraton term in the eq. [2.7.3], $a_\perp = g\cos(\theta_1 - \theta_2) + a_Y \sin\theta_1$

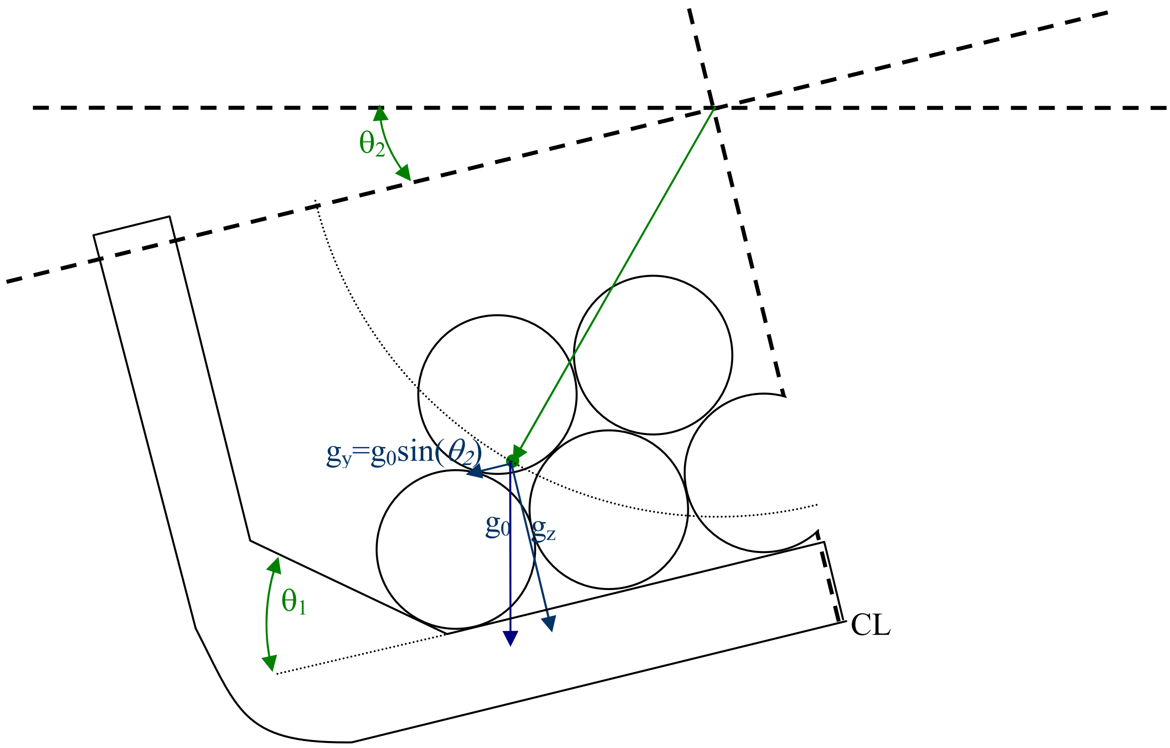


The rule formulation for acceleration according to Ch.4 Sec2 [3.2]:

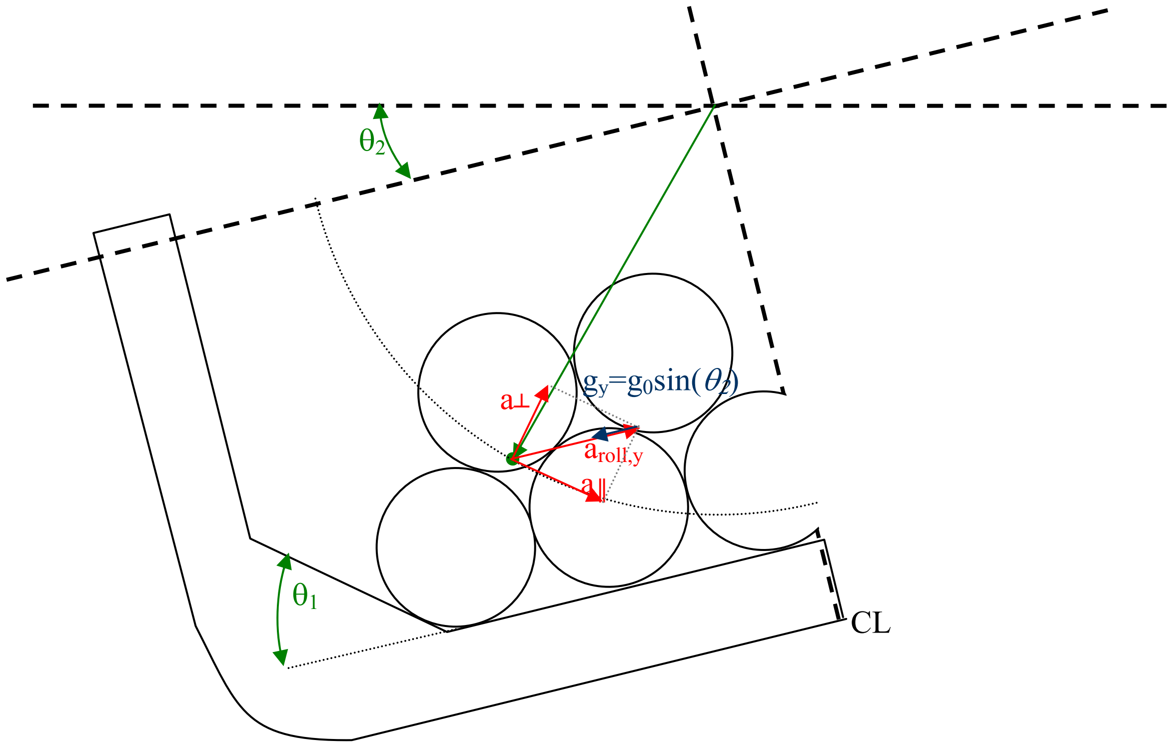
The component originating from the roll motion $C_{YR} a_{roll\ y}$ is shown in the figure below.



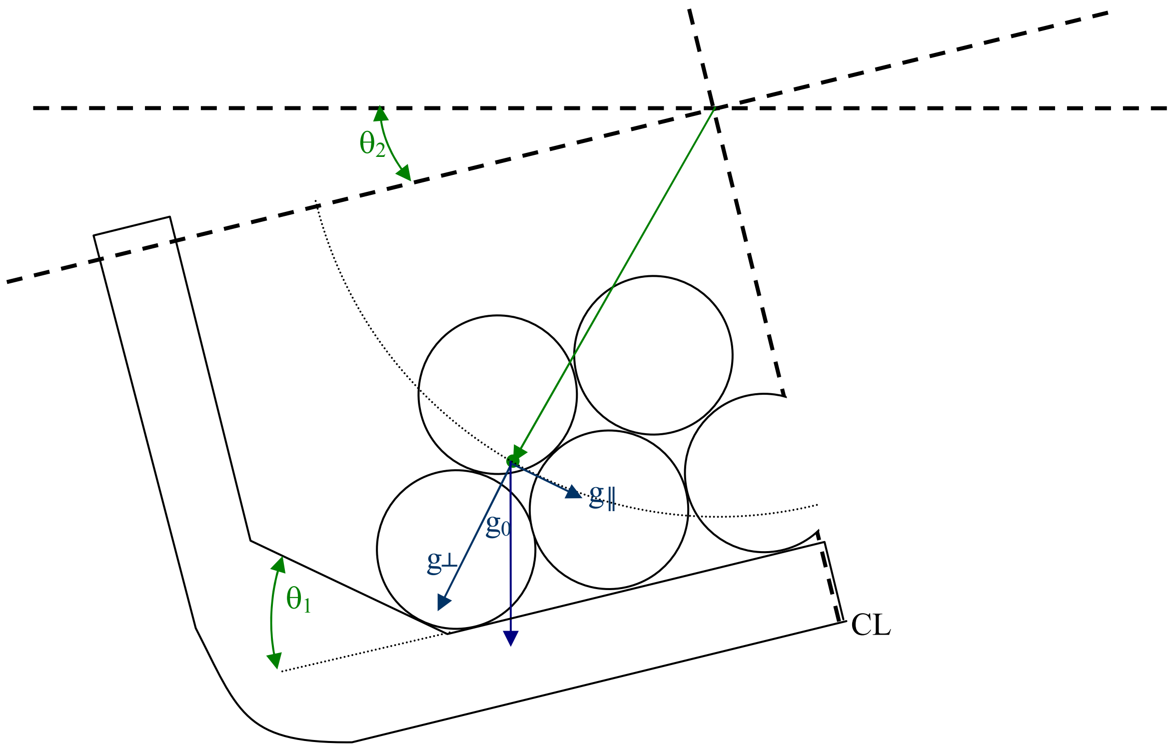
The component $C_{YG} g_0 \sin\theta_2$ is given in the following figure:



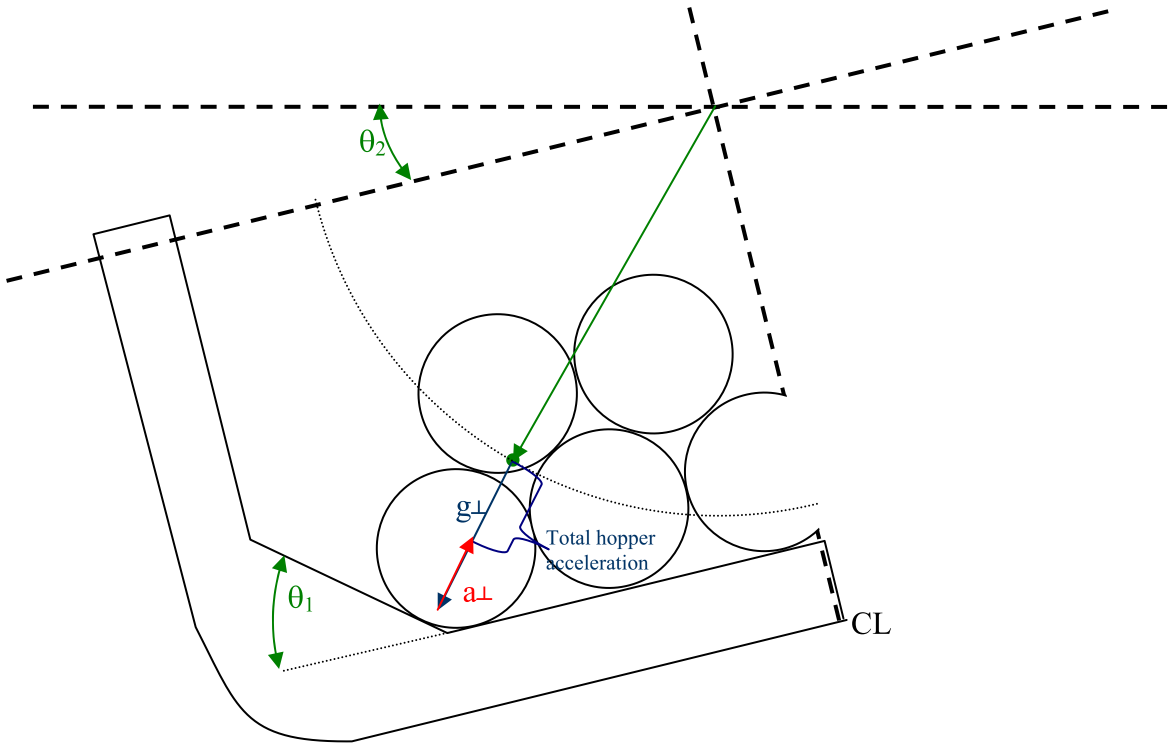
The total component $a_Y = C_{YG} g \sin\theta + C_{YR} a_{roll\,y}$, when neglecting the a_{sway} component, is illustrated in the figure below. The component normal to the hopper, $a_\perp = a_y \sin\theta_1$, is also indicated in the drawing.



The second term, $g_\perp = g_0 \cos(\theta_1 - \theta_2)$, is shown in the figure below:



Total rule acceleration $a_{\perp} = g\cos(\theta_1 - \theta_2) + a_Y \sin\theta_1$ is shown below:



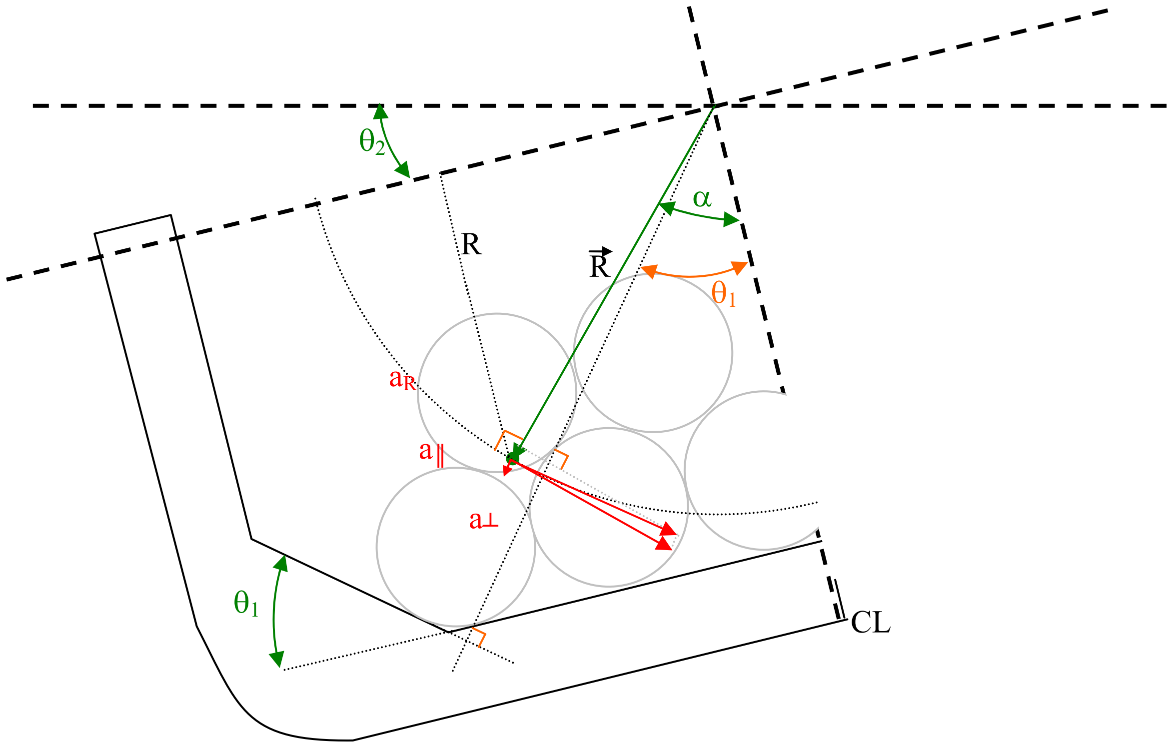
Please note following:

1. Gravity component in the equation is accounted for twice.
2. The roll component is decomposed twice. That is, the component normal to (⊥) the hopper tank is decomposed from the transverse acceleration a_y.
3. The rule formulation is in some cases summing the vectors without sign. This depend on the ratio between the hopper angle and the angle of the vector R. Please see below sketches.

