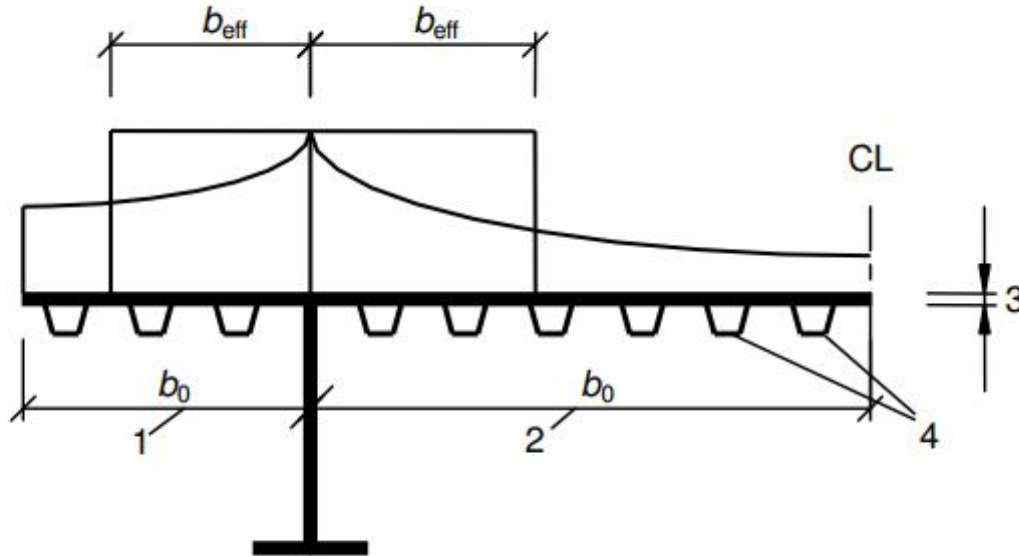


# **Investigations On the Effective Width of Wide Flange Steel Girders**

Encho Dulevski | Vasil Nikolov | Alexander Jiponov

## Effective width of wide flange steel girder according to EN



1 for flange outstand

2 for internal flange

3 plate thickness  $t$

4 stiffeners with  $A_{sl} = \sum A_{sli}$

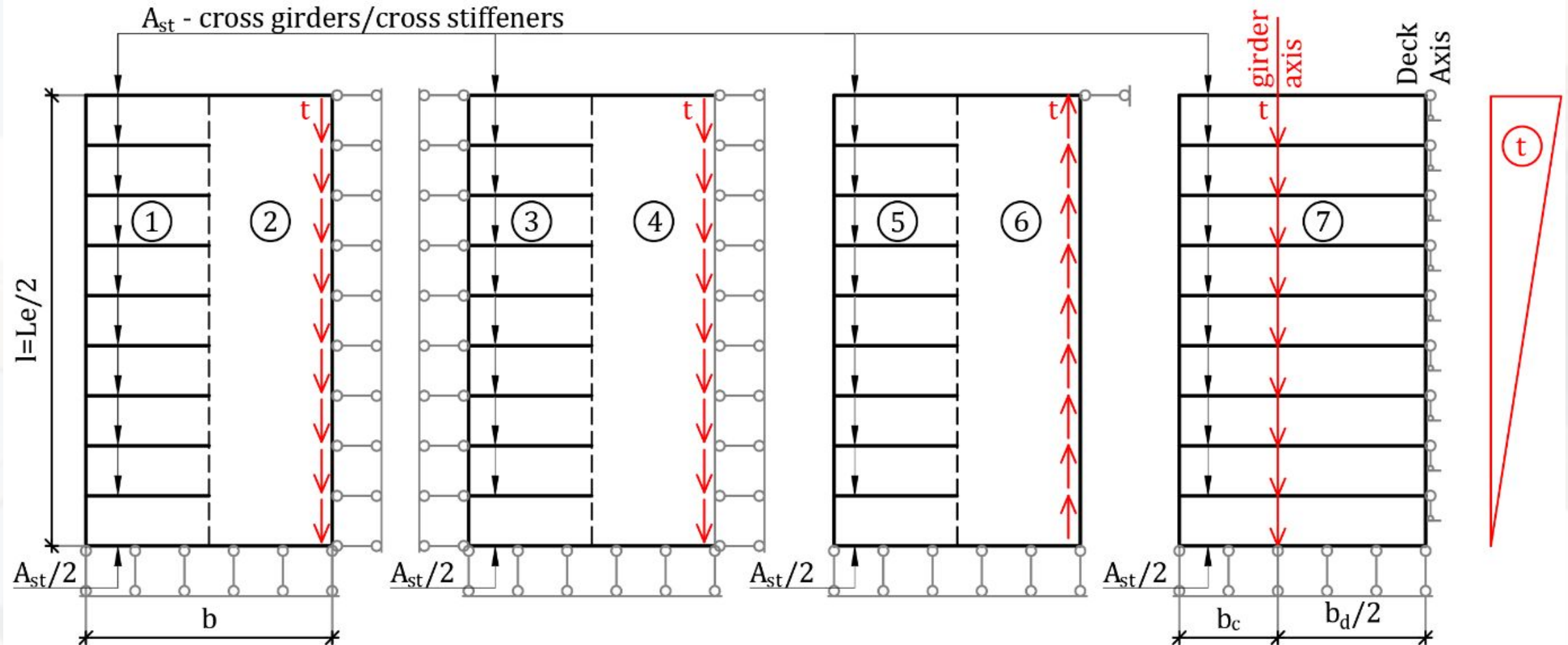
Table 3.1: Effective<sup>s</sup> width factor  $\beta$

