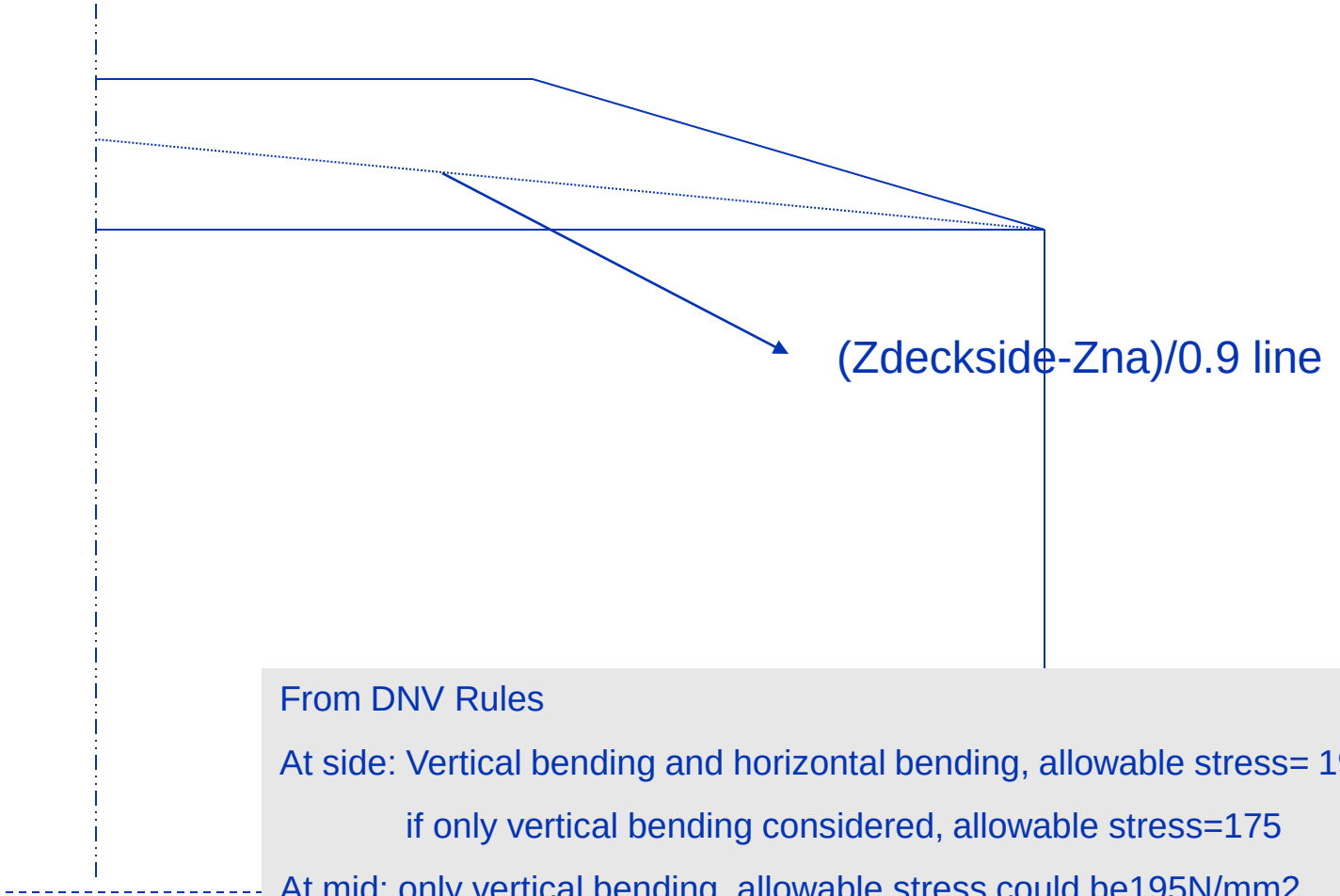
Section modulus calculation according to CSR Bulk and CST Tank

15 September 2010

MANAGING RISK

- 1. Background
- 2. CSR Tank
- 3.CST Bulk
- 4. Conclusion

1. Background



From DNV Rules

At side: Vertical bending and horizontal bending, allowable stress= 195N/mm2

if only vertical bending considered, allowable stress=175

At mid: only vertical bending, allowable stress could be195N/mm2

175/195=0.9

Between mid and deck side: Interpolate linearly

So a line “(Zdeckside-Zna)/0.9 line” introduced

2.CSR-Tank

1.2.2.5 The effective deck height from the horizontal neutral axis for the hull girder section modulus, $z_{dk\text{-}eff}$, is to be taken as:

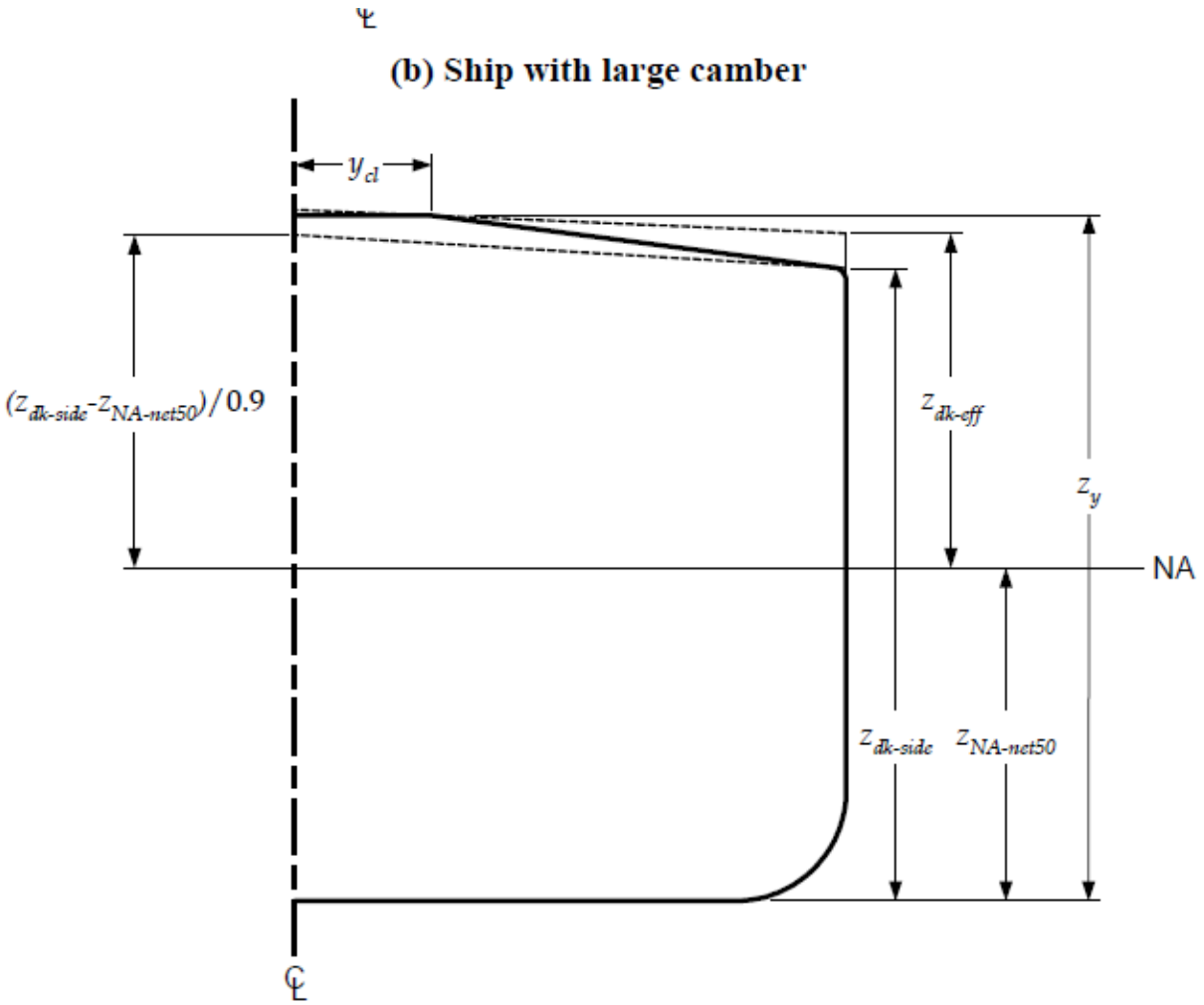
$$z_{dk-eff} = z_{dk-side} - z_{NA-net50} \quad \text{m}$$

When no effective longitudinal strength members are positioned above a line extending from moulded deck line at side to a position
$(z_{dk\text{-}side}\text{-}z_{NA\text{-}net50})/0.9$ from the neutral axis at the centreline