Please consider below alternative calculation. The calculation is based on the two fundamental acceleration components gravity,g_0, and roll acceleration a_{roll}.

The coil closest to the hopper is resting on the hopper only. That is, the force on the inner bottom is neglected.

The acceleration component normal to (⊥) the hopper from roll acceleration may be described as shown in the figure below:



The angle α is expressed as:

$$\sin\alpha = \frac{y_{COG}}{|\vec{R}|}$$

Further more the vector $\vec{R}$ is the vector from the ship roll centre to the coil COG:

$$\vec{R} = [y_{COG}, R]$$

Consequently the angle α may be expressed as:

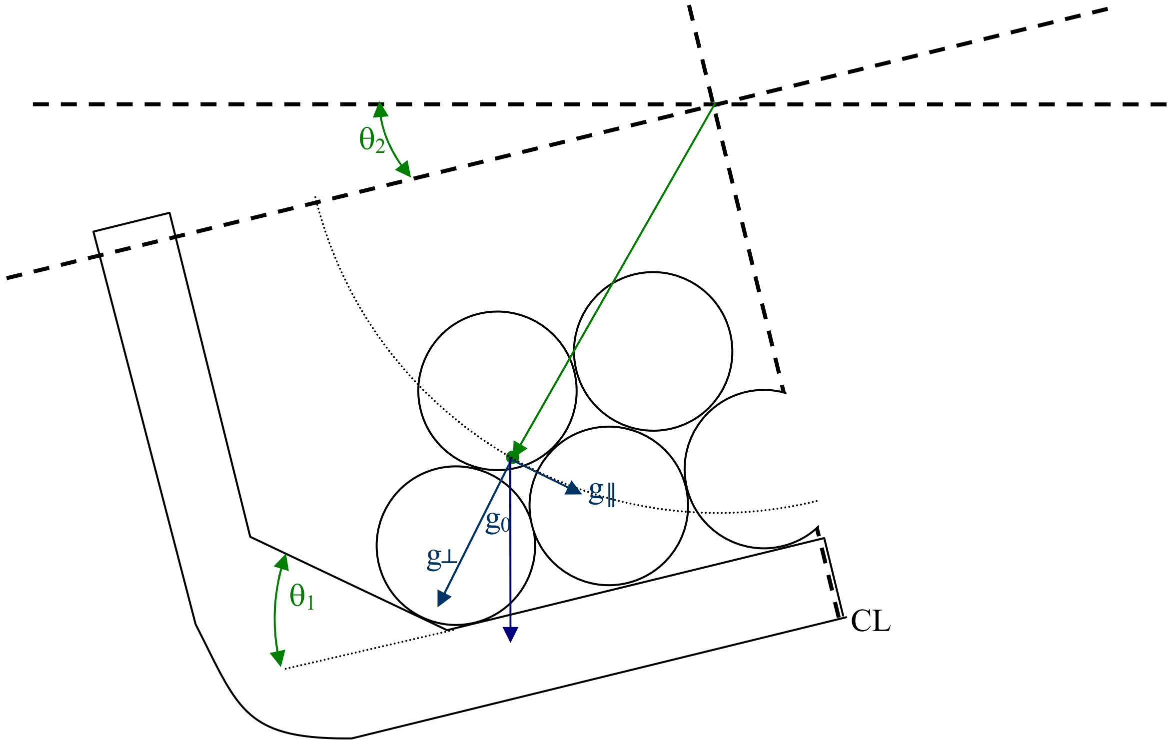
$$\sin\alpha = \frac{y_{COG}}{\sqrt{y_{COG}^{\ 2} + R^2}}$$

The normal acceleration can be expressed as:

$$a_{\perp} = a_R \sin(\alpha - \theta_1)$$

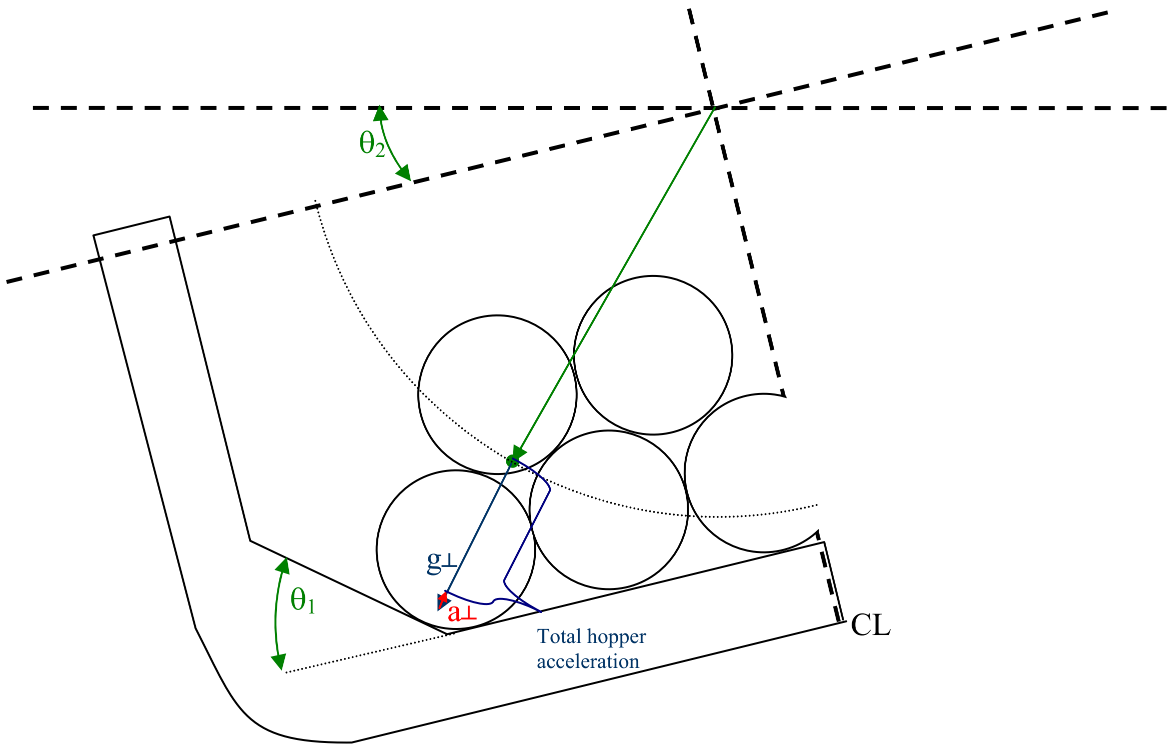
$$a_R = \theta_2 \frac{\pi}{180}\left(\frac{2\pi}{T_R}\right)^2 |\vec{R}| = \theta_2 \frac{\pi}{180}\left(\frac{2\pi}{T_R}\right)^2 \sqrt{y_{COG}^{\ 2} + R^2}$$

The gravity component is expressed in the same way as the rule formulation- $g_{\perp} = g\cos(\theta_1 - \theta_2)$. Ref. below figure.



The total acceleration is the sum of the contribution from the roll and the gravity component.

$$a_{\perp} = a_R \sin(\alpha - \theta_1) + g\cos(\theta_1 - \theta_2)$$



If we include the sway component and introduce the load combination factors, the acceleration can be written as:

$$a_{\perp} = C_{YR} a_R \sin(\alpha - \theta_1) + g\cos(\theta_1 - C_{YG}\theta_2) + C_{YS} a_{Sway} Sin(\theta_1)$$

Example for straight inner side (no hopper) configuration θ_I = 90. The EDW R1 is choosen as the condition is normally decisive for inner side/hopper structure.

Acceleration term according to the rules (EDW R1):

$$a_{\perp} = g\cos(\theta_1 - \theta_2) + a_Y \sin\theta_1 = g\cos(90 - \theta_2) + a_Y \sin 90 = g\sin(\theta_2) + a_Y$$

$$a_Y = C_{YG} g \sin\theta_2 + C_{YS} a_{sway} + C_{YR} a_{roll\,y} = g\sin\theta_2 + a_{roll\,y}$$

$$\Updownarrow$$

$$a_{\perp} = g\sin(\theta_2) + g\sin\theta_2 + a_{roll\,y} = 2g\sin\theta_2 + a_{roll\,y}$$

Acceleration term according to DNV above assumption (EDW R1)

$$a_{\perp} = C_{YR} a_R \sin(\alpha - \theta_1) + g\cos(\theta_1 - C_{YG}\theta_2) + C_{YS} a_{Sway} Sin(\theta_1) = a_R \sin(\alpha - 90) + g\cos(90 - \theta_2)$$

$$a_{\perp} = -a_R \cos(\alpha) + g\sin(\theta_2) = -\theta_2 \frac{\pi}{180}\left(\frac{2\pi}{T_R}\right)^2 \sqrt{y_{COG}{}^2 + R^2}\cos(\alpha) + g\sin(\theta_2), \cos(\alpha) = \frac{|R|}{\sqrt{y_{COG}{}^2 + R^2}}$$

$$a_{\perp} = -a_R \cos(\alpha) + g\sin(\theta_2) = -\theta_2 \frac{\pi}{180}\left(\frac{2\pi}{T_R}\right)^2 \frac{\sqrt{y_{COG}{}^2 + R^2}\,|R|}{\sqrt{y_{COG}{}^2 + R^2}} + g\sin(\theta_2)$$

$$a_{\perp} = -a_{roll\,y} + g\sin(\theta_2)$$

Please note that the $a_{roll,y}$ term is negative in the CSR. Except the 2 x factor the two terms are identical.

For a small handy the trem $a_{roll,y}$ is about 0.5 m/s^2 and gsin θ_2 = 4.1m/s^2 (typical θ_2=25 deg)

CSR acceleration $a_{\perp}$=7.8m/s2

DNV interpretation $a_{\perp}$ = 3.6m/s2

Q1: Please note that the hopper normal acceleration calculated directly based on the fundamental accelerations is smaller than the rule accelerations. Dependent on the term $\sin(\alpha - \theta_1)$, the roll acceleration will work towards the gravity acceleration. Please note that the acceleration is sensitive to the definition of COG. The procedure to define COG should be clearly defined in the rules. With reference to IACS KC #380 please consider above acceleration calculations.

Q2: DNV have noted that the results of eq. [2.7.3] give very strict results for the hopper sloping plate. The thickness of the hopper sloping plate is in many cases in excess of the requirement of the inner bottom.

The force on the hopper is larger than the force for the inner bottom. This is caused by the Ck factor which is 4 for 2 tiers stowage. Could you please give details regarding the background of this term. According to our steel coil experts the stowage is, even though it is shored, quite flexible. Have there been attempted any test to account for the amount of force taken by the hopper plating?

KC#470

CH6, Sec3, 3.2.4 – Checking criteria

Rule Change:

In addition each compressive stress σ_X and σ_Y and the shear stress τ are to comply with the following formulae:

$$\left(\frac{\sigma_x' \cdot S}{\kappa_x \cdot R_{eH}}\right)^{e1} \leq 1.0$$

$$\left(\frac{\sigma_y' \cdot S}{\kappa_y \cdot R_{eH}}\right)^{e2} \leq 1.0$$

$$\left(\frac{|\tau| \cdot S \cdot \sqrt{3}}{\kappa_\tau \cdot R_{eH}}\right)^{e3} \leq 1,0$$

GL-Answer: In General we consider only the rule defined load cases and loading conditions for the dimensioning of the structure, which are called design-load cases. In case of buckling checks we have to accept, that in reality also load cases exist, they give other load and therefore stress combinations as defined in the design-load-cases. Of course it is guaranteed, that the design-load cases cover the cases with respect of the calculation of the most critical stress-components. In case of buckling we have to consider all possible stress combinations. This is somewhat different and because of that we require, that the buckling strength of the plate has to be high enough to withstand each compressive stress acting alone. This means, that possible stabilizing effects of pressure stresses are neglected.
This can be illustrated with the following figures.
In Figure 1 the interaction curve is shown including the Poisson effect. As can be seen there are stress combinations allowable for which the Sy-component can be greater, than in the case for Sy is acting alone on the plate. Because of the problem mentioned above, the interaction curve as the base for the rule requirements is limited to stress combinations as shown in figure 2. Please note that this figure is given in Appendix 1 of the Buckling-TB-document. Please refer to "Buckling Strength Assessment of Plates in the IACS Common Structural rules for Bulk Carriers – Sample Applications", Figure 2.

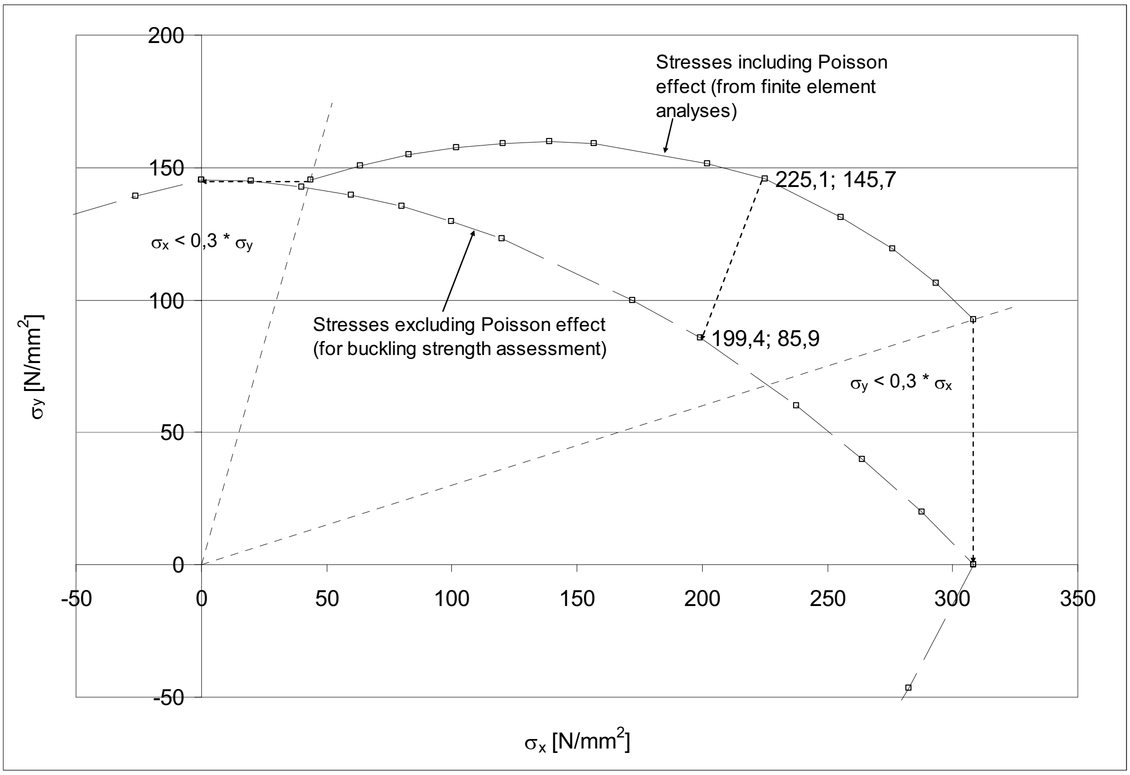


Figure 1: interaction **without** the requirement that the plate has to be stiff enough to withstand each compressive stress alone

