Comments on CIP_B3
By CCS

1. Comments on 2.3 in CIP_B3

CCS Comments

According to the interpretation about "permissible" in 2.3, in order to avoid any confusion, the definition of permissible still water shear force should be similar to the permissible still water bending moment in [5.1.1] for intact condition and [5.1.3] for flooded condition, the rule change is proposed as following.

In addition, hull girder shear force based on an initial yield capacity check should not be a permissible value. Same as still water bending moment in Ch4/Sec3/[2.2.2], the present texts in Ch5/Sec1/[5.1.2], [5.1.3], [5.3.2] and [5.3.3] could be moved to Ch4/Sec3/[2.3] as a reference still water shear force if the design still water shear forces are not defined at a preliminary design stage.

Chapter 5

Section 1

5.1.2 Permissible still water shear force ~~– Direct calculation~~

~~Where the shear stresses are obtained through calculation analyses according to [2.2.1], the permissible positive or negative still water shear force in intact condition at any hull transverse section is obtained, in kN, from the following formula:~~

$$Q_P = \varepsilon|Q_T| - Q_{WV}$$

~~where:~~

$\varepsilon = \text{sgn}(Q_{SW})$

Q_T ~~: Shear force, in kN, which produces a shear stress $\tau = 120/k$ N/mm² in the most stressed point of the hull net transverse section, taking into account the shear force correction ΔQ_C in accordance with [2.2.2].~~

~~A lower value of the permissible still water shear force may be considered, if requested by the Shipbuilder.~~

The permissible still water shear force Q_P at any hull transverse section in intact condition is the value Q_{SW} considered in the hull girder shear stress calculation according to [2.2.2].

5.1.3 ~~Permissible still water shear force - Simplified calculation~~

(void)

5.3.2 Permissible still water shear force ~~– Direct calculation~~

~~Where the shear stresses are obtained through calculation analyses according to [2.2.1], the permissible positive or negative still water shear force in flooded condition at any hull transverse section is obtained, in kN, from the following formula:~~

$$Q_{P,F} = \varepsilon|Q_T| - Q_{WV,F}$$

~~where:~~

$\varepsilon = \text{sgn}(Q_{SW,F})$

Q_T ~~: Shear force, in kN, which produces a shear stress τ = 120/k N/mm² in the most stressed point of the hull net transverse section, taking into account the shear force correction ΔQ_C in accordance with [2.2.2].~~

The permissible still water shear force in flooded condition $Q_{P,F}$ at any hull transverse section is the value $Q_{SW,F}$ considered in the hull girder shear stress calculation according to [2.2.3].

5.3.3 ~~Permissible still water shear force - Simplified calculation~~

(void)

Chapter 6

Section 3

2.1.3 Shear stress

The shear stress τ_{SF} to be considered for each of the mutually exclusive load cases as referred in [2.1.1] is the shear stress induced by the shear forces, in kN, equal to:

~~$Q=Q_{SW}+C_{QW}Q_{WV}$~~

$Q=Q_{SW}+C_{QW}Q_{WV}-\Delta Q_C$

ΔQ_C: Shear force correction, to be calculated according to Chapter 5, Section 1, [2.2.2], to be considered independently forward and aft of the transverse bulkhead.

2. Comments on Figure 1 in CIP_B3

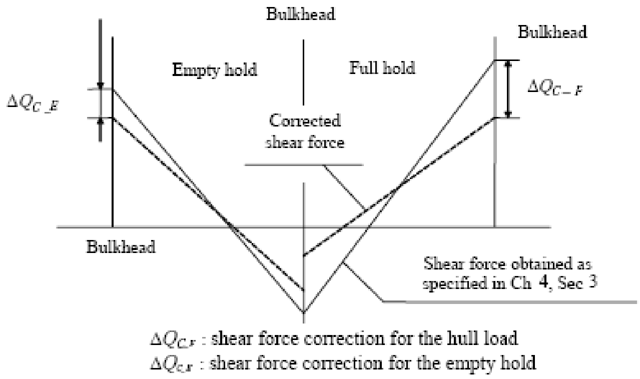


Figure 1

CCS Comment

Figure 1 should be changed as following because $\Delta Q_{C,E}$ is bigger than $\Delta Q_{C,F}$ generally.