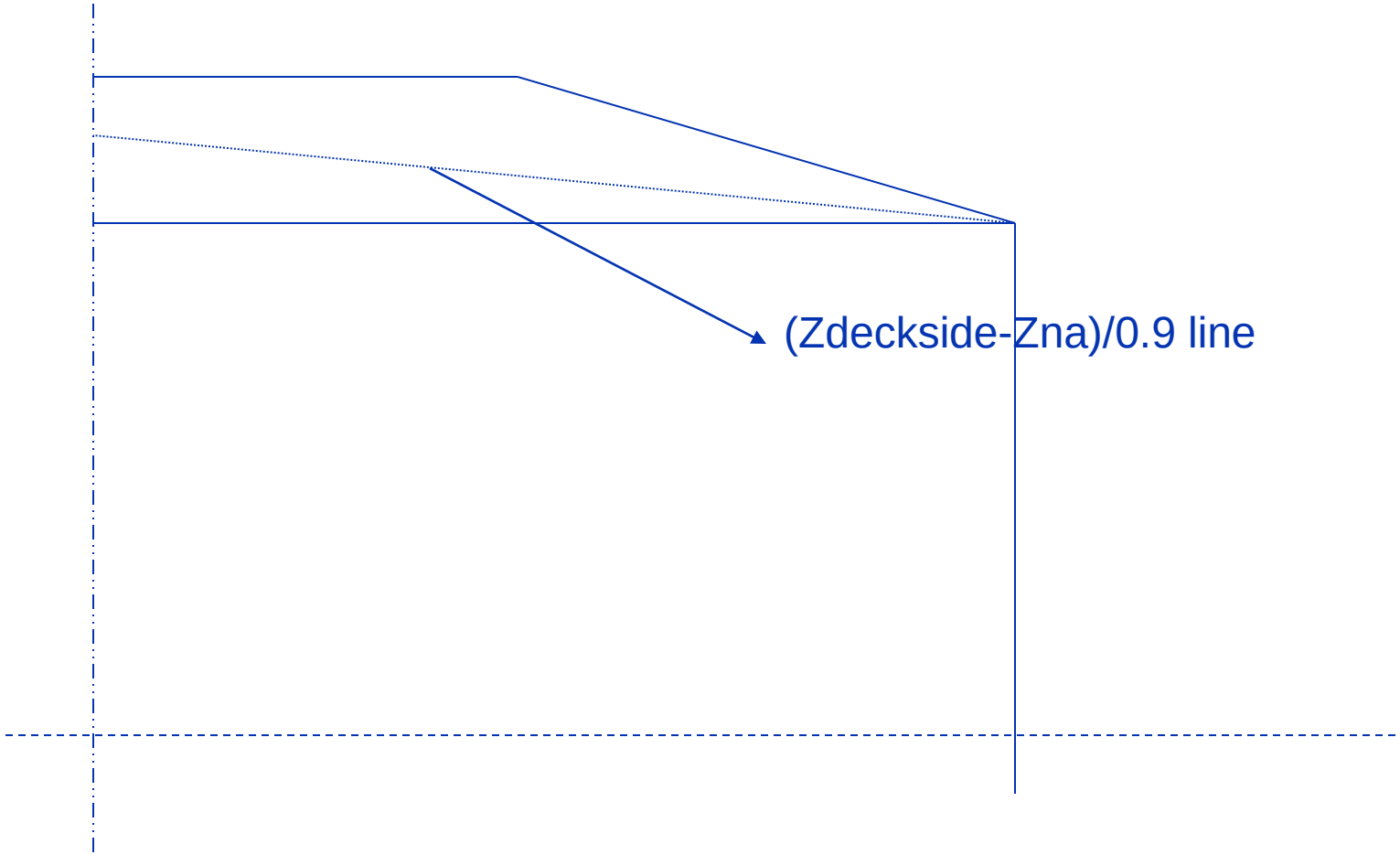
$$z_{dk-eff} = (z_y - z_{NA-net50})\left(0.9 + 0.2\frac{y_{cl}}{B}\right) \quad \text{m}$$

When any effective longitudinal strength members are positioned above a line extending from moulded deck line at side to a position
$(z_{dk\text{-}side}\text{-}z_{NA\text{-}net50})/0.9$ from the neutral axis at the centreline
Where:

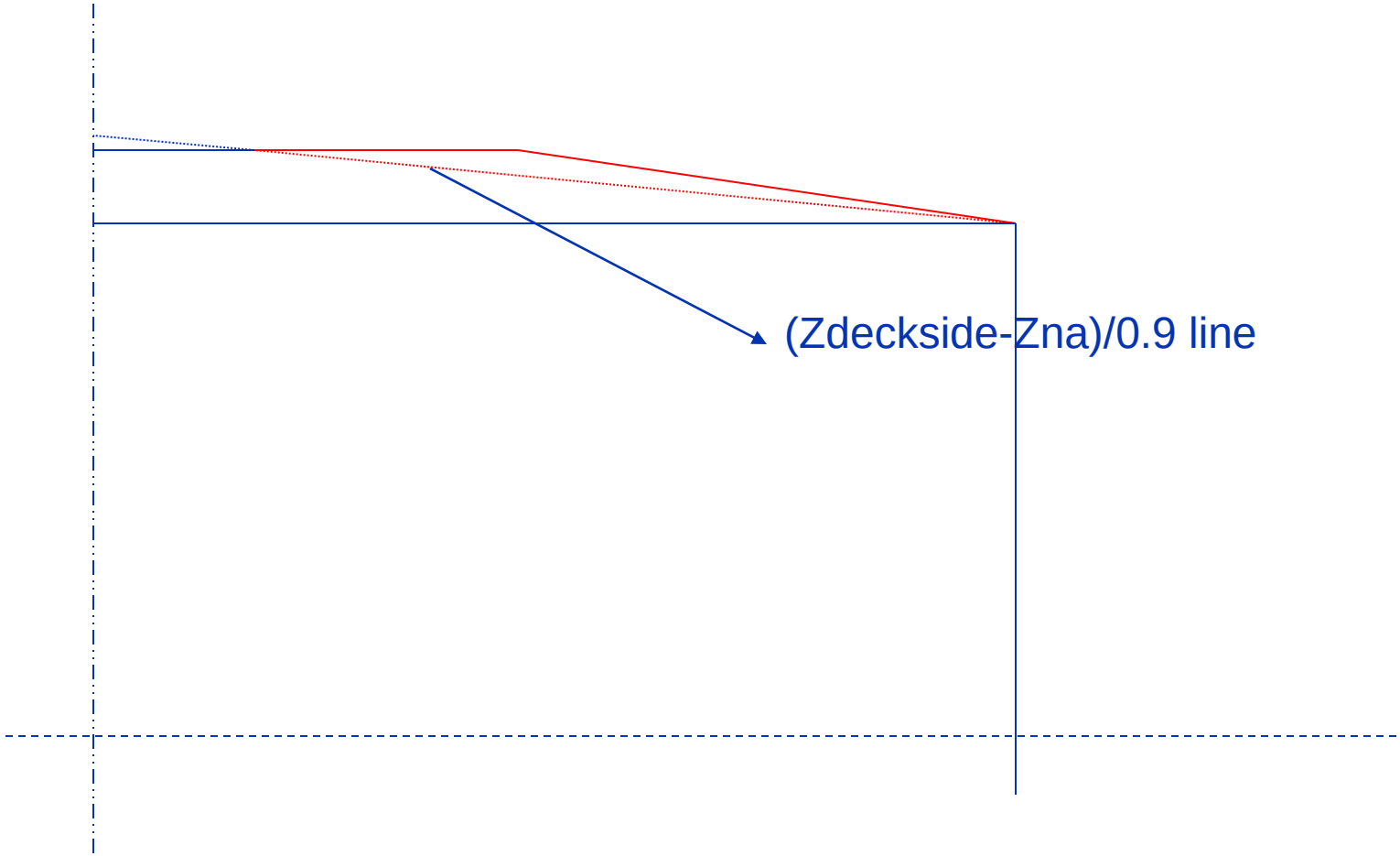
z_y	distance from the baseline to top of the continuous strength member at a distance y from the centreline, in m, giving the largest value of $z_{dk\text{-}eff}$, see Figure 8.1.1
$z_{NA\text{-}net50}$	distance from baseline to horizontal neutral axis, in m, see Figure 8.1.1
y_{cl}	distance from the top of the continuous strength member to the centreline of the ship, in m, giving the largest value of $z_{dk\text{-}eff}$, see Figure 8.1.1
B	moulded breadth, in m, as defined in Section 4/1.1.3.1
$z_{dk\text{-}side}$	distance from the baseline to the moulded deck line at side, in m, see Figure 8.1.1