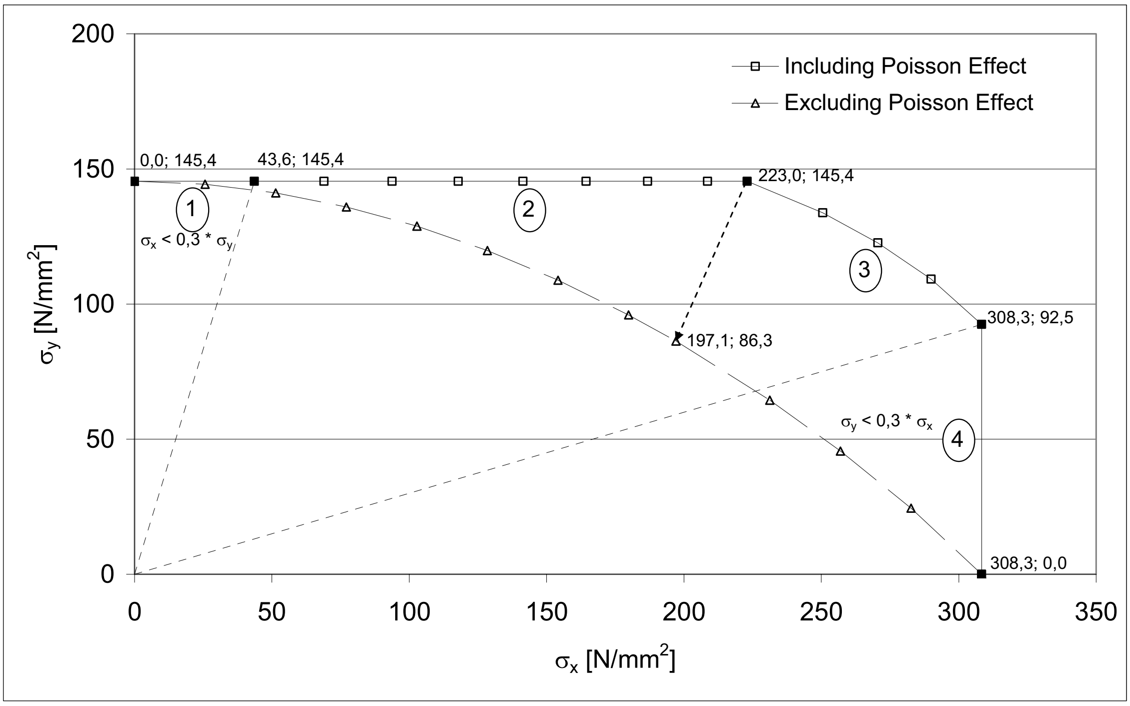


Figure 2: interaction **with** the requirement that the plate has to be stiff enough to withstand each compressive stress alone

Proof of Single Plate Fields

Ramification Study to KC-ID XXX
About the proper usage of FE-stresses in the interaction formula IF (CSR-BC, CH6, Sec3, 3.2.4)

This table gives an overview over the different results of the interaction formula when it is properly used with non-converted FE-stresses (Poisson Effect, CSR-BC, CH6, Sec3, 3.2.3) and when the formula is used wrongly with converted FE-stresses.

Yellow marked single term results indicate that the check of the single acting stress gives a more severe result in comparison to the interaction.

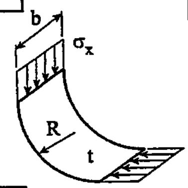
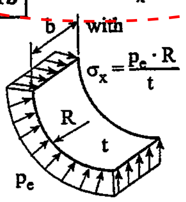
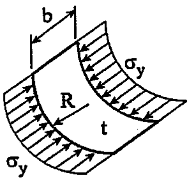
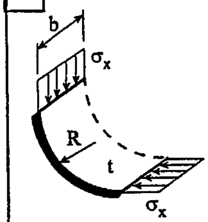
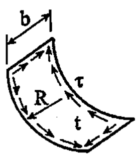
Red marked single term results with properly used stresses indicate that this proper usage gives more severe results. This case would influence the scantlings.

Input Values							Calculated Values						Results of Interaction Formula (IF)					
FE-Stresses			Buck. red. factor			Material	Corrected Stresses		Factors				Single Terms with converted stresses			Proper usage of IF		
σ_x*	σ_y*	τ	κ_x	κ_y	κ_t	R_{eH}	σ_x	σ_y	B	e_1	e_2	e_3	1st Term IF	2nd Term IF	IF	1st Term IF	2nd Term IF	IF
200	200	0	1.00	1.00	1.00	235	154	154	1.00	2.00	2.00	2.00	0.43	0.43	0.72	0.72	0.72	0.72
200	150	0	1.00	1.00	1.00	235	170	99	1.00	2.00	2.00	2.00	0.53	0.18	0.59	0.72	0.41	0.59
200	100	0	1.00	1.00	1.00	235	187	44	1.00	2.00	2.00	2.00	0.63	0.03	0.54	0.72	0.18	0.54
200	50	0	1.00	1.00	1.00	235	200	0	1.00	2.00	2.00	2.00	0.72	0.00	0.59	0.72	0.05	0.59
200	0	0	1.00	1.00	1.00	235	200	0	1.00	2.00	2.00	2.00	0.72	0.00	0.72	0.72	0.00	0.72
200	-50	0	1.00	1.00	1.00	235	200	-50	1.00	2.00	2.00	2.00	0.72	0.05	0.95	0.72	0.05	0.95
200	-100	0	1.00	1.00	1.00	235	200	-100	1.00	2.00	2.00	2.00	0.72	0.18	1.27	0.72	0.18	1.27
200	-150	0	1.00	1.00	1.00	235	200	-150	1.00	2.00	2.00	2.00	0.72	0.41	1.67	0.72	0.41	1.67
200	-200	0	1.00	1.00	1.00	235	200	-200	1.00	2.00	2.00	2.00	0.72	0.72	2.17	0.72	0.72	2.17
200	200	0	0.70	1.00	1.00	235	154	154	0.17	1.24	2.00	1.70	0.92	0.43	1.88	1.27	0.72	1.88
200	150	0	0.70	1.00	1.00	235	170	99	0.17	1.24	2.00	1.70	1.04	0.18	1.59	1.27	0.41	1.59
200	100	0	0.70	1.00	1.00	235	187	44	0.17	1.24	2.00	1.70	1.17	0.03	1.39	1.27	0.18	1.39
200	50	0	0.70	1.00	1.00	235	200	0	1.00	1.24	2.00	1.70	1.27	0.00	1.14	1.27	0.05	1.14
200	0	0	0.70	1.00	1.00	235	200	0	1.00	1.24	2.00	1.70	1.27	0.00	1.27	1.27	0.00	1.27
200	-50	0	0.70	1.00	1.00	235	200	-50	1.00	1.24	2.00	1.70	1.27	0.05	1.50	1.27	0.05	1.50
200	-100	0	0.70	1.00	1.00	235	200	-100	1.00	1.24	2.00	1.70	1.27	0.18	1.82	1.27	0.18	1.82
200	-150	0	0.70	1.00	1.00	235	200	-150	1.00	1.24	2.00	1.70	1.27	0.41	2.22	1.27	0.41	2.22
200	-200	0	0.70	1.00	1.00	235	200	-200	1.00	1.24	2.00	1.70	1.27	0.72	2.72	1.27	0.72	2.72
200	200	0	0.40	1.00	1.00	235	154	154	0.01	1.03	2.00	1.40	1.66	0.43	2.89	2.17	0.72	2.89
200	150	0	0.40	1.00	1.00	235	170	99	0.01	1.03	2.00	1.40	1.84	0.18	2.57	2.17	0.41	2.57
200	100	0	0.40	1.00	1.00	235	187	44	0.01	1.03	2.00	1.40	2.02	0.03	2.35	2.17	0.18	2.35
200	50	0	0.40	1.00	1.00	235	200	0	1.00	1.03	2.00	1.40	2.17	0.00	2.03	2.17	0.05	2.03

200	0	0	0.40	1.00	1.00	235	200	0	1.00	1.03	2.00	1.40	2.17	0.00	2.17	2.17	0.00	2.17
200	-50	0	0.40	1.00	1.00	235	200	-50	1.00	1.03	2.00	1.40	2.17	0.05	2.40	2.17	0.05	2.40
200	-100	0	0.40	1.00	1.00	235	200	-100	1.00	1.03	2.00	1.40	2.17	0.18	2.71	2.17	0.18	2.71
200	-150	0	0.40	1.00	1.00	235	200	-150	1.00	1.03	2.00	1.40	2.17	0.41	3.12	2.17	0.41	3.12
200	-200	0	0.40	1.00	1.00	235	200	-200	1.00	1.03	2.00	1.40	2.17	0.72	3.62	2.17	0.72	3.62
200	200	0	0.10	1.00	1.00	235	154	154	0.00	1.00	2.00	1.10	6.55	0.43	9.24	8.51	0.72	9.24
200	150	0	0.10	1.00	1.00	235	170	99	0.00	1.00	2.00	1.10	7.25	0.18	8.92	8.51	0.41	8.92
200	100	0	0.10	1.00	1.00	235	187	44	0.00	1.00	2.00	1.10	7.95	0.03	8.69	8.51	0.18	8.69
200	50	0	0.10	1.00	1.00	235	200	0	1.00	1.00	2.00	1.10	8.51	0.00	8.38	8.51	0.05	8.38
200	0	0	0.10	1.00	1.00	235	200	0	1.00	1.00	2.00	1.10	8.51	0.00	8.51	8.51	0.00	8.51
200	-50	0	0.10	1.00	1.00	235	200	-50	1.00	1.00	2.00	1.10	8.51	0.05	8.74	8.51	0.05	8.74
200	-100	0	0.10	1.00	1.00	235	200	-100	1.00	1.00	2.00	1.10	8.51	0.18	9.06	8.51	0.18	9.06
200	-150	0	0.10	1.00	1.00	235	200	-150	1.00	1.00	2.00	1.10	8.51	0.41	9.46	8.51	0.41	9.46
200	-200	0	0.10	1.00	1.00	235	200	-200	1.00	1.00	2.00	1.10	8.51	0.72	9.96	8.51	0.72	9.96
200	200	0	1.00	0.70	1.00	235	154	154	0.17	2.00	1.24	1.70	0.43	1.88	0.72	0.72	1.27	1.88
200	150	0	1.00	0.70	1.00	235	170	99	0.17	2.00	1.24	1.70	0.53	1.52	0.59	0.72	0.89	1.52
200	100	0	1.00	0.70	1.00	235	187	44	0.17	2.00	1.24	1.70	0.63	1.20	0.54	0.72	0.54	1.20
200	50	0	1.00	0.70	1.00	235	200	0	1.00	2.00	1.24	1.70	0.72	0.77	0.59	0.72	0.23	0.77
200	0	0	1.00	0.70	1.00	235	200	0	1.00	2.00	1.24	1.70	0.72	0.72	0.72	0.72	0.00	0.72
200	-50	0	1.00	0.70	1.00	235	200	-50	1.00	2.00	1.24	1.70	0.72	1.13	0.95	0.72	0.23	1.13
200	-100	0	1.00	0.70	1.00	235	200	-100	1.00	2.00	1.24	1.70	0.72	1.63	1.27	0.72	0.54	1.63
200	-150	0	1.00	0.70	1.00	235	200	-150	1.00	2.00	1.24	1.70	0.72	2.16	1.67	0.72	0.89	2.16
200	-200	0	1.00	0.70	1.00	235	200	-200	1.00	2.00	1.24	1.70	0.72	2.72	2.17	0.72	1.27	2.72
200	200	0	1.00	0.40	1.00	235	154	154	0.01	2.00	1.03	1.40	0.43	1.66	2.89	0.72	2.17	2.89
200	150	0	1.00	0.40	1.00	235	170	99	0.01	2.00	1.03	1.40	0.53	1.05	2.33	0.72	1.61	2.33

200	100	0	1.00	0.40	1.00	235	187	44	0.01	2.00	1.03	1.40	0.63	0.46	1.79	0.72	1.07	1.79
200	50	0	1.00	0.40	1.00	235	200	0	1.00	2.00	1.03	1.40	0.72	0.00	1.07	0.72	0.52	1.07
200	0	0	1.00	0.40	1.00	235	200	0	1.00	2.00	1.03	1.40	0.72	0.00	0.72	0.72	0.00	0.72
200	-50	0	1.00	0.40	1.00	235	200	-50	1.00	2.00	1.03	1.40	0.72	0.52	1.43	0.72	0.52	1.43
200	-100	0	1.00	0.40	1.00	235	200	-100	1.00	2.00	1.03	1.40	0.72	1.07	2.15	0.72	1.07	2.15
200	-150	0	1.00	0.40	1.00	235	200	-150	1.00	2.00	1.03	1.40	0.72	1.61	2.88	0.72	1.61	2.88
200	-200	0	1.00	0.40	1.00	235	200	-200	1.00	2.00	1.03	1.40	0.72	2.17	3.62	0.72	2.17	3.62
200	200	0	1.00	0.10	1.00	235	154	154	0.00	2.00	1.00	1.10	0.43	6.55	9.24	0.72	8.51	9.24
200	150	0	1.00	0.10	1.00	235	170	99	0.00	2.00	1.00	1.10	0.53	4.21	7.11	0.72	6.38	7.11
200	100	0	1.00	0.10	1.00	235	187	44	0.00	2.00	1.00	1.10	0.63	1.87	4.98	0.72	4.26	4.98
200	50	0	1.00	0.10	1.00	235	200	0	1.00	2.00	1.00	1.10	0.72	0.00	2.67	0.72	2.13	2.67
200	0	0	1.00	0.10	1.00	235	200	0	1.00	2.00	1.00	1.10	0.72	0.00	0.72	0.72	0.00	0.72
200	-50	0	1.00	0.10	1.00	235	200	-50	1.00	2.00	1.00	1.10	0.72	2.13	3.03	0.72	2.13	3.03
200	-100	0	1.00	0.10	1.00	235	200	-100	1.00	2.00	1.00	1.10	0.72	4.26	5.34	0.72	4.26	5.34
200	-150	0	1.00	0.10	1.00	235	200	-150	1.00	2.00	1.00	1.10	0.72	6.38	7.65	0.72	6.38	7.65
200	-200	0	1.00	0.10	1.00	235	200	-200	1.00	2.00	1.00	1.10	0.72	8.51	9.96	0.72	8.51	9.96
99	99	0	0.50	1.00	1.00	235	76	76	0.03	1.06	2.00	1.50	0.63	0.11	1.01	0.83	0.18	1.01

Table 3.4 Curved plate field $R/t \le 2500$ [1]