$\kappa$	Verification	$\beta$ - value
$\kappa \leq 0,02$		$\beta = 1,0$
$0,02 < \kappa \leq 0,70$	sagging bending	$\beta = \beta_1 = \frac{1}{1 + 6,4 \kappa^2}$
	hogging bending	$\beta = \beta_2 = \frac{1}{1 + 6,0 \left( \kappa - \frac{1}{2500 \kappa} \right) + 1,6 \kappa^2}$
$> 0,70$	sagging bending	$\beta = \beta_1 = \frac{1}{5,9 \kappa}$
	hogging bending	$\beta = \beta_2 = \frac{1}{8,6 \kappa}$
all $\kappa$	end support	$\beta_0 = (0,55 + 0,025 / \kappa) \beta_1$ , but $\beta_0 < \beta_1$
all $\kappa$	Cantilever	$\beta = \beta_2$ at support and at the end

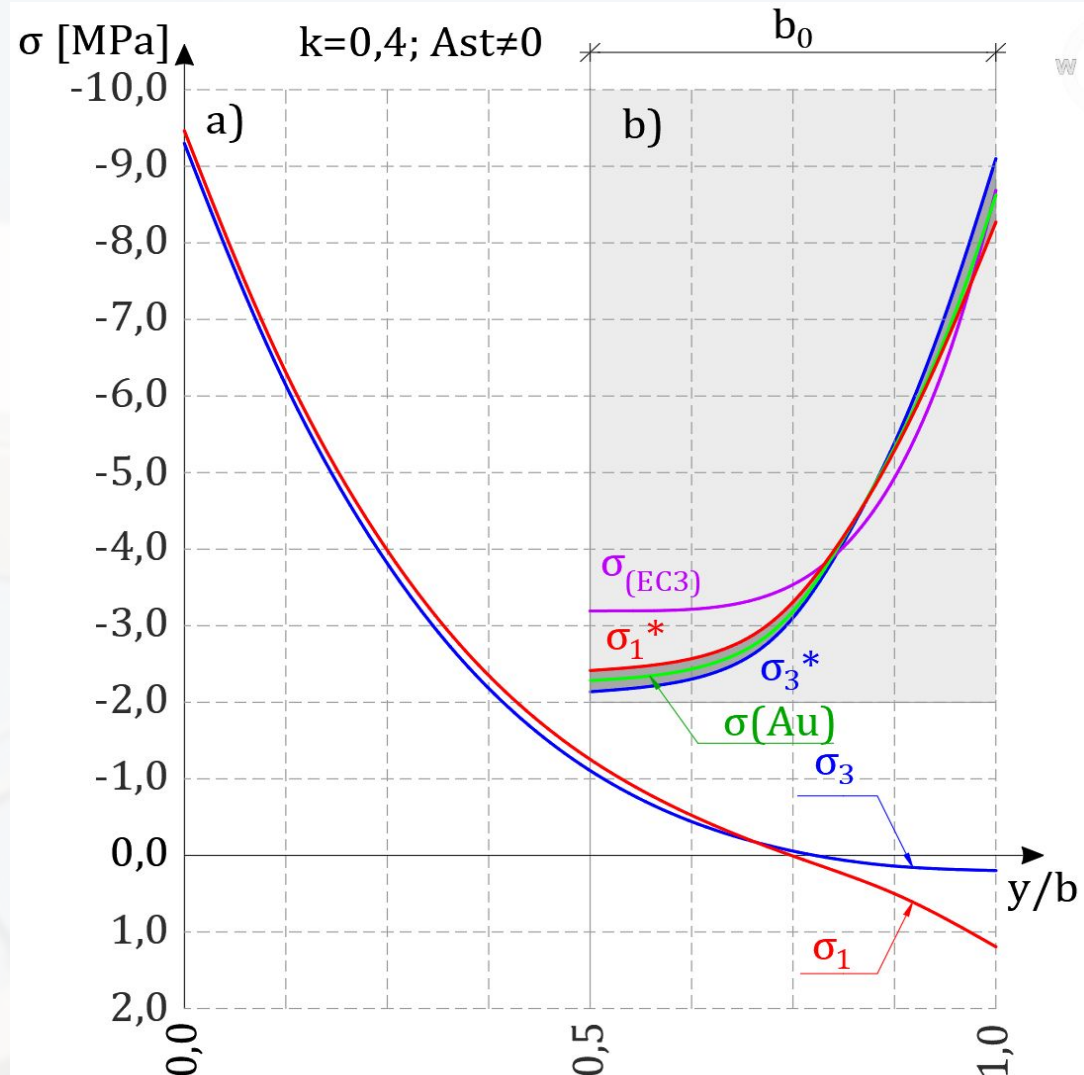
$\kappa = \alpha_0 b_0 / L_e$  with  $\alpha_0 = \sqrt{1 + \frac{A_{sl}}{b_0 t}}$

in which  $A_{sl}$  is the area of all longitudinal stiffeners within the width  $b_0$  and other symbols are as defined in Figure 3.1 and Figure 3.2.