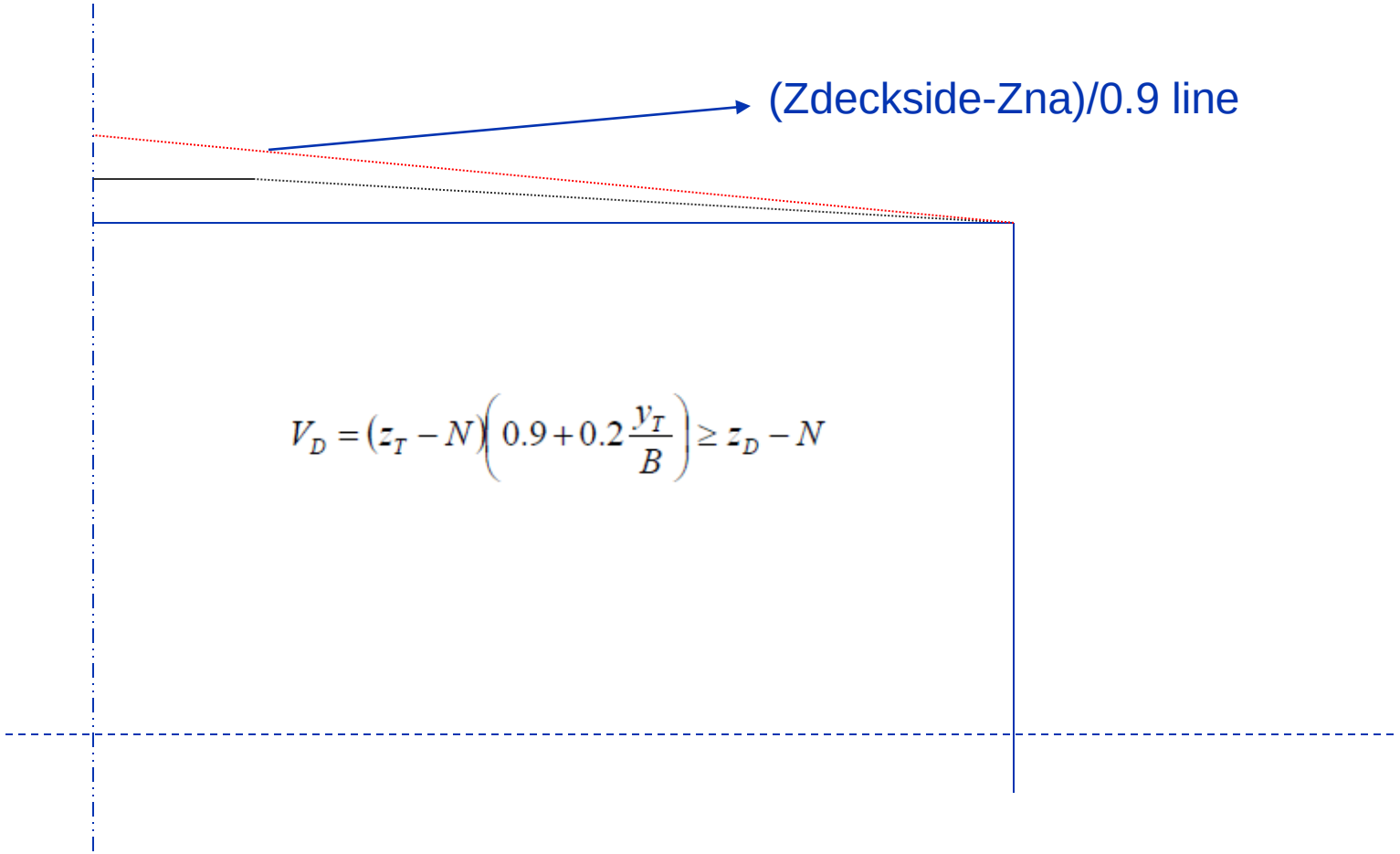
A) General case_to be considered both in CSR Tank and CSR Bulk



b) For camber shown below , Need to check by CSR Tank rules



c) All the area below (Zdeckside-Zna)/0.9 line not to be checked both by CSR Tank and CSR Bulk