Load case	Aspect ratio b / R	Buckling factor K	Reductions factor κ
1a 	$\frac{b}{R} \le 1{,}63\sqrt{\frac{R}{t}}$	$K = \frac{b}{\sqrt{R \cdot t}} + 3\,\frac{(R \cdot t)^{0{,}175}}{b^{0{,}35}}$	$\kappa_x = 1$ [2] for $\lambda \le 0{,}4$; $\kappa_x = 1{,}274 - 0{,}686\,\lambda$ for $0{,}4 < \lambda \le 1{,}2$; $\kappa_x = \frac{0{,}65}{\lambda^2}$ for $\lambda > 1{,}2$
1b  p_e = external pressure in [N/mm²]	$\frac{b}{R} > 1{,}63\sqrt{\frac{R}{t}}$	$K = 0{,}3\,\frac{b^2}{R^2} + 2{,}25\left(\frac{R^2}{b \cdot t}\right)^2$	
2 	$\frac{b}{R} \le 0{,}5\sqrt{\frac{R}{t}}$	$K = 1 + \frac{2}{3}\,\frac{b^2}{R \cdot t}$	$\kappa_y = 1$ [2] for $\lambda \le 0{,}25$; $\kappa_y = 1{,}233 - 0{,}933\,\lambda$ for $0{,}25 < \lambda \le 1$; $\kappa_y = 0{,}3/\lambda^3$ for $1 < \lambda \le 1{,}5$; $\kappa_y = 0{,}2/\lambda^2$ for $\lambda > 1{,}5$
	$\frac{b}{R} > 0{,}5\sqrt{\frac{R}{t}}$	$K = 0{,}267\,\frac{b^2}{R \cdot t}\left[3 - \frac{b}{R}\sqrt{\frac{t}{R}}\right] \ge 0{,}4\,\frac{b^2}{R \cdot t}$	
3 	$\frac{b}{R} \le \sqrt{\frac{R}{t}}$	$K = \frac{0{,}6 \cdot b}{\sqrt{R \cdot t}} + \frac{\sqrt{R \cdot t}}{b} - 0{,}3\,\frac{R \cdot t}{b^2}$	as in load case 1a
	$\frac{b}{R} > \sqrt{\frac{R}{t}}$	$K = 0{,}3\,\frac{b^2}{R^2} + 0{,}291\left(\frac{R^2}{b \cdot t}\right)^2$	
4 	$\frac{b}{R} \le 8{,}7\sqrt{\frac{R}{t}}$	$K = K_\tau \cdot \sqrt{3}$; $K_\tau = \left[28{,}3 + \frac{0{,}67 \cdot b^3}{R^{1{,}5} \cdot t^{1{,}5}}\right]^{0{,}5}$	$\kappa_\tau = 1$ for $\lambda \le 0{,}4$; $\kappa_\tau = 1{,}274 - 0{,}686\,\lambda$ for $0{,}4 < \lambda \le 1{,}2$; $\kappa_\tau = \frac{0{,}65}{\lambda^2}$ for $\lambda > 1{,}2$
	$\frac{b}{R} > 8{,}7\sqrt{\frac{R}{t}}$	$K_\tau = 0{,}28\,\frac{b^2}{R\sqrt{R \cdot t}}$	

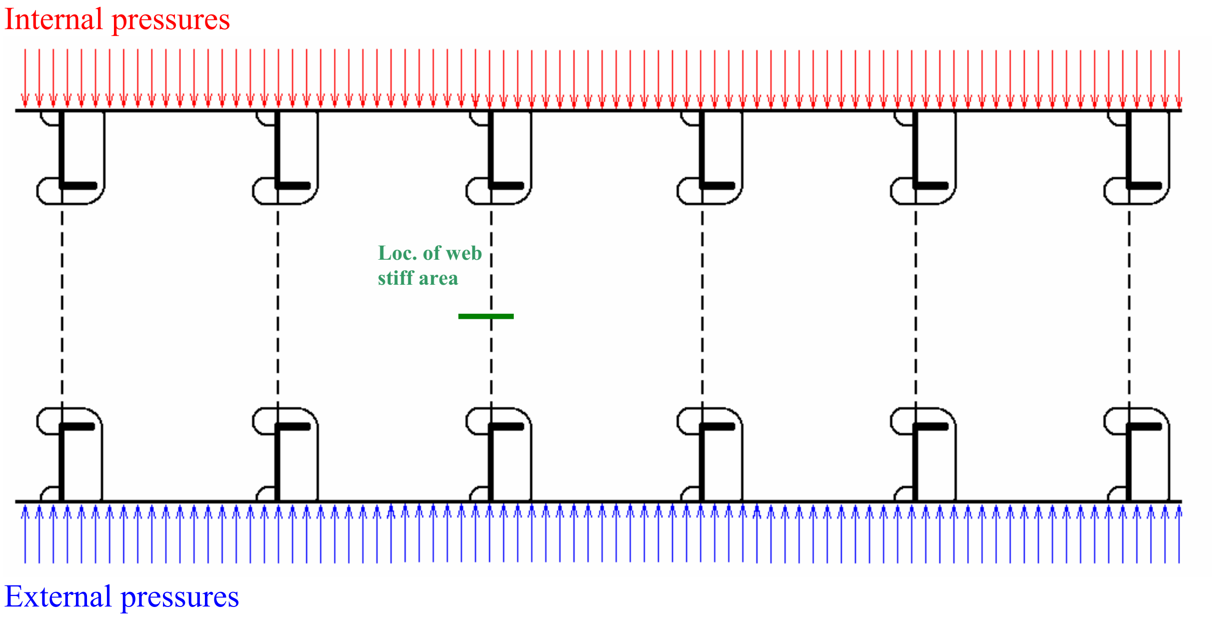
Explanations for boundry conditions:
- - - - - plate edge free
——— plate edge simply supported
▬▬▬ plate edge clamped

[1] For curved plate fields with a very large radius the κ-value need not to be taken less than one derived for the expanded plane field.

[2] For curved single fields. e.g. the bilge strake, which are located within plane partial or total fields, the reduction factor κ may taken as follow:

Load case 1b: $\kappa_x = 0{,}8/\lambda^2 \le 1{,}0$; load case 2: $\kappa_y = 0{,}65/\lambda^2 \le 1{,}0$

KC#493-1


Internal pressures
Loc. of web
stiff area
External pressures

KC#493-2

KC#493 Technical background

The combined effect of external and internal pressures applied on ordinary stiffeners depends on the position of the stiffener as specified in CSR BC Chapter 6 – Section 1 – [1.3].

Elements of the outer shell

Two cases are to be considered:

1. the stiffener is located below the waterline
    a. the compartment is empty: only the external still water and wave pressures are considered.
    b. the compartment is intended to carry liquids: the internal still water and wave pressures are to be reduced by the external still water and wave pressures

    The external pressures are to be set in accordance with the draught that matches the loading condition to be assessed.
2. the stiffener is located above the waterline

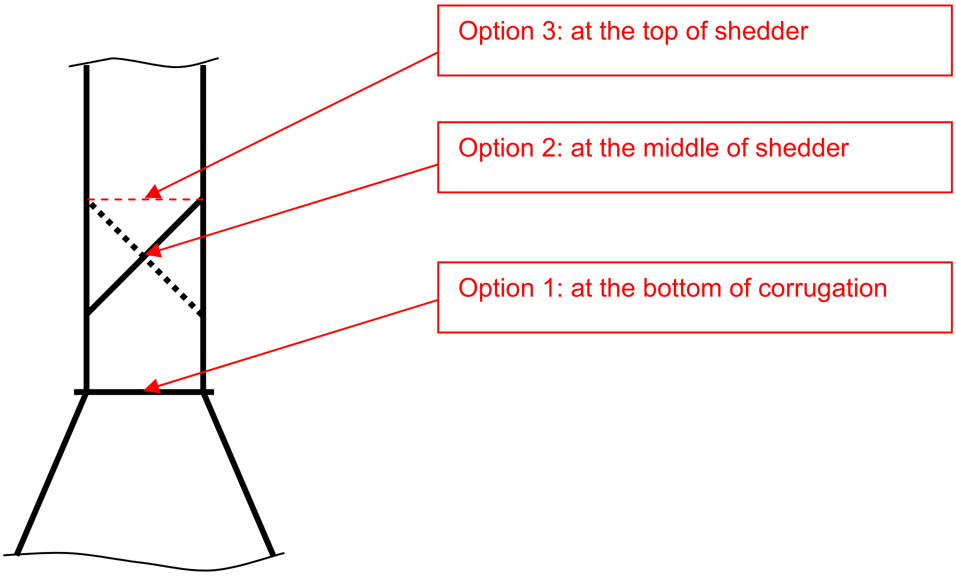
only the still water and wave internal pressures are to be considered.

Other elements

If the stiffener is attached to an element that separates two adjacent compartments, then the pressures to be considered are the still water and wave lateral pressures of each compartment individually loaded.

KC#497

Where is the pressure point to be used for scantling check of corrugation web?
Please note that option 1 is inside the gusset/shedder. Therefore, eventually there is no pressure.



KC#529

Derivation of the normal stress terms in the formulae for p_{zi} CH6, Sec3, 4.2.2
(Dr.-Ing. Arne Schulz-Heimbeck)

The formulae for the nominal pressures p_{zx} and p_{zy} contain the influence of normal stresses.

$$p_{zx} = \frac{t_a}{b}\left(\sigma_{xl}\left(\frac{\pi \cdot b}{a}\right)^2 + 2 \cdot c_y \cdot \sigma_y + \sqrt{2}\tau_1\right)$$

$$p_{zy} = \frac{t_a}{a}\left(2 \cdot c_x \cdot \sigma_{xl} + \sigma_y\left(\frac{\pi \cdot a}{n \cdot b}\right)^2\left(1 + \frac{A_y}{a \cdot t_a}\right) + \sqrt{2}\tau_1\right)$$

with $\sigma_{xl} = \sigma_x\left(1 + \frac{A_x}{b \cdot t_a}\right)$

The axial acting stresses can be calculated according the TB document ***New Req. of GL for Proof of Buckling Strength (inkl DIN18800).pdf***

$$M_\ell = \frac{q\ell^2}{\pi^2} = F_{Ki}\frac{\frac{\pi^2}{\ell^2}F \cdot w_o}{\frac{\pi^2}{\ell^2}F_{Ki} - \frac{\pi^2}{\ell^2}F} = F_{Ki}\frac{p_{zl} \cdot w_o}{c_f - p_{zl}}$$

where:

p_{zl} = load caused by the longitudinal force

p_{zl} = $\frac{\pi^2}{\ell^2} \cdot F = \frac{\pi^2}{\ell^2}\sigma_a \cdot A$

The following derivation shows the equivalence of the formula for p_{zx} and the first term of the formula for p_{zx}.

$$\frac{t_a}{b}\left(\sigma_{xl}\left(\frac{\pi \cdot b}{a}\right)^2\right) = \sigma_x\left(\frac{t_a\pi^2 b^2}{a^2 b} + \frac{t_a\pi^2 b^2 A_x}{a^2 b \cdot bt_a}\right)$$

$$= \sigma_x\frac{\pi^2}{a^2}\left(t_a b + A_x\right) = \sigma_x\frac{\pi^2}{a^2}A$$

This derivation shows in addition, that the stress σ_x in the formulae for p_{zx} and p_{zy} is the axial stress, acting in the stiffener.

$\sigma_x = \sigma_a$ with $\sigma_a = \sigma_x^* - 0.3 \cdot \sigma_y^*$ where σ_x^* and σ_y^* are FE-stresses.

In case of a transverse stiffener, the stress of the second term with σ_y can be derived accordingly.

In the two formulae for p_{zx} and p_{zy} are different assumptions.

- Longitudinal stiffeners
  - are not supported by intermediate transverse stiffeners.
  - act always as secondary members
- Transverse stiffeners
  - are classified in two kind of stiffeners
    a) small transverse stiffener (secondary member), located between two longitudinals
    b) transverse stiffener with higher rigidity than the longitudinal stiffener, which is supported by intermediate longitudinal stiffeners and partially constrained at the ends (primary member)

    The factor c_s characterises the support condition at the ends of the transverse stiffener in line with the categorisation. A secondary (transverse stiffener) is simply supported, a primary stiffener is partially constrained.

In case a) the stress acting normal to the stiffener is σ_x^*. No intermediate longitudinals have to be taken into account, so A_x is zero and the term $\sigma_{xl} = \sigma_x^*$. In this case is $n \neq 1$.

In case b) the intermediate longitudinal stifferners provide an additional support for the transverse stiffener and shift the acting normal stress out of the plate plane. It is obvious that the normal stress has to be reduced.

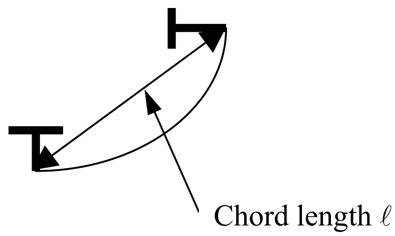
$$\frac{t_a}{a}\left(2c_x\sigma_{xl}\right) = \sigma_x\left(\frac{2t_a c_x}{a} + \frac{2t_a c_x A_x}{abt_a}\right)$$

$$= 2c_x\sigma_x\left(\frac{t_a}{a} + \frac{A_x}{ab}\right)$$

Both terms $\left(\frac{t_a}{a}\right)$ and $\left(\frac{A_x}{ab}\right)$ are much more smaller than 1 and represent the reduction factors for the normal acting stress σ_x with $\sigma_x = \sigma_a$.