## Analytical models for shear lag evaluation

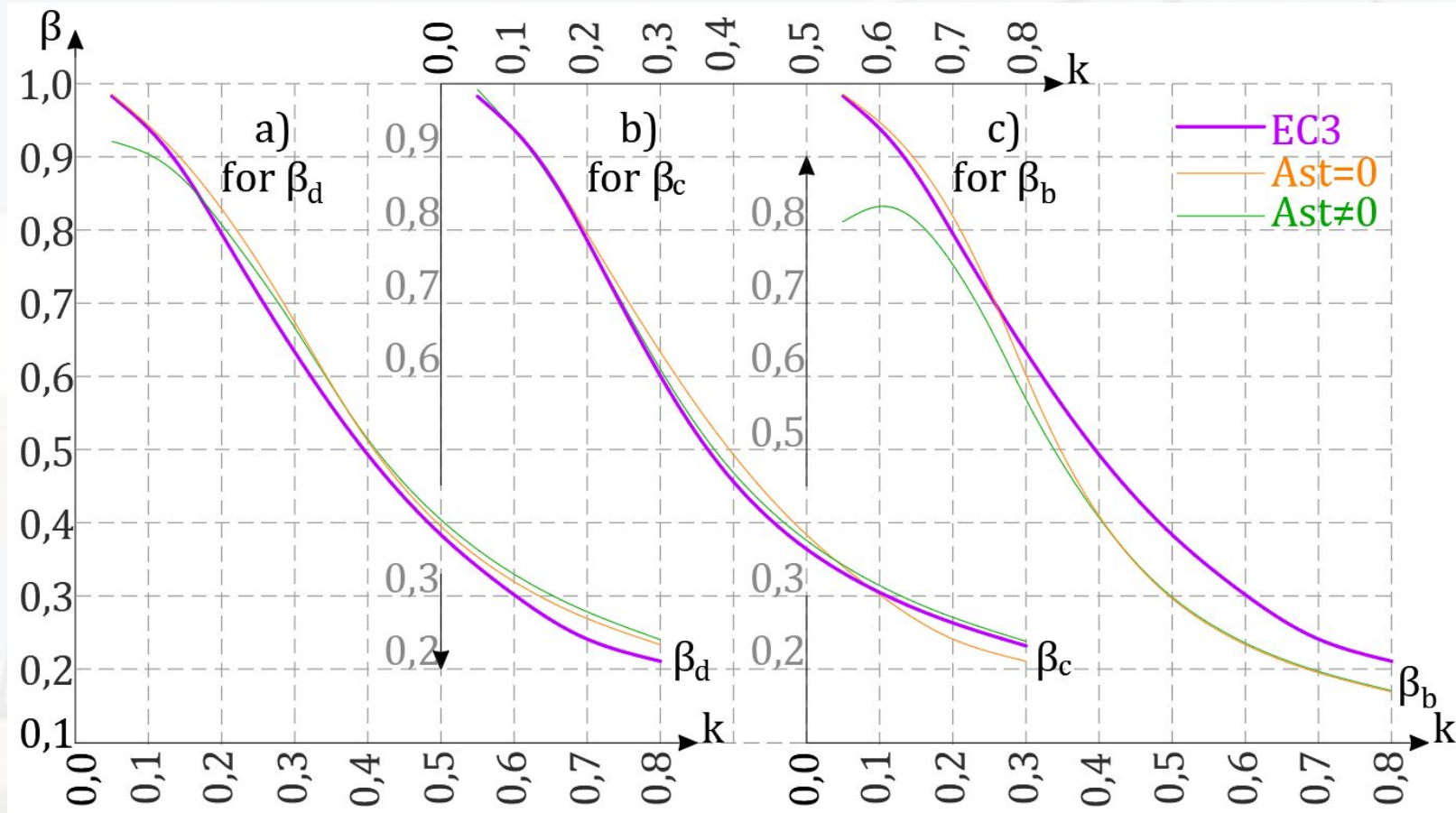


**Recalculated parameters of shear lag**



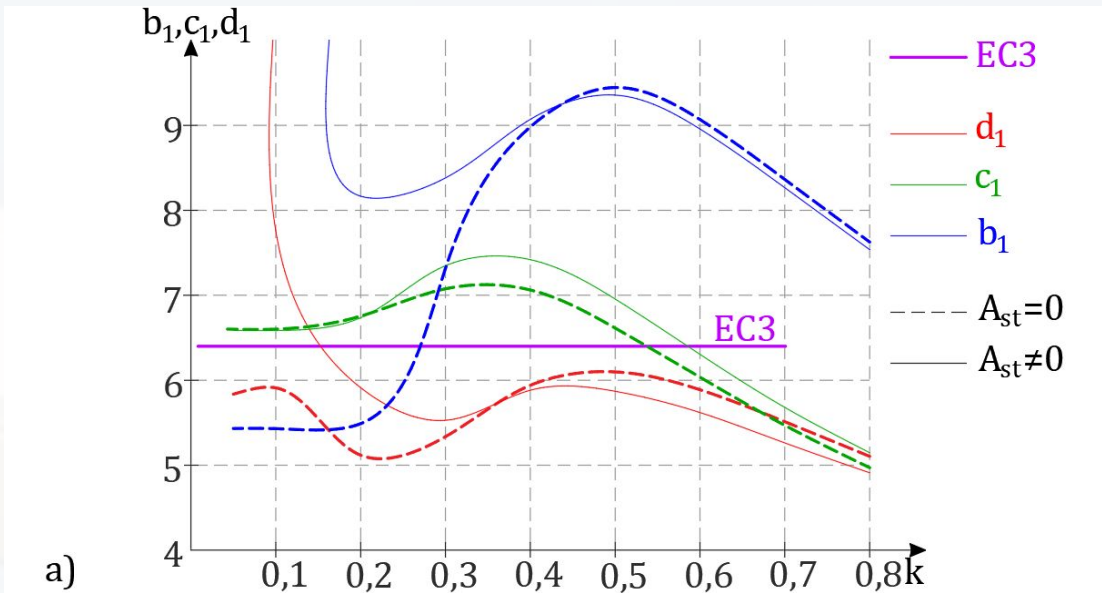
struct. part	$k$	0.1			
	case	$\beta$	$a_1$	$a_2$	$a_3$
deck plate	$a$	0.9442	5.9097	0.2108	2.022
	$b$	0.8684	10.523	0.2033	2.669
	$c_1$	0.9107	9.8026	0.2060	2.587
	$c_2$	0.9108	9.7975	2.061	2.586
cantilever plate	$a$	0.9382	6.5852	0.2167	1.708
	$b$	0.9343	7.0332	-0.019	
	$c$	0.9454	5.7738	0.0321	
bottom plate	$a$	0.9485	5.4300	0.2100	2.021
	$b$	0.8552	16.930	0.1895	3.428
	$c_1$	0.8722	14.647	0.1924	3.361
EC3		0.9398	6.4	0.2	4.0