3.CSR-BC

— if continuous trunks or hatch coamings are taken into account in the calculation of I_Y, as specified in [1.2.2]:

$$V_D = (z_T - N)\left(0.9 + 0.2\frac{y_T}{B}\right) \geq z_D - N$$

where:

y_T, z_T = Y and Z co-ordinates, in m, of the top of continuous trunk or hatch coaming with respect to the reference co-ordinate system defined in Ch 1, Sec 4, [4]; y_T and z_T are to be measured for the point which maximises the value of V_D

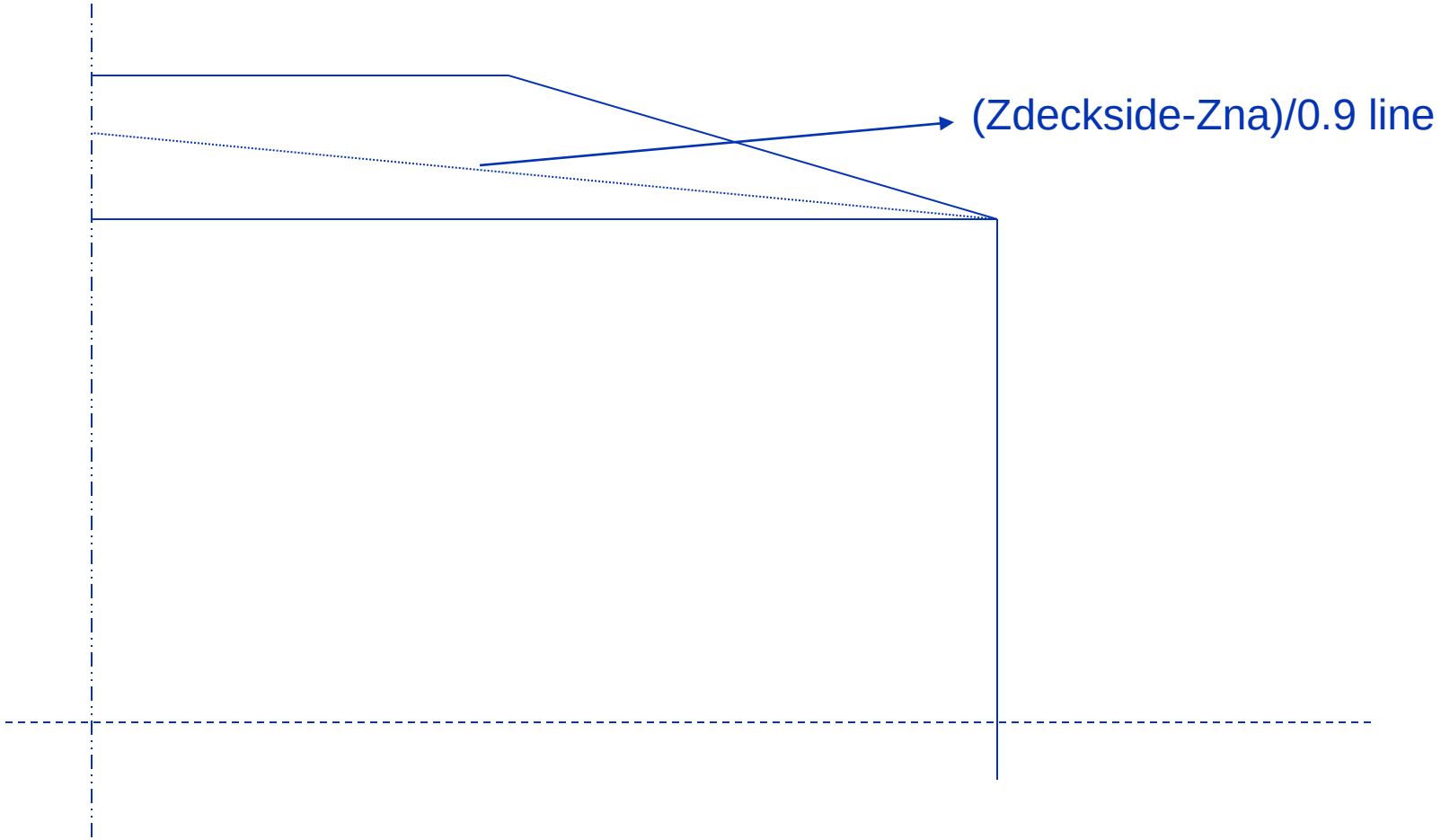
— if longitudinal ordinary stiffeners or girders welded above the strength deck are taken into account in the calculation of I_Y, as specified in [1.2.3], V_D is to be obtained from the formula given above for continuous trunks and hatch coamings. In this case, y_T and z_T are the Y and Z co-ordinates, in m, of the top of the longitudinal stiffeners or girders with respect to the reference co-ordinate system defined in Ch 1, Sec 4, [4].