KC#557

Bilge Shell Plate



KC#563

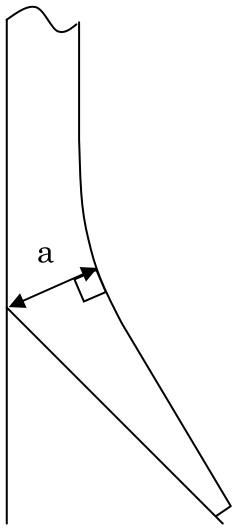


Fig. A

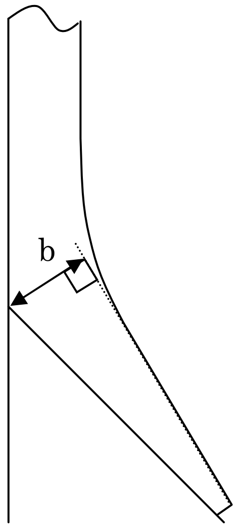
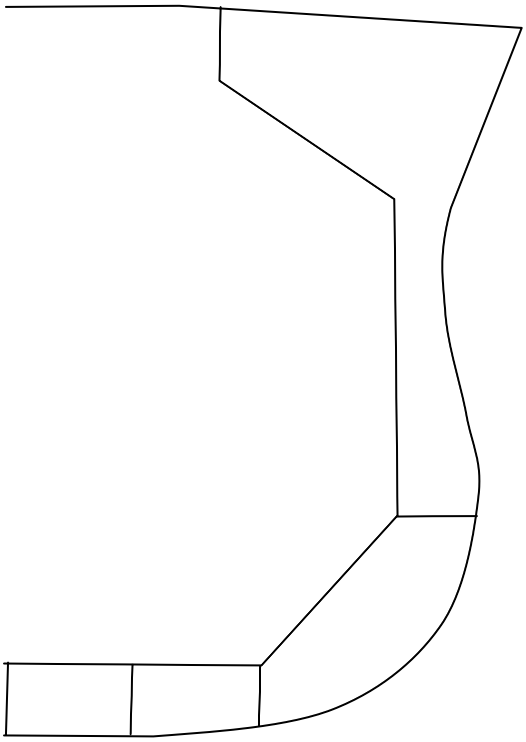


Fig. B

KC#567



KC#580

Table 4: Values of *K*, in case $d_H \geq 2.5d_0$

Upper end support	
Welded directly to deck	**Welded to stool efficiently supported by ship structure**
1.00	0.83

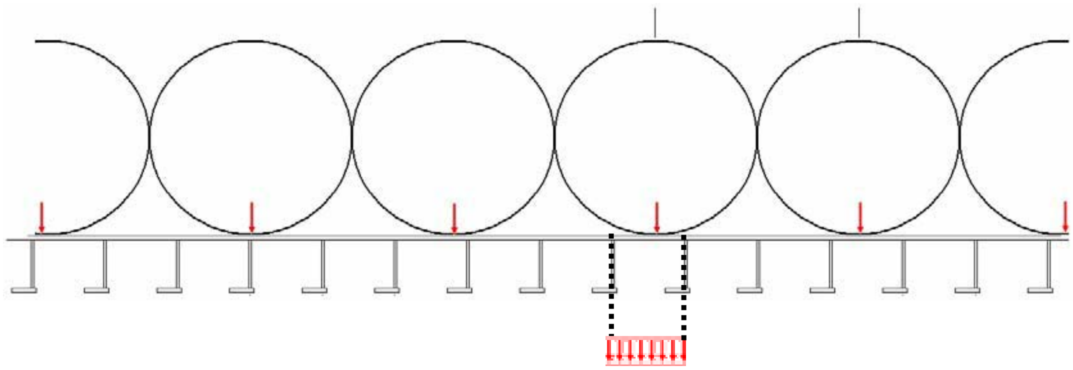
Table 5: Values of *K*, in case $d_H < 2.5d_0$

Section modulus of	Upper end support	
	Connected to deck	**Connected to stool**
Corrugated bulkhead	0.71	0.65
Stool at bottom	1.25	1.13

KC#609-1

RCP on evenly distributed load according to Ch. 6 Sec. 1 [2.7.1] and Sec. 2 [2.5.4] Steel coil loading

Load to be distributed over 1 elementary plate panel at per sketch below.



Uniform distributed load, when distributed to one elementary plate panel becomes:

$$P = (n_{tier} \times W_{coil} \times l_{stiff}/l_{coil}) / (l_{stiff} \times S_{stiff}) = (n_{tier} \times W_{coil}) / (l_{coil} \times S_{stiff})$$

Load on one EPP

Area of EPP

According to our understanding of Ch.6 Sec.1 Table 3 and Table 4, a 20% gap between steel coils is included in the calculations. The same gap could be included in the formulation for uniform load giving:

$$P = (n_{tier} \times W_{coil}) / (1.2 \times l_{coil} \times S_{stiff})$$

KC#609-2

Steel coil loading according to Ch. 6 Sec. 1 [2.7.1] and Sec. 2 [2.5.4]

Abstract

In the 3rd JBP October 2005 draft Ch. 6 Sec. 1 [2.7.4] and Sec. 2 [2.5.4] for steel coil loading, it is proposed to calculate the double bottom as uniformly loaded if steel coils are supported by a large number of dunnages. This pre assumes that the dunnages are very stiff and able to transfer the load efficiently to the nearest longitudinals. There are no requirements in the rules as to the scantlings or stiffness of dunnages. If dunnage stiffness are disregarded the load on stiffeners should be changed to a line load. Comparative calculations enclosed herein show the requirement in the Rules to be non conservative for this case. Increase of up to 78% is required depending on the longitudinal spacing. Even when calculating the full plastic utilisation of the panel, disregarding longitudinal stresses, the required sectional modulus of longitudinals was 3-10% higher than the Rule formulation.

The calculations show that significant permanent deflection should be expected for both the plating and the longitudinals of the inner bottom when the design load condition is applied to the net scantled structure. Significant permanent deflection governed by the membrane response is therefore anticipated.

Based on this assessment, we are of the opinion that the rule formulation for inner bottom plating and longitudinals should be changed to a line load formulation. It is our consideration that the introduction of explicit requirements to the scantling and stiffness of the dunnages is impractical.

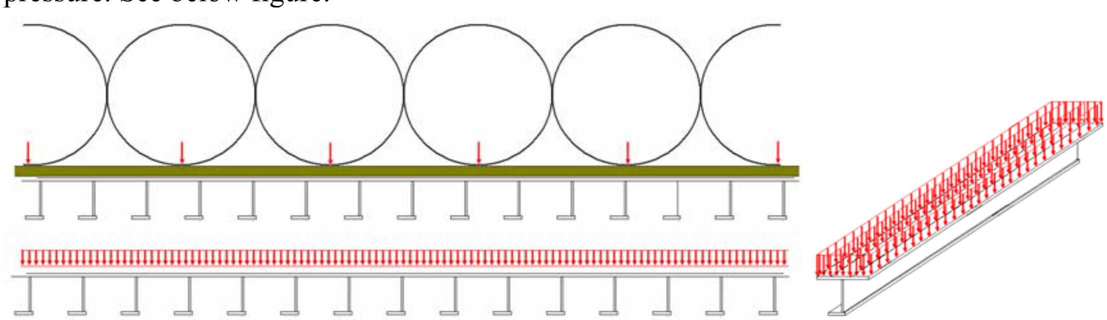
Table of contents

Introduction

JBP 3rd draft, Ch.6 Sec.2 [2.5.4]:

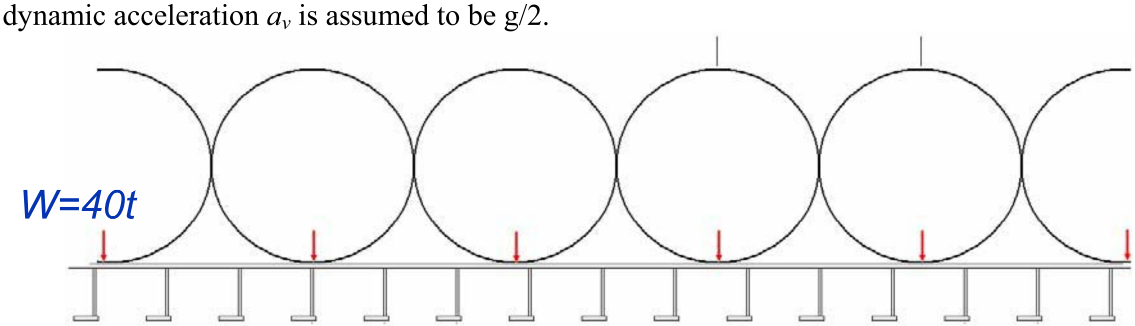
"Where the number of load points per elementary plate panel n_2 is greater than 10/or the number of dunnages n_3 is greater then 5, the inner bottom may be considered as loaded by a uniform distributed load. In such a case, the scantling of the inner bottom ordinary stiffeners is to be obtained according to [3.2.3]"

DNV interpretation of the text is: If the bottom coil is supported by 6 or more dunnages going transversally, the load from the coil on the inner bottom can be simplified to a uniform pressure. See below figure.



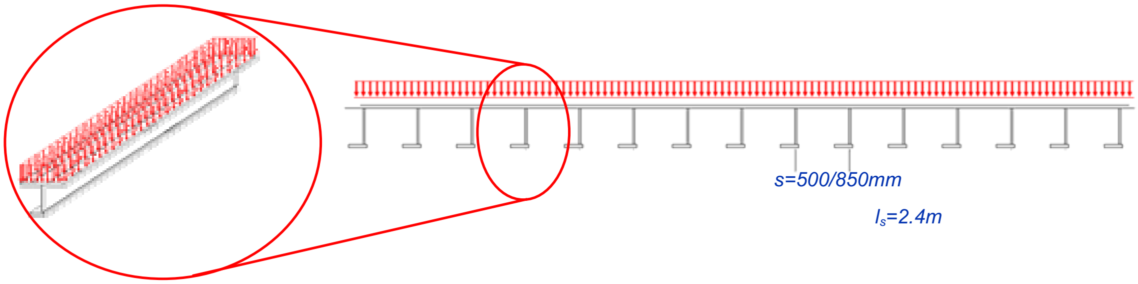
The load is then transferred between the longitudinals by the wooden dunnages. This requires the dunnages to be extremely stiff. It is our opinion that this assumption is wrong and that the pressure load should be changed to a line load on the stiffener. We have performed a small comparison case below in order to elaborate our understanding of the problem.

The following is pre-assumed. Coil, (or bottom coil), weight is 40t ≈ 400kN. Coil length is, including spacing, l_c = 1.2 meters and diameter D =1.5 meters. The allowable stress is assumed to be $\lambda_s R_Y$=0.9x235/0.78=271N/mm^2, which is maximum allowable stress for AH32 steel if longitudinal stresses are disregarded. Two stiffener spacings are calculated s_1=500mm and s_2=850mm. The length of stiffeners between floors is assumed to be l_s=2.4m. The dynamic acceleration a_v is assumed to be g/2.



Rule calculation

The rule calculation assumes that the double bottom is uniformly loaded.



Pressure from coil is:

$$P = W(g + a_v)/(Dl_c) = 40(9.81 \times 1.5)/(1.5 \times 1.2) = 327kN/m^2$$

Required plate thickness according to Sec. 1[2.7.4](C_a=C_r=1)

$$t_{req,s_1=500} = 15.8 C_a C_r s \sqrt{\frac{P}{\sigma_{all}}} = 8.68mm + t_k$$

$$t_{req,s_2=850} = 15.8 C_a C_r s \sqrt{\frac{P}{\sigma_{all}}} = 14.75mm + t_k$$

Typical t_k for inner bottom adjacent to ballast tank is 5.4 mm.

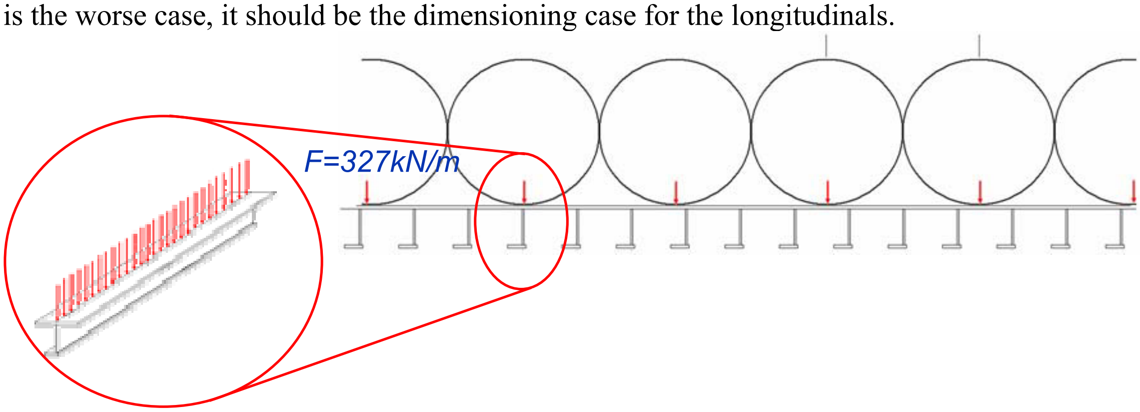
Required section modulus on stiffener is:

$$w_{req,s_1=500} = 10^3 \frac{Psl_s^2}{12\sigma} = 290cm^3$$

$$w_{req,s_2=850} = 10^3 \frac{Psl_s^2}{12\sigma} = 492cm^3$$

DNV alternative calculation

We assume that the load from the coils are transferred as a line load to the nearest longitudinal(s). As the coils diameter does not match the stiffener spacing exactly, there will always be one or more coils within the double bottom that will meet one longitudinal. As this is the worse case, it should be the dimensioning case for the longitudinals.



Line load on the most severe loaded longitudinal is:
$$q_l = W(g + a_v)/l_c = 40(9.81 \times 1.5)/1.2 = 491kN/m$$

Corresponding end moment on stiffener is:
$$M = \frac{q_l l_s^{\ 2}}{12} = 235kNm$$

The required section modulus is:
$$w_{req} = \frac{M}{\sigma} = \frac{160}{271} \times 10^3 = 869cm^3$$
The section modulus is independent of the stiffener spacing.

The required section modulus for the DNV calculation is three times the section modulus required by the Rules when the stiffener spacing is $s_1=500$mm. In order to calculate the longitudinals according to the Rules, the dunnages have to be extremely stiff in order to transfer the load efficiently between longitudinals.

Plastic coil response calculation

For reference, we have calculated the ultimate capacity of the inner bottom subjected to steel coil loading (plastic capacity). The calculation procedure used is originally derived for evaluation of ice loads on longitudinally stiffened panels.

Calculation procedure outline

Load model

It is assumed that the diameter of the coils is larger than two primary frame spaces, $D>2s$.The steel coil is loaded on a wooden support, which is soft compared to the steel coil. The coil will deform in to the wood and spread the load over a small distance *b* of the inner bottom plating, see Figure 1.

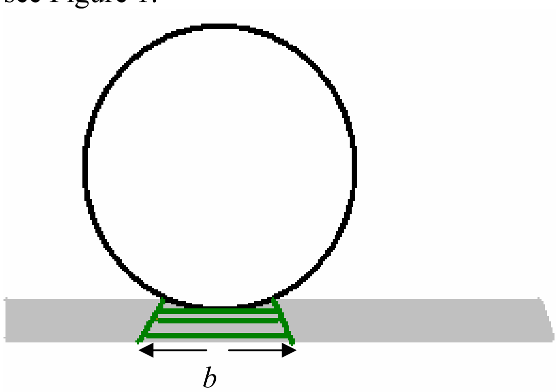


Figure 1 Steel coil deforming in to the wooden support

As described earlier, the coils will be loaded randomly within the double bottom. The diameter, *D*, of the coils do not match the primary longitudinal spacing. Consequently, there will always be coils meeting a longitudinal and coils at the middle of a plate field. The first will be the governing condition for the stiffeners scantlings, whereas the latter will be the governing condition for the plate scantlings.