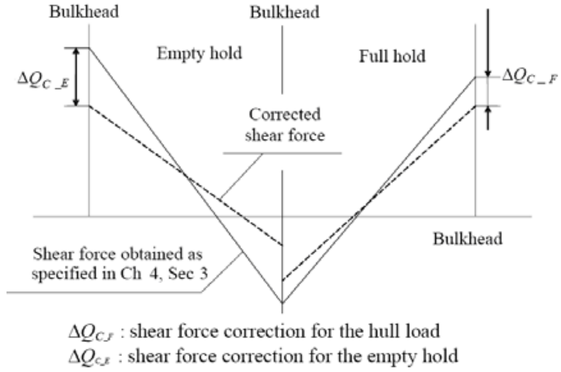


Figure 2

3. Comments on Figure 2 in CIP_B3

Example 1 Alternate condition

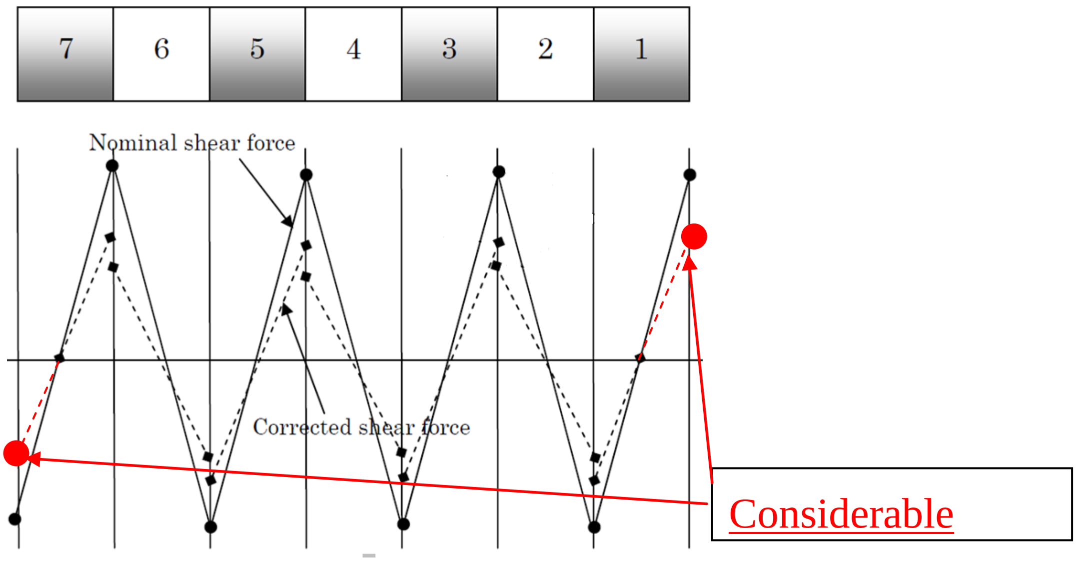


Figure 3

CCS Comments

Based on a verification study by FEM, as shown in the appendix A, the shear force correction need to be considered at the fore end of foremost hold and aft end of aftermost hold. But according to the 3rd paragraph in Ch5/Sec1/[2.2.1], the shear force correction need not to be considered at the fore end of foremost hold and aft end of aftermost hold. The rule change should be considered as following:

Chapter 5

Section 1

2.2 Shear stresses

2.2.1 General

The shear stresses induced by vertical shear forces Q_{SW} and Q_{WV} in intact condition and, for **BC-A** and **BC-B** ships by vertical shear forces $Q_{SW,F}$ and $Q_{WV,F}$ in flooded condition are normally to be obtained through direct analyses.

When they are combined, vertical shear forces Q_{SW} and Q_{WV} in intact condition are to be taken with the same sign. The same is to be applied also for combination of vertical shear forces $Q_{SW,F}$ and $Q_{WV,F}$ in flooded condition.

~~The shear force correction ΔQ_C is to be taken into account, in accordance with [2.2.2]. The shear force correction need not to be considered at the fore end of foremost hold and aft end of aftermost hold.~~

As an alternative to this procedure, the shear stresses induced by the vertical shear forces Q_{SW} and Q_{WV} in intact condition and, for **BC-A** and **BC-B** ships by the vertical shear forces $Q_{SW,F}$ and $Q_{WV,F}$ in flooded condition may be obtained through the simplified procedure in [2.2.2] and [2.2.3] respectively.