It is not clear camber considered or not?

Suggest that camber considered according to above

If camber considered based on CSR Bulk rules

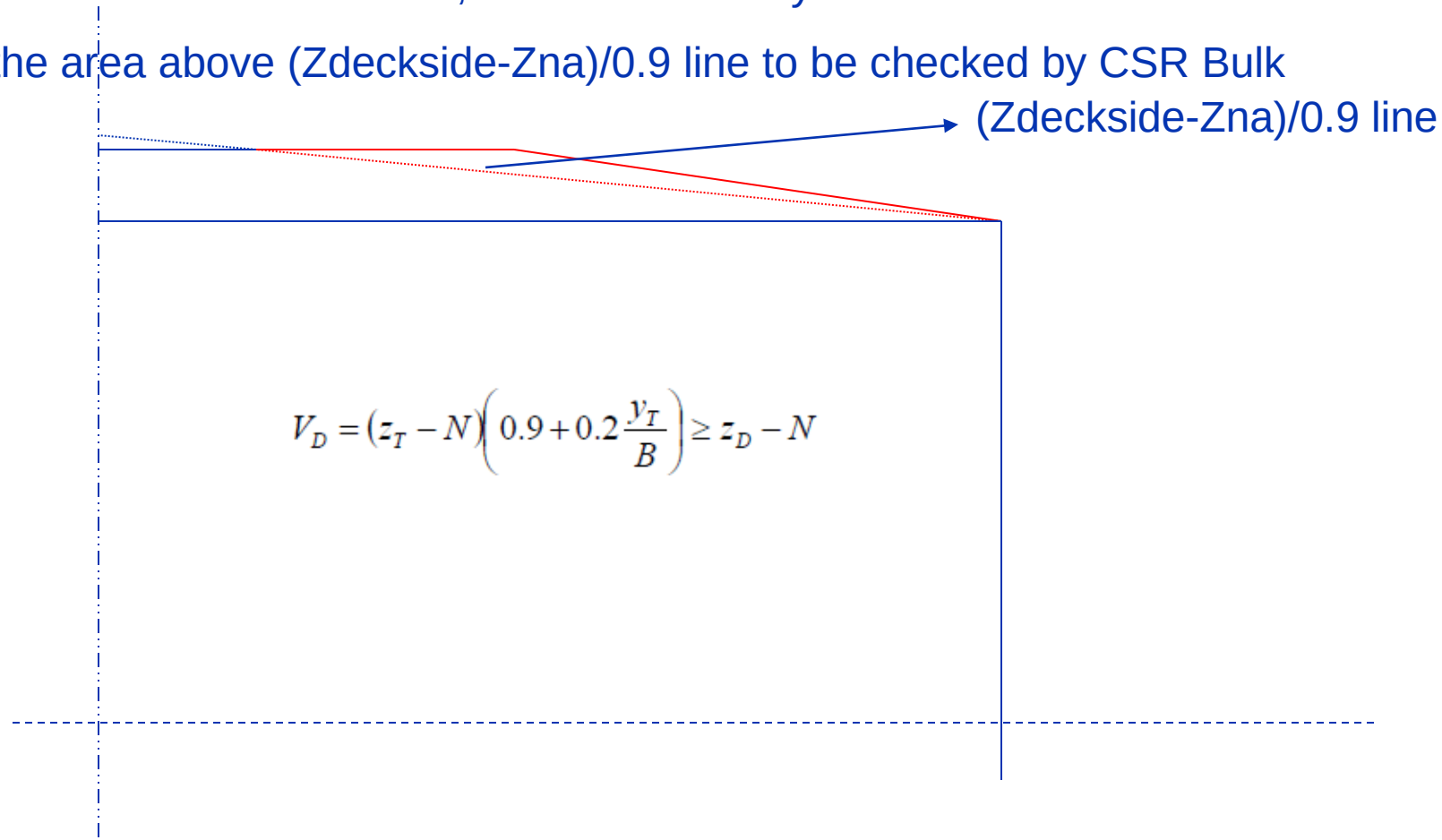
- A) General case_to be considered both in CSR Tank and CSR Bulk