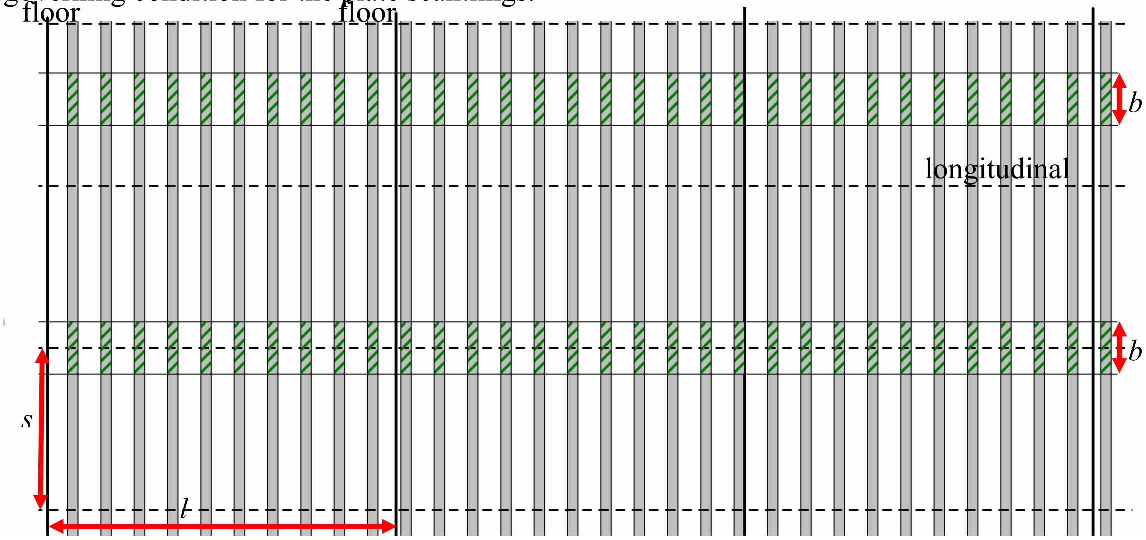


Figure 2 Load model plates and longitudinals

When the number of dunnages is large, the pressure from the steel coils on the wooden support will converge towards a uniform pressure within the breadth *b*, see Figure 2.

Longitudinals

We further assume plastic response of the plate and longitudinals.

The pressure within *b* is:

$$P = \frac{q_l}{b} = \frac{W(g + a_v)}{l_c b}$$

The required shear area is defined as:

$$A_{s,req} = 10 \frac{P \times 0.5 \times b_1 l}{\sigma_y / \sqrt{3}}$$

Where b_1/b is the portion of the load transferred in to the longitudinal and $(b - b1)/b$ is the portion transferred through plate bending in to the adjacent longitudinals. See Figure 3.

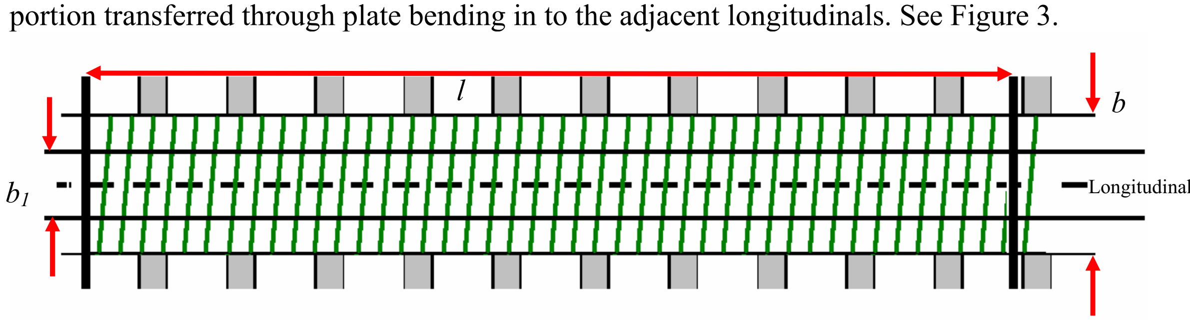


Figure 3 Relationship between b_1 and b

b_1 is given by:

$$b_1 = \max\left[k_0 b, b/3\right]$$

$$k_0 = 1 - \frac{2}{b}\left\{\sqrt{(s-b/2)^2 + \frac{10^{-3}t^2\sigma_y}{P}} - (s-b/2)\right\}$$

The plastic sectional modulus of longitudinal is given by:

$$z_{req} = 10^3 \frac{Pb_1 l^2 \alpha_{Plastc}}{8\sigma_y}$$

Where $\alpha_{plastic}$ is the relation between the plastic capacity of the longitudinal at the boundary to the plastic capacity at mid span.

$$\alpha_{Plastic} = \frac{1}{2 + k_{wl}\left[\sqrt{1-\alpha_{shear}{}^2} - 1\right]}$$

$\alpha_{shear} = A_{s,req}/A_{s,act}$ without being larger than 1. $A_{s,req}$ is the required shear area of longitudinal, whereas $A_{s,act}$ is the actual fitted shear area. α_s=1 will give the maximum required sectional modulus for the longitudinal.

$k_{wl} = \frac{1}{1 + 2\,A_{fl,act}/A_{s,act}}$ where $A_{fl,act}$ is the fitted flange area of the stiffener.

Plates

Based on plastic response of the plate the required thickness is:

$$t_{req} = 15.8s\sqrt{2\frac{b}{s} - \left(\frac{b}{s}\right)^2}\sqrt{\frac{P}{\sigma_y}}$$

Plastic calculation

The plastic calculation have been done for the case with longitudinal spacing, s=850mm.

If we assume b=0.15 m, the required scantling for the above condition will be:

$$q_l = \frac{W(g+a_v)}{bl_c} = \frac{40(9.81\times1.5)}{0.15\times1.2} = 3270kN/m^2$$

The fraction of the pressure carried by the stiffener:

$$k_{0,s_2=850} = 1 - \frac{2}{b}\left\{\sqrt{(s-b/2)^2 + \frac{10^{-3}t^2\sigma_y}{P}} - (s-b/2)\right\} = 0.8326$$

$$b_1 = \max[k_0 b, b/3] = \max[0.1249, 0.05] = 0.1249m$$

That is, the fraction of the load transferred to the adjacent stiffener is 16.7%.

The required shear area:

$$A_{s,req} = 10\frac{P\times0.5\times b_1 l}{\sigma_y/\sqrt{3}} = 10\frac{3270\times0.5\times0.1249x2.4}{301/\sqrt{3}} = 28.22cm^3$$

Required section modulus assuming α_{shear} =1.

$$k_{wl} = \frac{1}{1 + 2 \, {A_{fl,act}}/{A_{s,act}}} = \frac{1}{1 + 2 \, {(90 \times 13.1)}/{19.91}} = 0.4581$$

$$\alpha_{Plastic} = \frac{1}{2 + k_{wl}\left[\sqrt{1 - \alpha_{shear}{}^{2}} - 1\right]} = \frac{1}{2 + 0.4581\left[\sqrt{1 - 1^{2}} - 1\right]} = 0.6486$$

$$z_{req} = 10^{3} \frac{P b_{1} l^{2} \alpha_{Plastc}}{8 \sigma_{y}} = 10^{3} \frac{3270 \times 0.1249 \times 2.4^{2} \times 0.6486}{8 \times 301} = 634 cm^{3}$$

It should be noted that this is the required net plastic sectional modulus for the longitudinal. The elastic sectional modulus is typically ≈15-20% smaller. Hence, the equivalent net elastic section modulus is about 507-540cm^3.

Plates

$$t_{req} = 15.8 s \sqrt{2\frac{b}{s} - \left(\frac{b}{s}\right)^{2}} \sqrt{\frac{P}{\sigma_{y}}} = 15.8 \times 0.85 \sqrt{2\frac{0.15}{0.85} - \left(\frac{0.15}{0.85}\right)^{2}} \sqrt{\frac{3270}{301}} = 25.11 mm$$

It should be noted that *b*=0.15 is assumed to be slightly conservative at the middle of the plate span. If *b*=0.3m is used the requirement would decrease to 23.86mm.

It should be noted that the global, axial, stresses are disregarded in above calculation. The design condition is plastic, with allowable stress equal to yield. Fatigue is not evaluated.
If actual section modulus is smaller than the above calculated, the longitudinal will deform plastically. The shortage will be carried by the plate to the nearest longitudinals by membrane response. (i.e. significant permanent deformations)

Summary

In the 3rd JBP draft October 2005 Ch. 6 Sec. 1 [2.7.4] and Sec. 2 [2.5.4] for steel coil loading, it is proposed to calculate the double bottom as uniformly loaded if steel coils are supported by a large number of dunnages. This is pre assuming that the dunnages are very stiff and able to transfer the load efficiently to the nearest longitudinals.

Three calculations procedures are calculated above. All with the following coil particulars: W=40 tonnes, length 1.2 meters, diameter 1.5 meters and number of dunnages per coil >6.

(s=850mm)	**Dunnage assumption**	$W_{req,net}$ **[cm^3]**	$t_{req,net}$ **[mm]**
Rule calculation	Very stiff	490	14.75
DNV alternative	No stiffness	870	(not calc)
Plastic capacity disregarding longitudinal stress	No stiffness	540*	25.11**

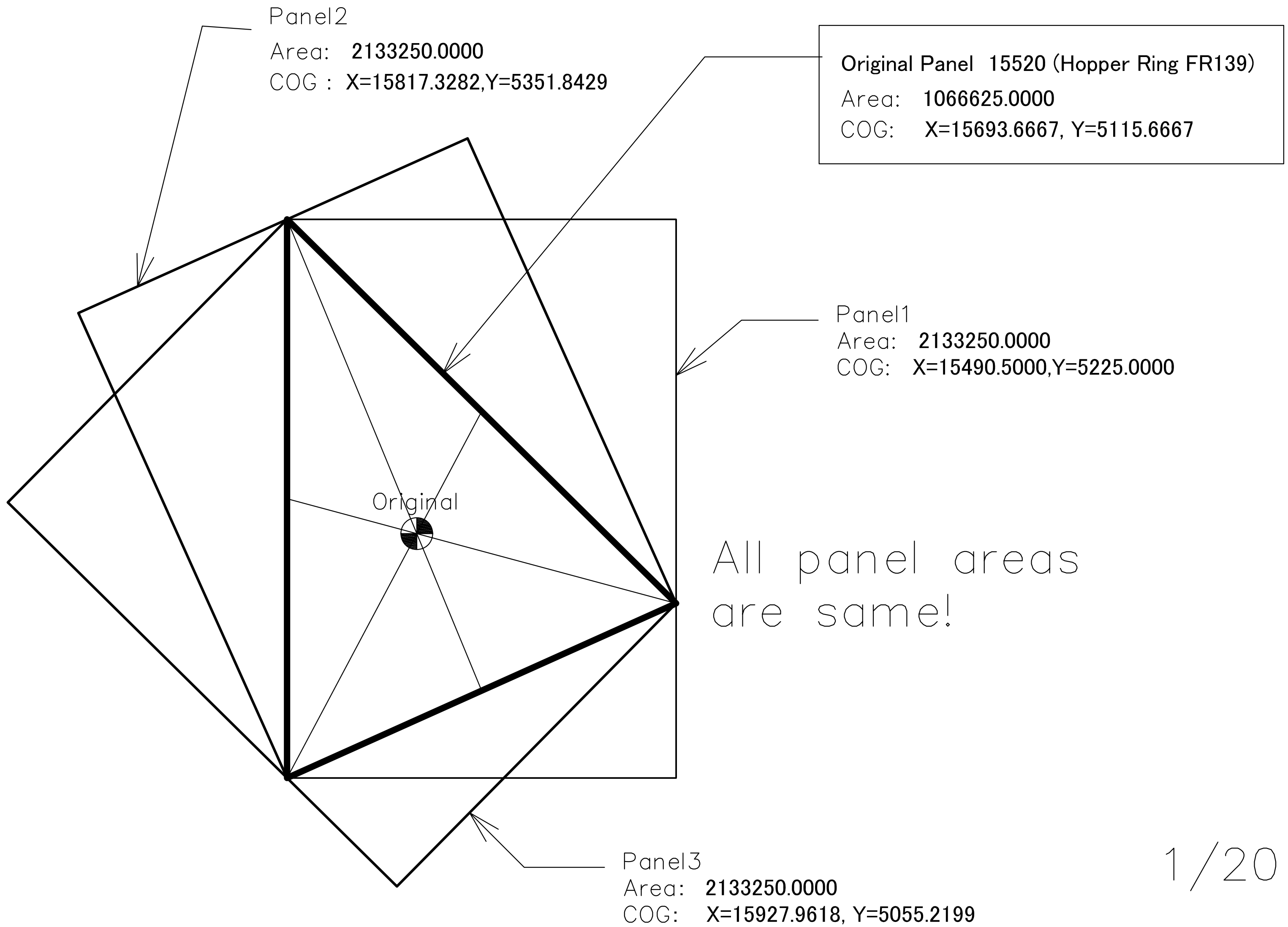
*Estimated elastic sectional modulus
** based on an assumed load breadth b=0.15 meters, see above calculation for details.

There is no requirement in the Rules as to the dimensions of dunnages. It is therefore unreasonable to assume a uniform pressure according to the Rule formulation. If dunnages are assumed to be without stiffness, the load should be applied as a line load on the longitudinals. In our calculation this corresponds to an increase of longitudinal section modulus of up to 78%, depending on the spacing of the longitudinals.
For reference, a plastic calculation was conducted for the latter case. The calculation was made without global stresses, allowing full plastic utilization of the longitudinals, σ_y=300. The calculation showed a required sectional modulus, compared to the Rule formulation, of +3-10% depending on the $w_{plastic}/w_{elastic}$ ratio of the longitudinals.

The calculations show that significant permanent deflection should be expected for both the plating and the longitudinals of the inner bottom when the design load condition is applied to the net scantled structure. Significant permanent deflection governed by the membrane response is therefore anticipated.

Based on this assessment, we are of the opinion that the rule formulation for inner bottom plating and longitudinals should be changed to a line load formulation. It is our consideration that the introduction of explicit requirements to the scantling and stiffness of the dunnages is impractical.

KC#623


Panel2
Area: 2133250.0000
COG : X=15817.3282,Y=5351.8429
Original Panel 15520 (Hopper Ring FR139)
Area: 1066625.0000
COG: X=15693.6667, Y=5115.6667
Panel1
Area: 2133250.0000
COG: X=15490.5000,Y=5225.0000
Original
All panel areas are same!
Panel3
Area: 2133250.0000
COG: X=15927.9618, Y=5055.2199

1/20

KC#624

CSR-BC Safety factors for stiffener buckling

In the third draft of the CSR_BC, the SOLAS safety factor S=1.15 for special members has been added. Only the stiffeners of transverse bulkheads is missing in the list.

BV gives the following explanations by E-mail:

For the following, it is based on the evolution within MSC discussions.

Some extracts are listed to illustrate the process.