“Au” approach in deck plate between girders

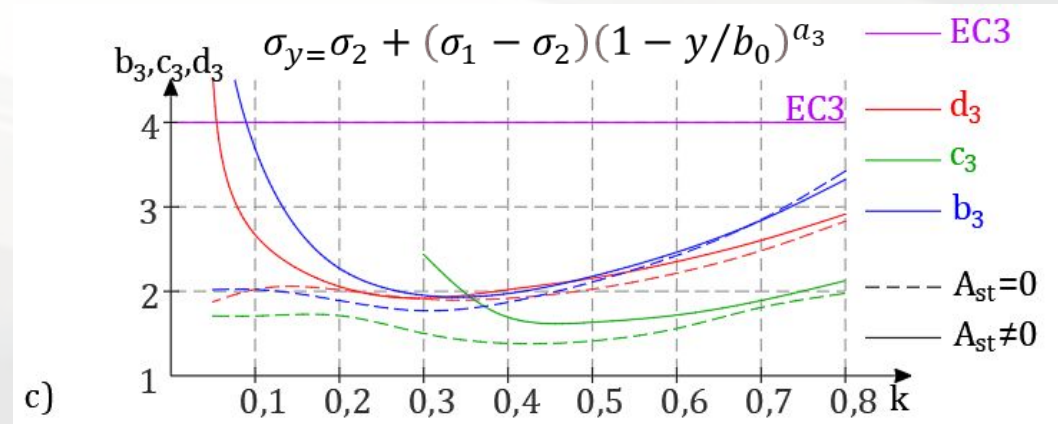
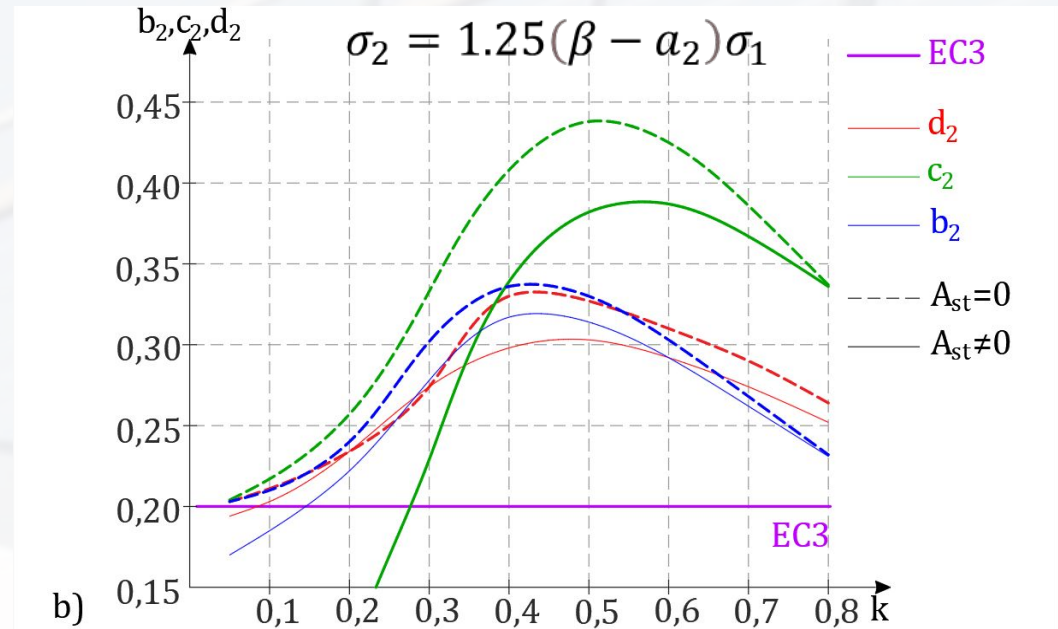