If camber considered based on CSR Bulk rules

b) For camber shown below, Need to check by CSR Bulk rules

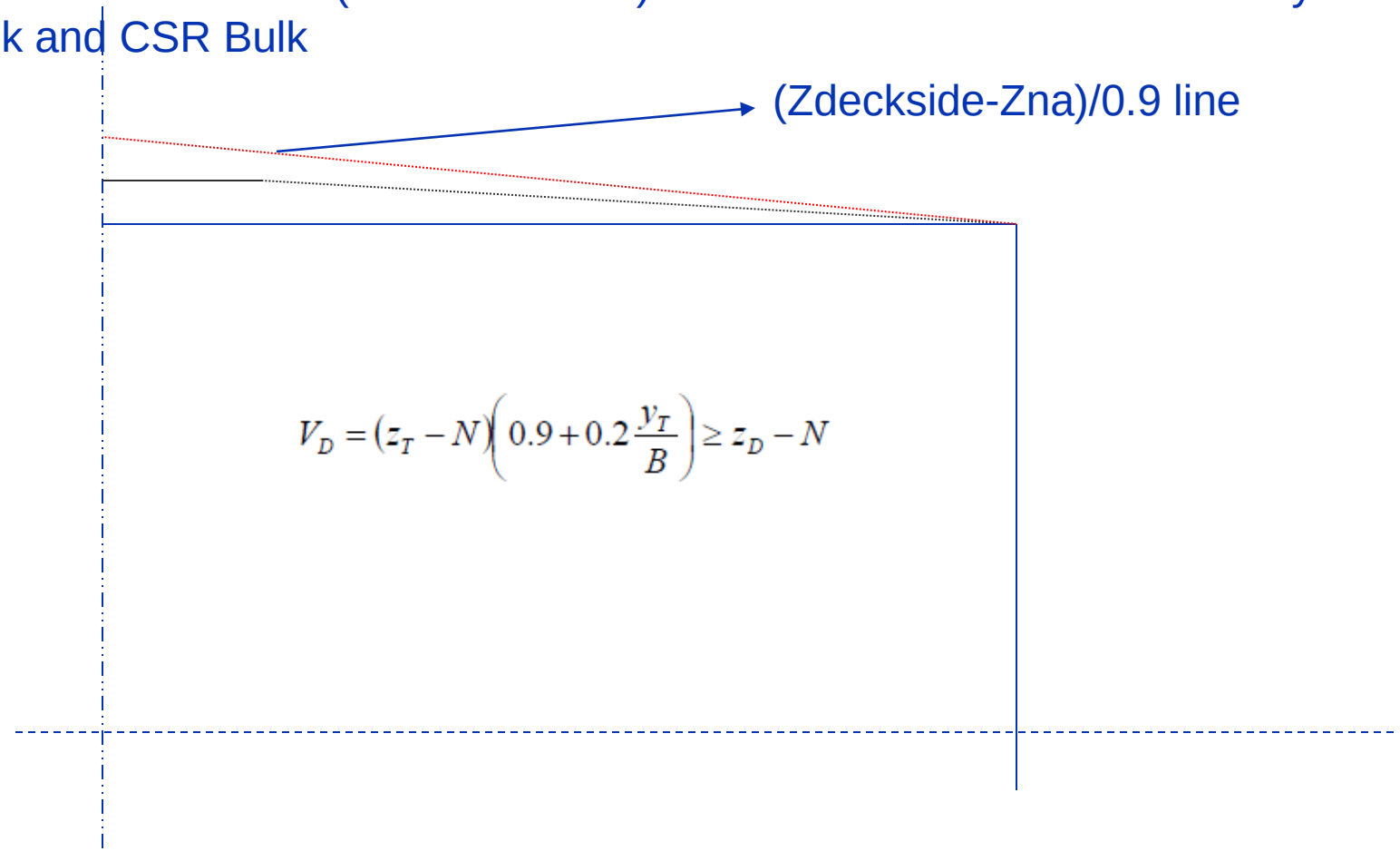
All the area above (Zdeckside-Zna)/0.9 line to be checked by CSR Bulk



$$V_D = (z_T - N)\left(0.9 + 0.2\frac{y_T}{B}\right) \geq z_D - N$$

If camber considered based on CSR Bulk rules

c) All the area below (Zdeckside-Zna)/0.9 line not to be checked both by CSR Tank and CSR Bulk