Iacs submission to MSC 80: Extract
Quote
XII/6.5.3 - the structure of cargo areas shall be such that single failure of one stiffening structural member will not lead to immediate consequential failure of other structural items potentially leading to the collapse of the entire stiffened panel.
a. As written this regulation could be understood to apply to stiffened plate panels of the bottom, side shell, deck, inner bottom, longitudinal bulkheads, upper wing tanks and/or lower wing tanks which are bounded by primary structural elements such as transverse and longitudinal bulkheads, transverse webs, floors or girders (or even more broadly to also include each stiffened plate panel of the transverse webs, floors and girders themselves). IACS considers that **this requirement does not apply to corrugated transverse bulkheads**, which have already been reinforced according to IACS Unified Requirement S18.
Unquote
The IACS proposal of interpretation, document MSC 80/18/2, was not supported during the MSC 80, and the task of proposing an interpretation was allocated to an intersessional working group of the MSC meeting on 12/13 September 2005.
A new IACS proposal has been submitted, document ISR ISWG 1/3/2. The submission deals with SOLAS regulation XII/6.5.3 as follows:
Quote
XII/6.5.3 - the structure of cargo areas shall be such that single failure of one stiffening structural member will not lead to immediate consequential failure of other structural items potentially leading to the collapse of the entire stiffened panel.
5.3 IACS understands that the objective of this regulation is to avoid immediate collapse of the stiffened panel after a single, localized mechanical damage *(such as local permanent deformation, cracking or weld failure that might result from accidental damage within the cargo hold from cargo operations)* of one stiffener of the structure bounding the cargo holds *(such as inner bottom, lower hopper tanks, lower half of internal longitudinal bulkhead of double side skin bulk carriers or side shell of single hull bulk carriers and lower stool of transverse corrugated bulkheads)*. Then, for the scope of application described in 3. and 4. above, two cases are to be considered:
Unquote

Extract of JBP interpretation sent by JF Segretain on 29/12/2005

Quote

IACS JOINT BULKER PROJECT – Technical Backgrounds
A3(CCS/KR/NK) – UNITAS (BV/GL/RINA) - RS
Structural redundancy requirements of SOLAS regulation XII/6.5.1and 6.5.3 in CSR for Bulk Carriers

1 Introduction

During the 24th assembly, MSC Committee of IMO adopted the unified interpretation of SOLAS regulations XII/6.5.1 and 6.5.3 provided here:

Regulation XII/6.5.1 . Protection of cargo holds from loading/discharge equipment

1 The protection of the structure of the cargo holds should be achieved by structural design features such as mandatory application of classification society grab notation.

2 The protection of hatchways and coamings from grab wire damage may be achieved by fitting protection bars (e.g. half-round bar) on the hatch side girder (e.g. upper portion of top side tank plates), hatch-end beams and the upper portion of hatch coamings.

Regulation XII/6.5.3 . Failure of cargo hold structural members and panels

1 Stiffening structural member means a stiffener attached to a structural plating panel.

2 For the purpose of this interpretation, cargo area includes hatchway coamings, topside tanks, side shells, longitudinal bulkheads of double-side skin construction, bilge hopper tanks and double bottom, but excludes hatchway covers.

3 Structural members of a cargo hold are the hatchway coamings, transverse bulkheads, panel plates of the top-side tanks and bilge hopper tanks facing the cargo hold, inner bottom, side shell of single-side skin construction or longitudinal bulkhead of double-side skin construction.

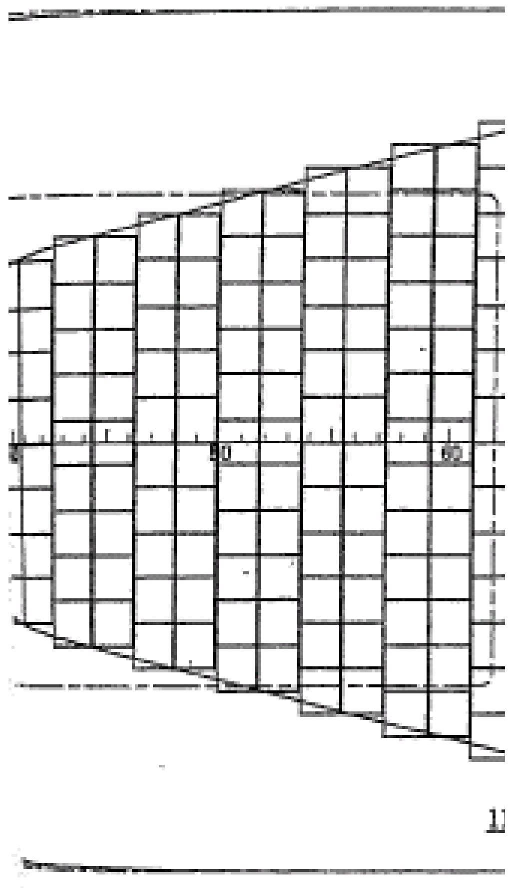
Unquote

Conclusions

So the factor s=1.15 applied to ordinary stiffeners which could be fitted on stools of transverse Bhds but not in my mind to the corrugation itself.

KC#631

Example of an arrangement of steel coil in aftermost cargo hold, showing the steel coils do not uniformly contact the hopper sloping plate.



KC#681

- Quote for immediate reference

1. CSR BC Rule, Ch.3 Sec.6/8.4.1

8.4 Upper and lower brackets

8.4.1

The face plates or flange of the brackets is to be sniped at both ends.

Brackets are to be arranged with soft toes.

The as-built thickness of the brackets is to be not less than the as-built thickness of the side frame webs to which they are connected.

2. CSR BC Rule, Ch.6 Sec.2/3.3.3

3.3.3 Lower bracket of side frame

In addition, at the level of lower bracket as shown in Ch 3, Sec 6, Fig 19, the net section modulus of the frame and bracket, or integral bracket, with associated shell plating, is to be not less than twice the net section modulus w required for the frame mid-span area obtained from [3.3.1].

The net thickness t_{LB} of the frame lower bracket, in mm, is to be not less than the net thickness of the side frame web plus 1.5 mm.

3. IACS UR S12 (Rev 4)

S12.4 - Lower and upper brackets

The thickness of the frame lower brackets is not to be less than the greater of t_w and $t_{w,min}$ + 2 mm, where t_w is the fitted thickness of the side frame web. The thickness of the frame upper bracket is not to be less than the greater of t_w and $t_{w,min}$.

- Unquote

Comments:

1. It is considered CSR BC Rule, Ch.3, Sec.6/8.4.1 is equivalent to “The thickness of the frame lower brackets is not to be less than the greater of tw ……, where tw is the fitted thickness of the side frame web. …….” in IACS UR S12.

2. It is also considered “the net thickness of the side frame web plus 1.5mm” in CSR BC Rule, Ch.6, Sec.2/3.3.3 is equivalent to “tw,min+2 mm” in IACS UR S12. (Underlined in red)

3. As such, CSR BC Rule, Ch.6, Sec.2/3.3.3 is recommended to be changed to “…… the net minimum thickness defined in Ch.6 Sec.2/2.2.2 of the side frame web plus 1.5mm.”

KC#697

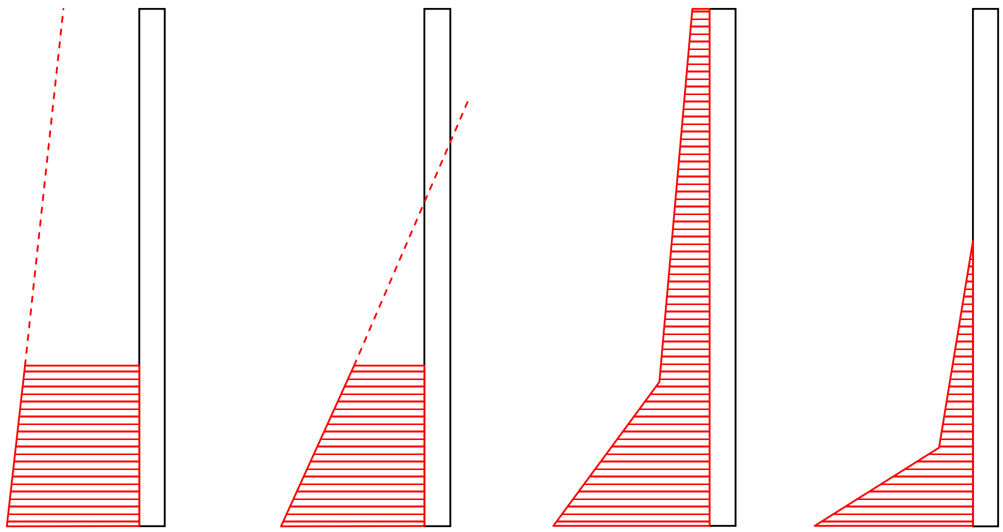
CH6, Sec2, 1.4.2

The formulae in this paragraph derive the pressure p for two cases:

(a) The stiffener is loaded with pressure over the whole height
(b) The stiffener is loaded with pressure only in a part of its height

Both cases are valid under the assumption, that the slope of the pressure curve is constant.

In case of structure, loaded from both sides the following additional pressure distributions are possible.



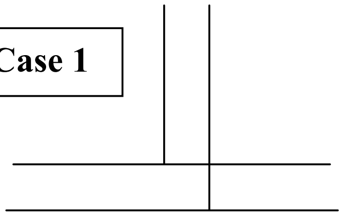
(c) (d) (e) (f)

How to calculate the pressure p, used in CH6, Sec2, 3.2.3 for examples (c) to (f)?

KC#708

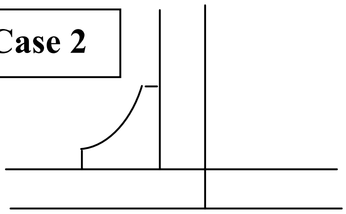
Applicability of C6S2[4.1.3]

Case 1



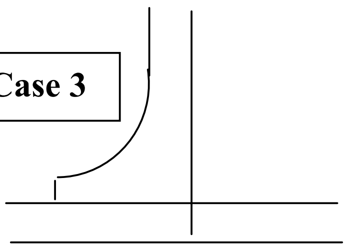
Applicable

Case 2



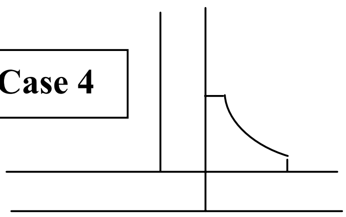
Applicable

Case 3



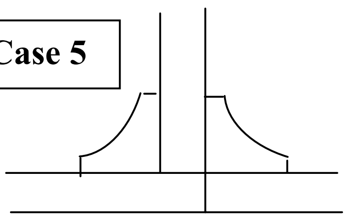
Applicable

Case 4



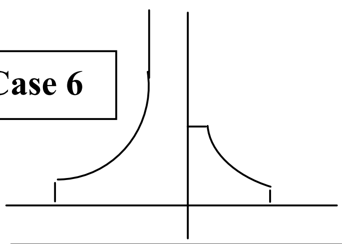
Not Applicable

Case 5



Not Applicable

Case 6



Not Applicable

KC#717

$$\left(\frac{|\sigma_x|S}{\kappa_x R_{eH}}\right)^{e1}+\left(\frac{|\sigma_y|S}{\kappa_y R_{eH}}\right)^{e2}-B\left(\frac{\sigma_x\sigma_y S^2}{R_{eH}^2}\right)+\left(\frac{|\tau|S\sqrt{3}}{\kappa_\tau R_{eH}}\right)^{e3}\leq 1.0$$

Notes:
Tensile stress need to be considered as the actual values

$$\left(\frac{\sigma_x S}{\kappa_x R_{eH}}\right)^{e1}\leq 1.0$$

$$\left(\frac{\sigma_y S}{\kappa_y R_{eH}}\right)^{e2}\leq 1.0$$

Notes:
The buckling utilization factor is taken as zero, where the normal stress is tensile.

KC#768

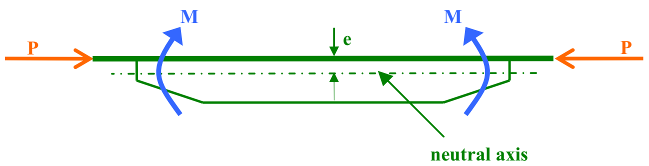
Rule Change Proposal
for Net Section Modulus of Stiffener Wst
in Paragraph 4.2.2 of Chapter 6, Section 3 of CSR BC

LR Yokohama Design Support Office
4 June 2008

1. In Paragraph 4.2.2 of Chapter 6, Section 3 of the CSR BC, it is noted that the net section modulus Wst of a stiffener is calculated at its flange (or face plate) or the attached plate to it, where compressive bending stress may appear, to assess its buckling capability, in both cases of availability of lateral pressure and no pressure on it.

2. However, it is not clear there how the net section modulus of a stiffener snipped at both ends is calculated.

3. When the stiffener is under compression, compressive stress is induced at the attached plate by a moment due to eccentricity of a compression force off the neutral axis of the stiffener. Consequently the net section modulus is to be calculated at the attached plate for this purpose.



4. A description in the definition of imperfection wo seems to support the above, i.e., "For stiffeners sniped at both ends wo must not be taken less than the distance from the midpoint of the attached plating to the neutral axis of the stiffener".

5. It is proposed that the net section modulus of a stiffener snipped at both ends is to be clearly defined in the CSR in line with the above.

KC#852

Application of Ch.6 Sec. 2 , [4.1.1] for steel coil loads

In according to the current text of Ch. 6, Sec.2 [4.1.1], pressure, in kN/m^2, acting on the ordinary stiffener is considered.
It is obviously that the loads due to steel coil is also acting on the ordinary stiffener.
Therefore, the requirement of Ch.6 Sec.2, [4.1.1] is applicable in case of steel coil loading.

In this case, the load due to steel coil specified in Ch.6 Sec 2 [2.2.3] should be considered, instead of the pressure.
In addition, as the load due to steel coil is the concentrated load, "s" and "l" in the formula of Ch 6 Sec 2, [4.1.1] should not use.

For your reference, the following formula should be used in case of steel coil loading.

When steel coils are loaded, the net section area at the web stiffener mid-height is to be not less than the value obtained, in cm^2, from the following formula:

$$A = 0.1 k_1 F_{coil}$$

where:

F_{coil} : Steel coil load, in *kN*, acting on the elementary panel in which the ordinary stiffener is attached, to be taken as:

$$F_{coil} = \frac{[g\cos(C_{ZP}\phi)\cos(C_{ZR}\theta) + a_Z]F}{1000}$$ for double bottom structures

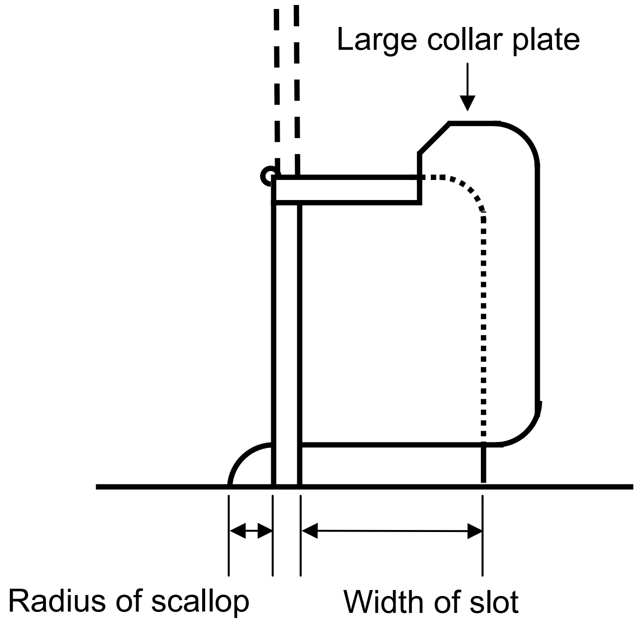
$$F_{coil} = \frac{a_{hopper} F'}{1000}$$ for bilge hopper structures

C_{ZP} , C_{ZR} : Load combination factors defined in Ch.4 Sec.4 2.2
ϕ : Single pitch amplitude, in *deg*, defined in Ch.4 Sec.2 2.2
θ : Single roll amplitude, in *deg*, defined in Ch.4 Sec.2 2.1
a_Z : Acceleration, in m/s^2, in vertical direction defined in Ch.4 Sec.2 3.2
a_{hopper} : Acceleration, in m/s^2, defined in Ch.6 Sec.1 2.7
F : Force due to steel coil, in *kg*, defined in Ch.6 Sec.1 2.7
F' : Force due to steel coil, in *kg*, defined in Ch.6 Sec.1 2.7

The above formulae have been included in RCN 1 adopted by the Council in January 2009.