Effective breadth ratio  $\beta_i$ .

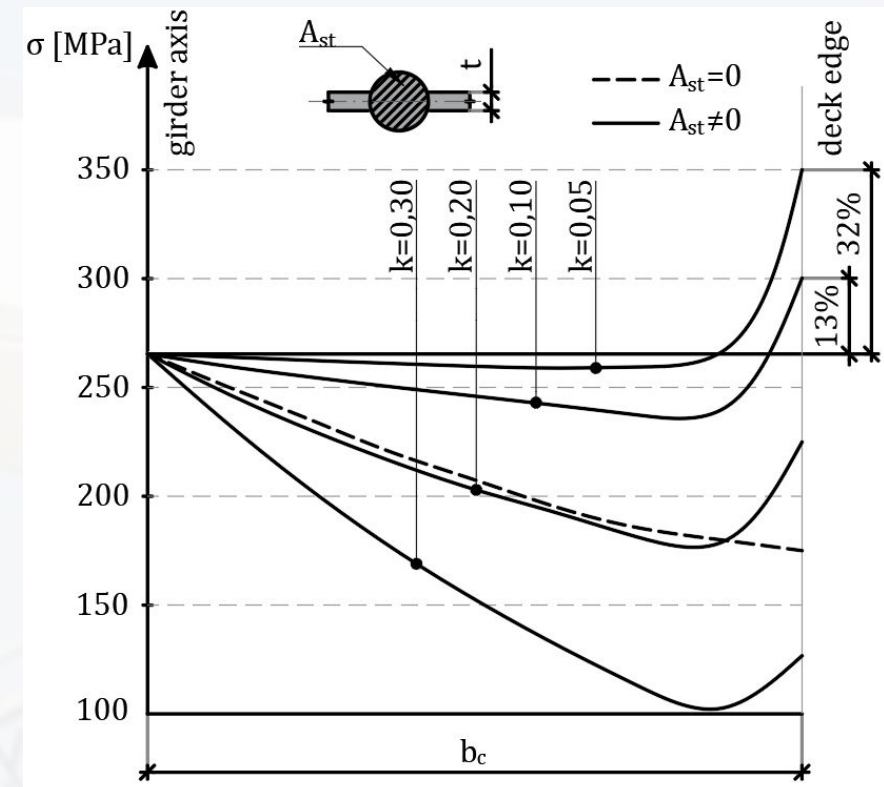
“Au” approach in deck plate between girders