4. Comments on Figure 3 in CIP_B3

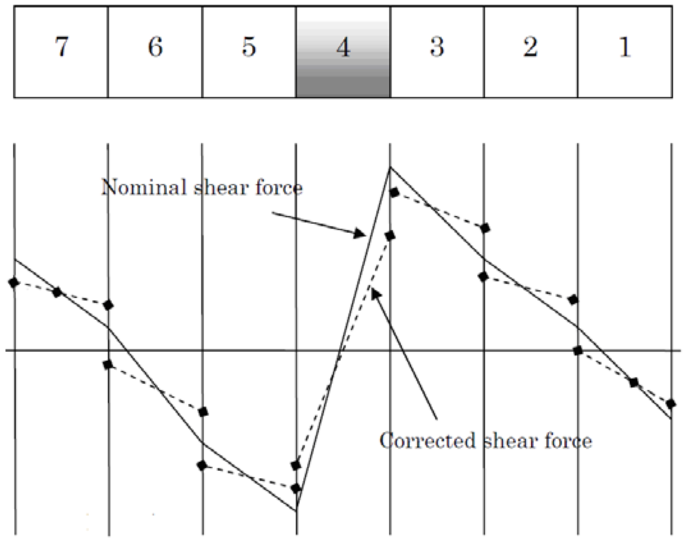


Figure 4

CCS Comments

1. Based on a verification study by FEM, as shown in the appendix A, the shear force correction should always be taken into account for every hold.
2. For BC-B and BC-C ships, the shear forces in heavy ballast condition are generally larger than those in other loading conditions. So the shear force correction should be considered for every hold in heavy ballast condition.
3. Regarding homogenous loading condition, the shear force correction can be ignored because it is little.

Appendix A Shear force correction verification by FEM By CCS

A-1 Assumption

When the vertical shear load is directly applied to the double bottom, some fraction of the load is transmitted through longitudinal elements in the double bottom. We assumed that the vertical shear stresses of the side shell, which is calculated with finite element method, equal to those based on the beam theory when the corrected shear force is applied to the hull girder transverse section. Thus the corrected shear force can be obtained by formula (1).

$$Q_{A1} = \frac{\tau}{k\delta}\frac{I_y t}{S} \tag{1}$$

$$Q_{A2} = Q - \Delta Q_C \tag{2}$$

where:

Q: The shear force got by the integral of net-vertical shear load, it is the design shear force generally.

Q_{A1}: The corrected shear force calculated by finite element method

Q_{A2}: The corrected shear force calculated by CSR bulker carrier rule formula.

ΔQ_C: Shear force correction in Ch5/Sec1 of CSR BC.

τ: The vertical shear stress of side shell from finite element analysis results.

A-2 Model

Seven cargo holds are included in the finite element model. For simplicity, the plane bulkheads are used.

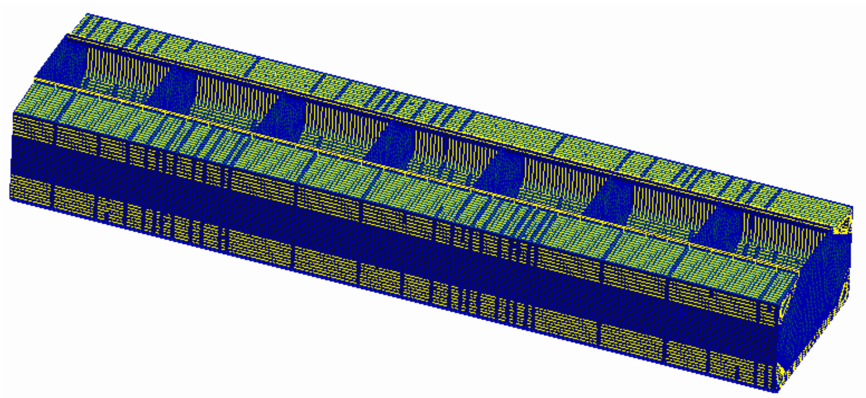


Figure A-1

A-3 Loading condition

The alternate condition and heavy ballast condition were calculated. For simplicity, only static load was used and the pressures were only applied on double bottom and hopper side tanks. The inertia relief was used to avoid the boundary condition's influence on the fore end of foremost hold and aft end of aftermost hold.

A-4 Results and conclusion

All results of Q_{A1} was linear fitted using least square approach. The comparisons among Q, Q_{A1}, and Q_{A2} are shown in Figure A-2 and Figure A-3.

