# Technical Background of Ch 3 Sec 6 [5.2.1] of CSR for Bulker

The web stiffener of the primary supporting member (PSM) is provided to prevent the buckling failure of the web plate of PSM.

Even if the buckling failure occurs in the web plate of PSM, the web stiffener has to withstand the buckling loads. For that reason, the stiffness of the web stiffener is always larger than that of the web plate of PSM.

Now, the ratio of the stiffness of the web stiffener to that of the web plate of PSM sets to C and the web stiffener is assumed to be of flat bar with thickness "t" and depth "h"

The stiffness of the web plate of PSM:

$$Et^3 \big/ 12(1-v^2)$$

The stiffness of the web stiffener:
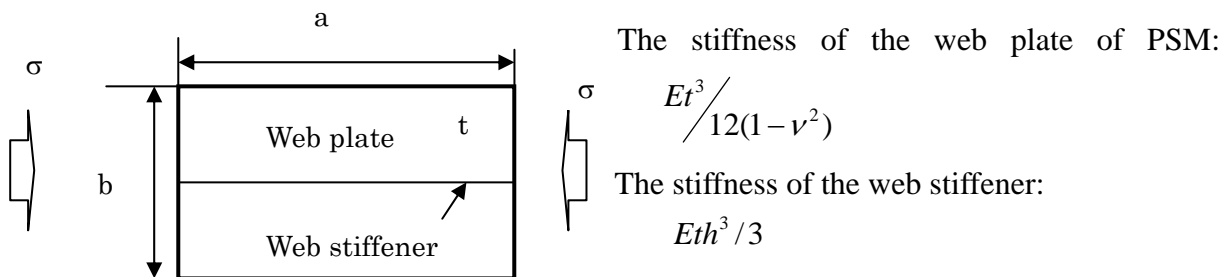
$$Eth^3 / 3$$

The critical value "C" can be obtained by the following formula;

$$C = \frac{Eth^3/3}{Et^3/12(1-v^2)b} = 3.64 \frac{t}{b}\left(\frac{h}{t}\right)^3$$

The critical value C varies depending on the aspect ratio of web plate. Here, the critical value C is taken to 20, based on the actual designs. Then, we can get the following formula.

$$\frac{h}{b} = 1.77\left(\frac{t}{b}\right)^{2/3}$$

The ratio of thickness and height of flat bar (b/t) varies to 135 to 80 which are obtained from the current design, then, $\frac{h}{b} = 0.067\ to\ 0.095 \cong \frac{1}{15}\ to\ \frac{1}{10}$ can be obtained.

The value "1/12" is the average value of $\frac{h}{b}$ above.

Considering the actual design, it was found that this relationship between web stiffener height and panel length can apply to web stiffeners with flat bar fitted to all PSM.

Then, to simplify this relationship, the web stiffener length l has been used instead of b.

As a conclusion, CSR has been adopted the last sentence of the requirement of Ch 3 Sec 6 5.1.2 that the depth of web stiffener is to be more than 1/12 of stiffener length.

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