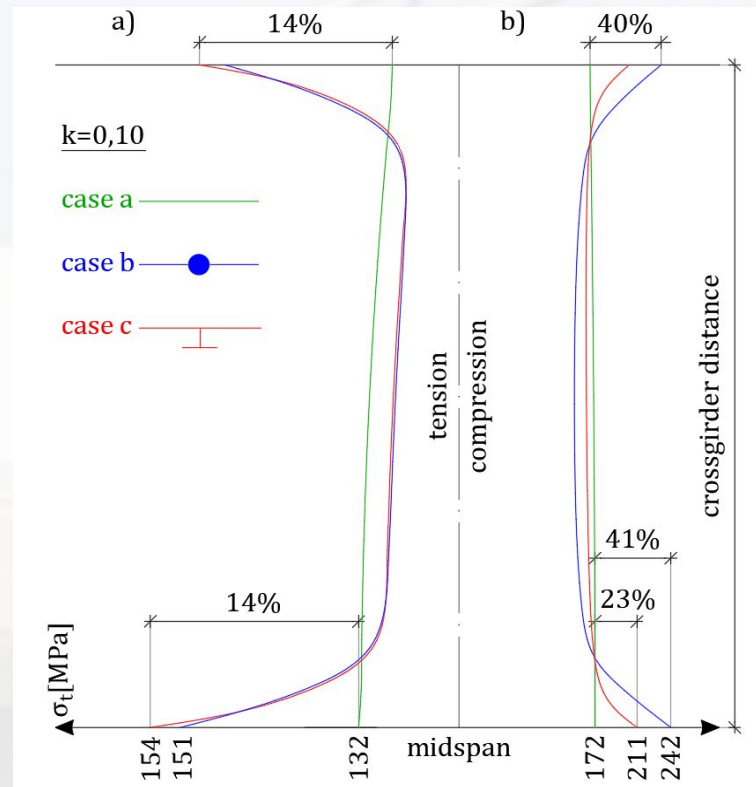
$$\beta = 1/(1 + a_1 k^2)$$



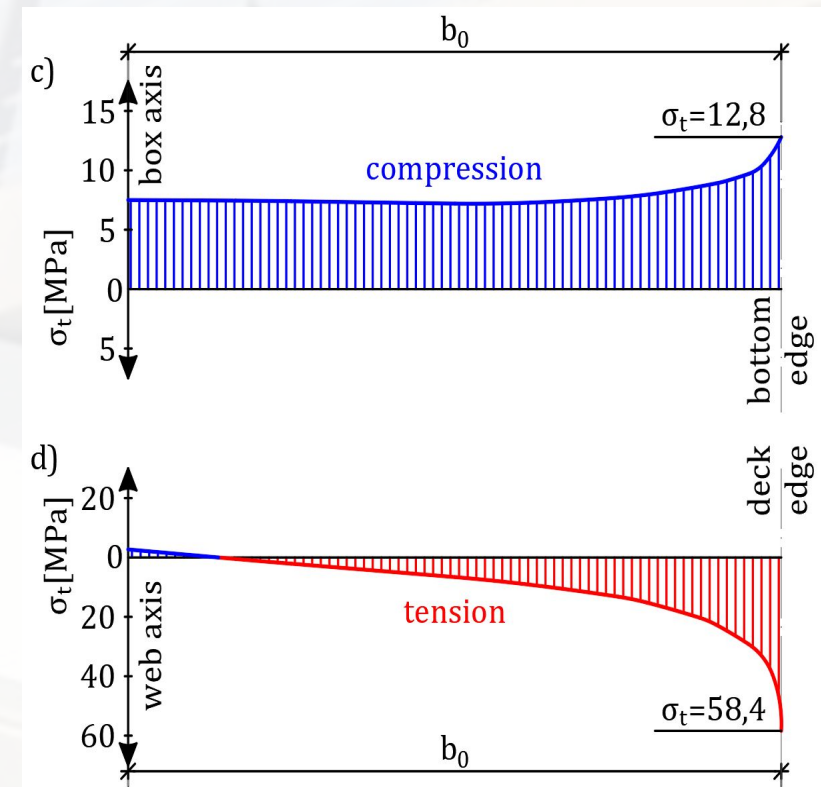
**“Au” approach in cantilever deck parts**



Transverse distribution of the direct stresses for a cantilever deck plate



a) at the bottom plate  
b) at the deck plate



stress diagrams along the transverse elements  
c) at bottom plate  
d) at deck plate