The shear force correction phenomena will always take place, and the shear force correction need to be considered at the fore end of foremost hold and aft end of aftermost hold.

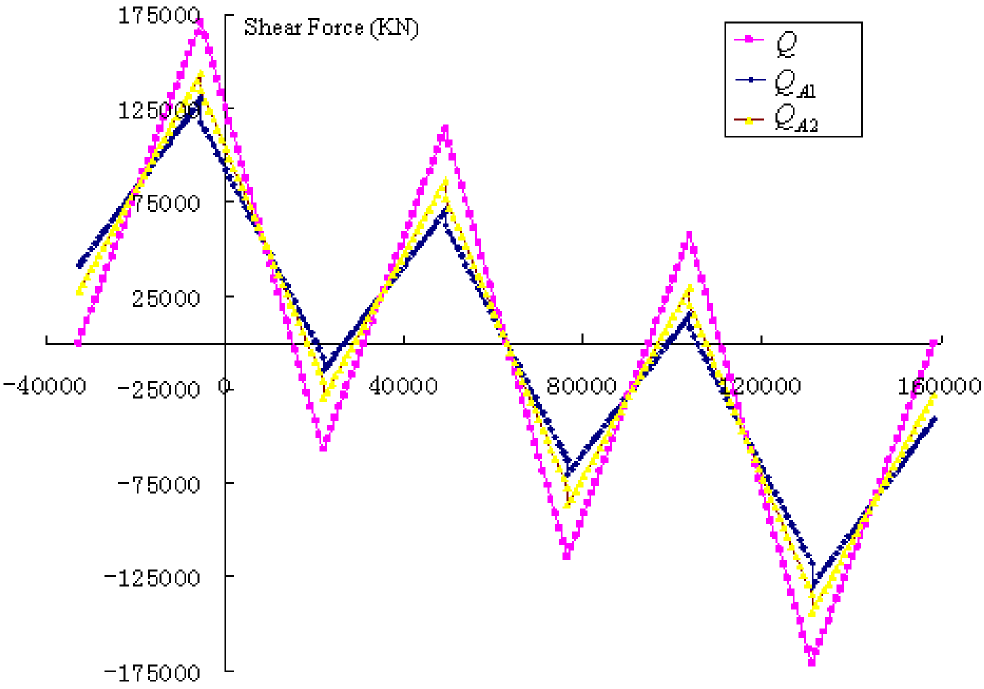
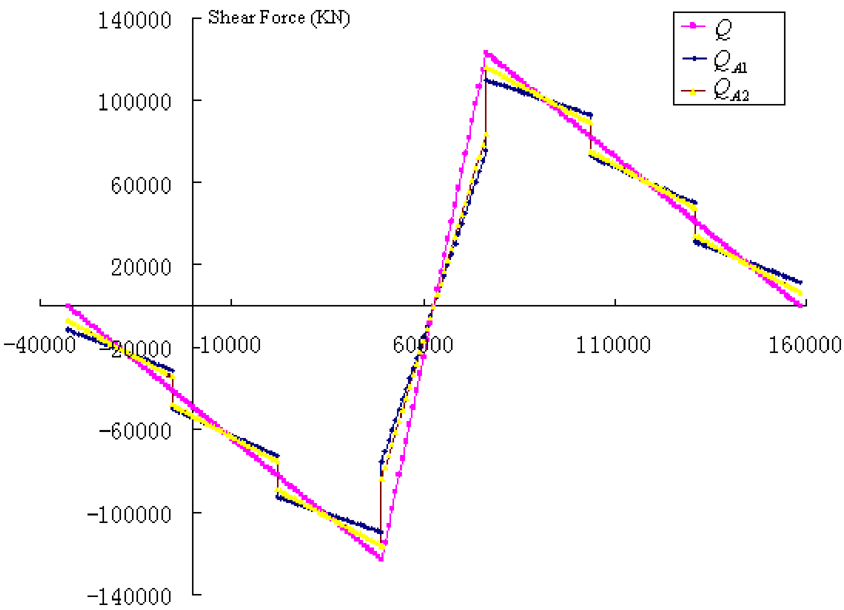


Figure A-2



Shear Force (KN)
140000
100000
60000
20000
-20000
-60000
-100000
-140000
-40000
10000
60000
110000
160000
Q
Q_{A1}
Q_{A2}

Figure A-3