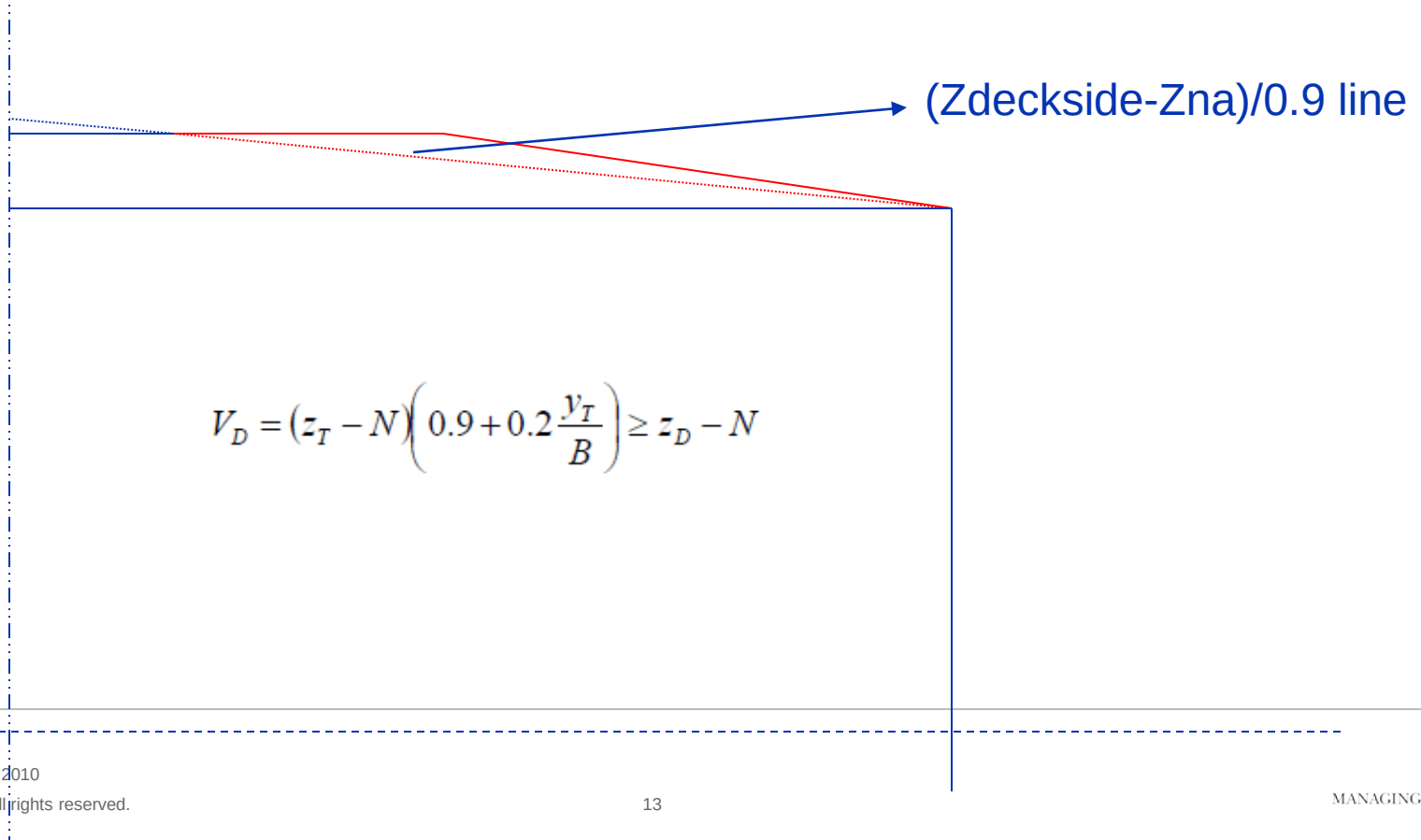


4. Conclusion

1. **Camber not mentioned in CSR Bulk**
2. **If camber considered in CSR Bulk,**

   Same calculation results for CSR Tank and CSR bulk
3. **Rules change proposal? effective for vessel constructed after rule change entered into force ?**

   or editorial error, to be effective for all vessels?



$$V_D = (z_T - N)\left(0.9 + 0.2\frac{y_T}{B}\right) \geq z_D - N$$

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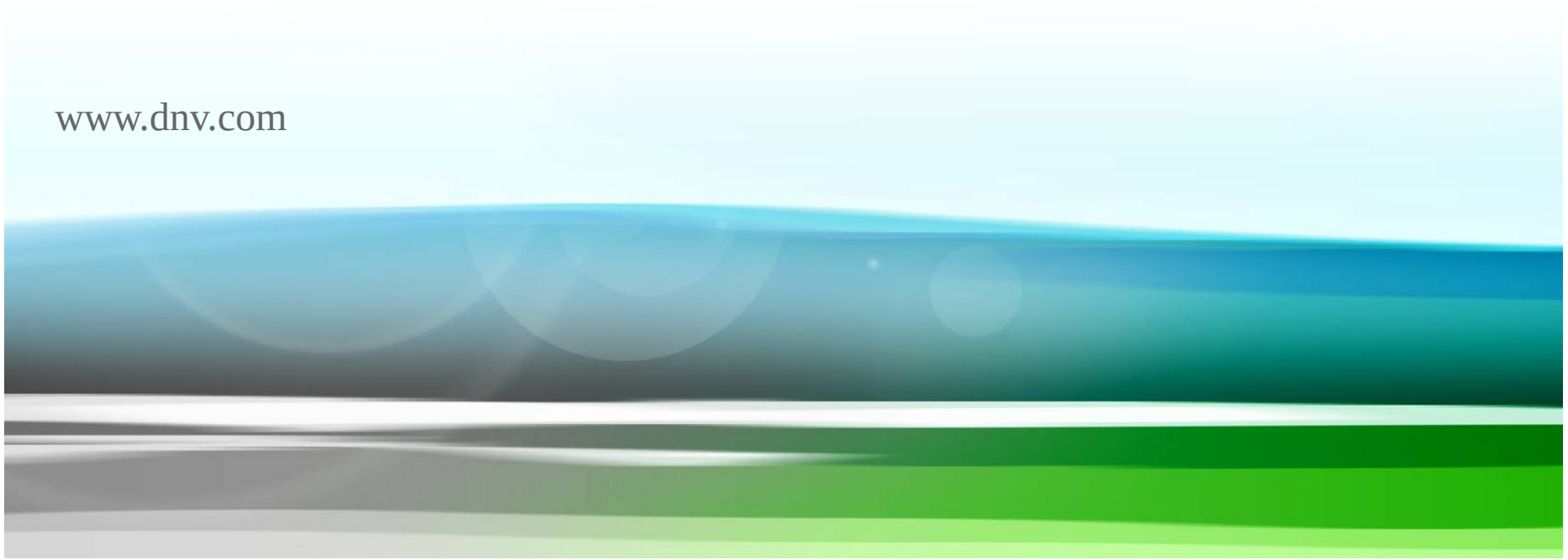

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