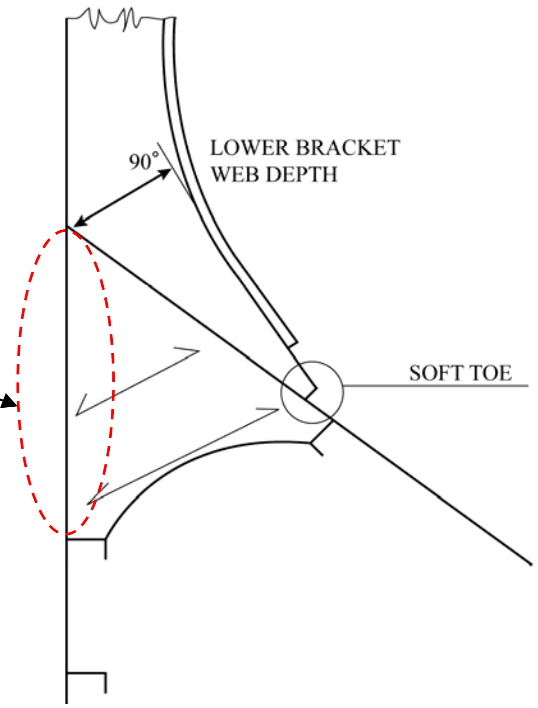
We will propose the RCP in order to clarify the application.

KC#866



KC#883

Side shell panels in way of brackets above/below side frames



KC#914

Rule Change Proposal
Requirement to single side frame section modulus due to ballast pressure.

Reference is made to requirements for frames of single side bulk carrier subject to ballast pressure. Ch. 6 Sec. 2 [3.3.1]. IACS KC 457/215/356

Summary of DNV understanding, Ballast hold assumed.

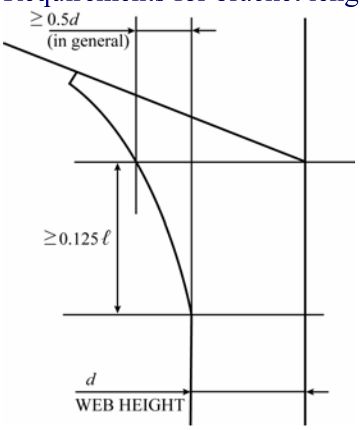
Section modulus at mid span

1. [3.3.1] (All pressures) with length as defined in Ch. 3 Sec. 6 Figure 16
2. [3.2.3] (Ballast pressure only) with length as defined in sketch 4 of Figure 2 in Ch. 3 Sec. 6.

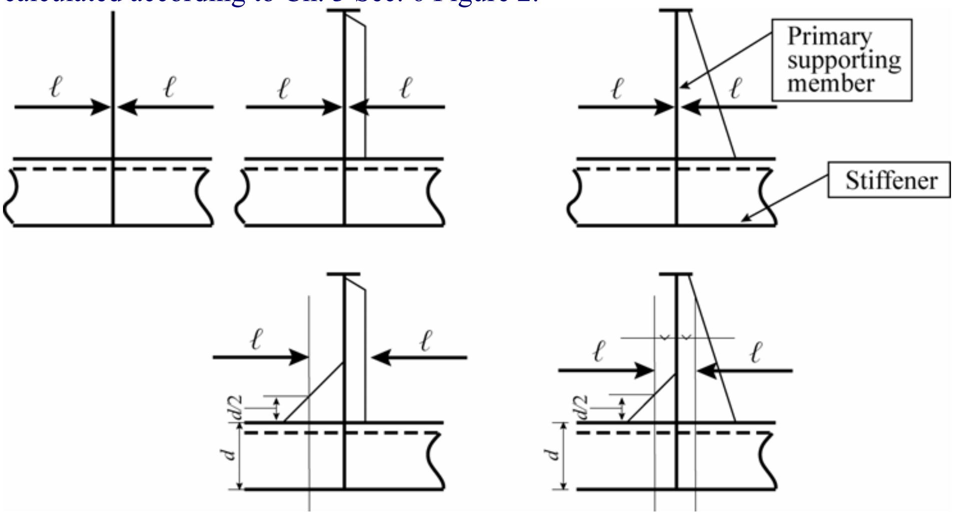
Sectional modulus at ends ref. [3.3.3]/[3.3.4]

1. 2xW[3.3.1] (All pressures) with length as defined in Ch. 3 Sec. 6 Figure 16
2. 2xW[3.2.3] (Ballast pressure only) with length as defined in Ch. 3 Sec. 6 Figure 2

Requirements for bracket length are given in Ch. 3 Sec. 6 Figure 20 (same as UR S12).



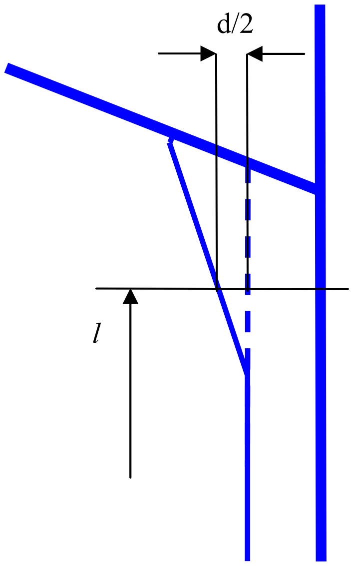
At the connection of top wing tank, the bracket height is 0.5d. The effective length is calculated according to Ch. 3 Sec. 6 Figure 2.



It should be noted, that for the standard UR S12 bracket arrangement, the effective lengths are identical to the length between topwing and hopper knuckle ($l_{eff}=l$). That is, no reduction by effective span as stipulated in KC #215.

In KC#356 it is shown that for $l_{eff}=l$ the sectional modulus for [3.2.3]= 2x [3.3.1]. In practice this correspond to an m-factor of m_{mid}=10 and m_{end}=5, which is very conservative. Note also that m=10 is normally the end moment of a vertical stiffener.

In order to accommodate the equation [3.2.3] we see designs with long and slender brackets for side frame as shown in the figure below.



The brackets give large reduction to effective length. DNV is concerned about this development as the length may be reduced to an extent so that the mid span sectional modulus is below originally required by DNV Rules.
DNV is of the opinion that the requirement of [3.2.3] should be substituted by equations giving a more physically representation of the moment distribution of the frame, removing the possibility to manipulate the requirement by bracket design.

Please note following

1. **The effective span evaluation according to Ch.3Sec.6Figure2 is not valid for side frames.**
   The span of single side frames should be according to Ch.3Sec.6Figure2. In Fig. 2 typical end connections <u>for continuous stiffeners are shown</u>. End connection cases where the stiffener is terminated at the end support have not been shown. Also, no precaution is taken. E.g. stating that the stipulations of Figure 2 only apply provided the end bracket is effectively supported. Hence, Figure 2 should not be used for single side frames.

2. **Bending moment distribution of the side frames is governed by elastic response of the supporting structure in top wing and hopper tank.**
   The side frames in bulk carriers is a typical case where the effectiveness of the end support could be questioned. The end support for side frames in Ch.6 Sec.2 [3.4.1] is formulated as a requirement to the section modulus of the longitudinal stiffeners supporting the upper and lower connecting brackets of the side frame. The requirement ensures that the end supports have <u>bending moment capacities (plastic)</u> that are related to the sea pressure load on the side frame. The actual bending moment by the connecting brackets on a side frame subject to the sea or the ballast pressure load will be determined <u>by the elastic response of the structure.</u>
   It may be noted that the required bending moment capacity of the upper end is only half of that required for the lower end support. Current formulation for section modulus is assuming same bending moment in both ends (m=5).

3. **Increased extent of main frame bracket gives limited effect of the bending moment distribution of the main frame.**
   According to the present CSR, an increase of frame bracket length allow for reduction of span length according to Ch.3 Sec. 6 Figure 2 (sketch 4), and thus the section modulus of the frame. Bearing in mind item 1 and 2 above, it is expected that increase of bracket length have a marginal effect on the bending moment of the frame.

We therefore ask for background documentation for the requirement of the last sentence of 3.3.1 of Ch.6 Sec.2.

If documentation is not available, it is suggested that the requirement formulation is revised such that the same span length is applied for the ballast load as for the sea pressure load. The revised formulation should reflect that the bending moment distribution in the frame is dependent on the elastic response of the supports, which is the internal structure in hopper and topwing tank. As discussed above, the elastic stiffness of the bottom support is larger than the top support. Additionally the pressure distribution on the frame should be taken in to account.

Possible rule formulation

Following rule formula is provided as a basis for discussion. The formula is based on DNV Pt.5 Ch.2 Sec.8 and valid for ballast pressure only:

$$W = \frac{l^2 s(P_s + P_w)}{0.9 m R_Y} 10^3$$

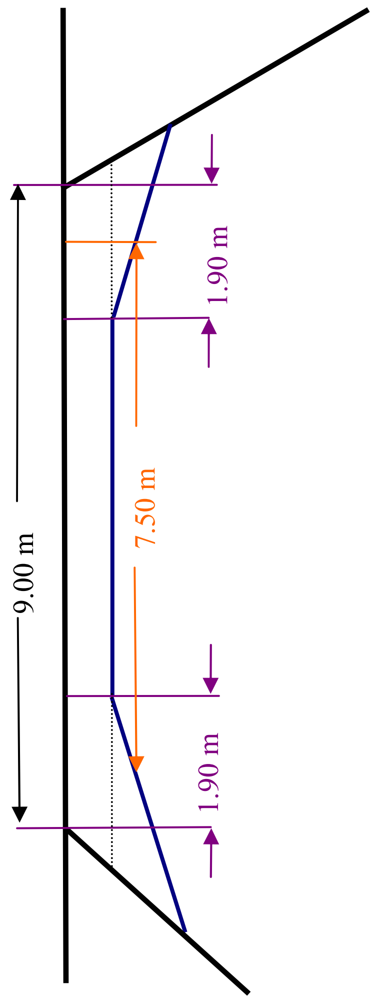
$$m_{UpperEnd} = 12, m_{MidSpan} = 18, m_{LowerEnd} = 9$$

Span length l is as defined in Ch. 3 Sec. 6 Figure 19, same as UR S12.

Motivation for change:

1. The proposed equation will give a more physical representation of the bending moment distribution in the frame.
2. For bracket designs as per Ch. 3 Sec. 6 Figure 20, the sectional modulus requirements will be more realistic.
   $m_{UpperEnd}$ change from 5 => 12
   $m_{MidSpan}$ change from 10 => 18
   $m_{LowerEnd}$ change from 5 => 9
3. Section modulus can not be manipulated by large slender brackets in order to bring the requirement of [3.2.3] back to a realistic value.

Comparative calculation

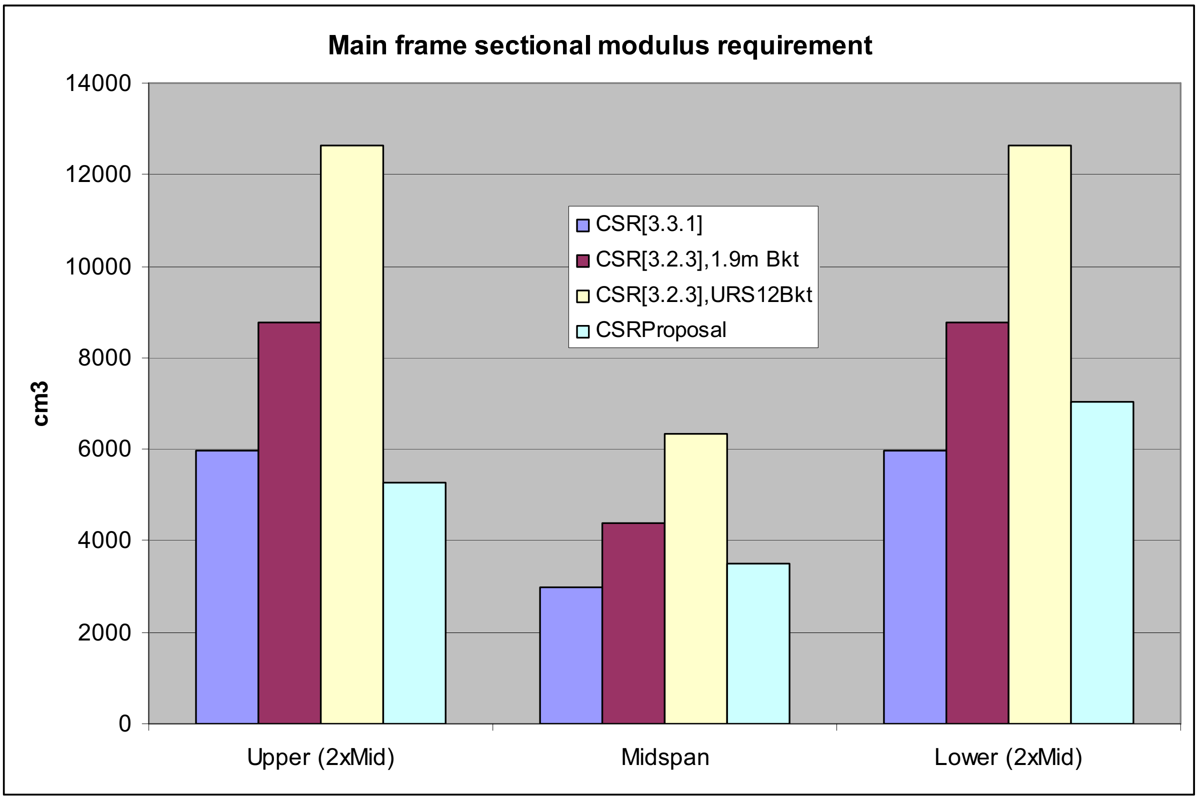


CSR Cape Size Bulk BC-A

$P_{Ballast,Mid\ Span}$	230	kN/m^2
Fr. Sp.	920	mm
Steel	315	N/mm^2

Sectional modulus calculation:

	$CSR_{[3.3.1]}$	$CSR_{[3.2.3]}$ BKT 1.9m	$CSR_{[3.2.3],}$ URS12Bkt	$CSR_{Proposal}$	
Upper (2xMid)	5973	8779	12642	5267	cm^3
Midspan	2987	4390	6321	3512	cm^3
Lower (2xMid)	5973	8779	12642	7023	cm^3



KC#1055

Attachment to GL-KC-Request referring to Ch6, Sec1, 2.4.1