## Distribution of transversal stresses along web axis of girder due to bending

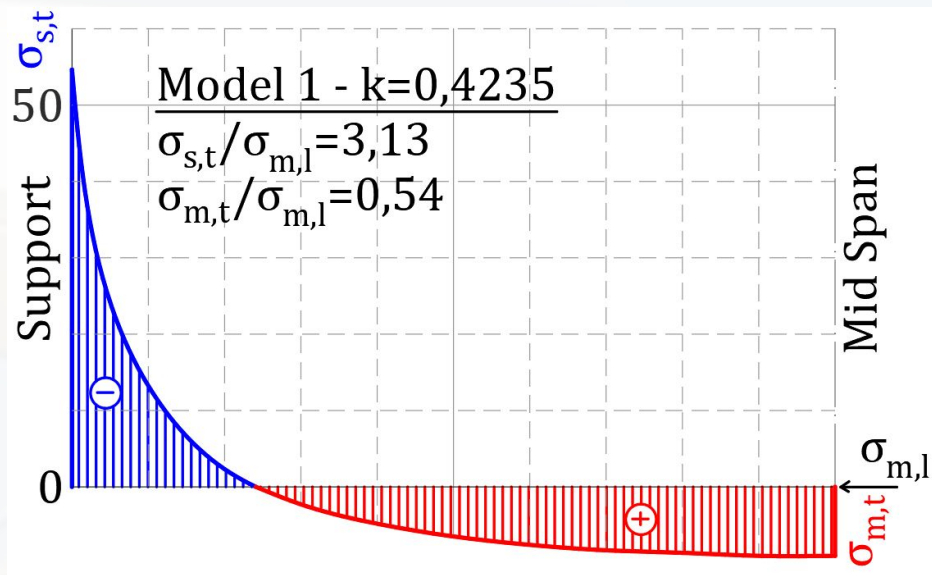
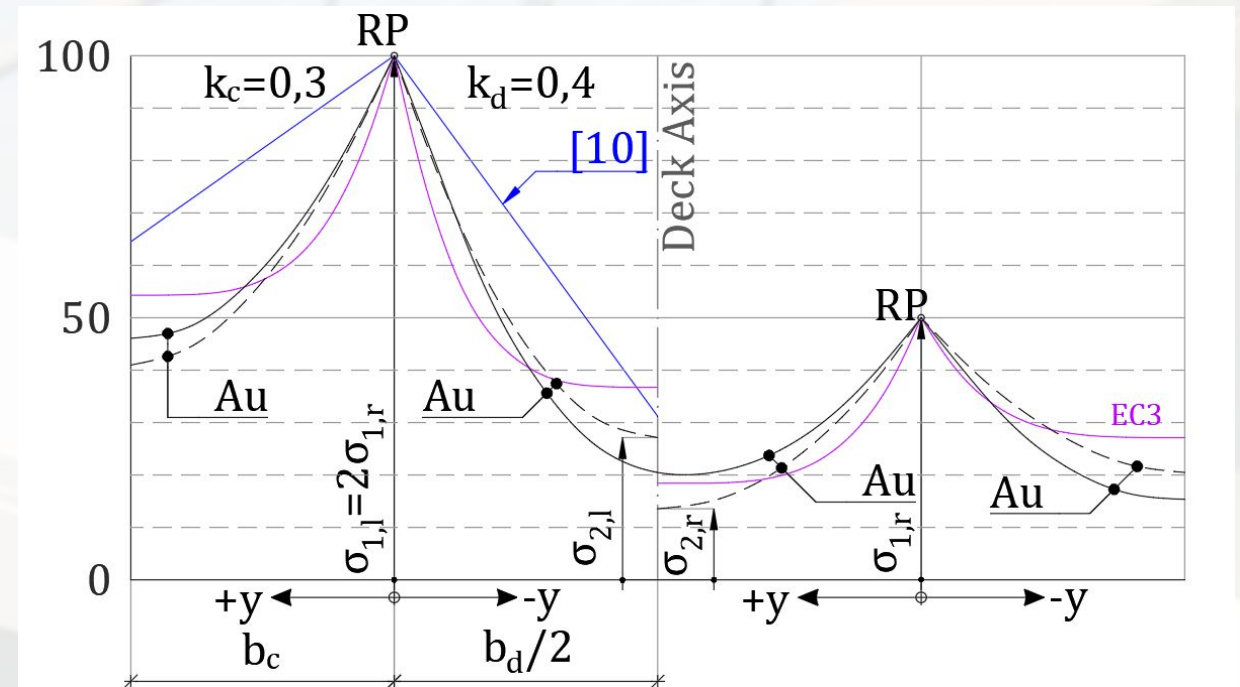


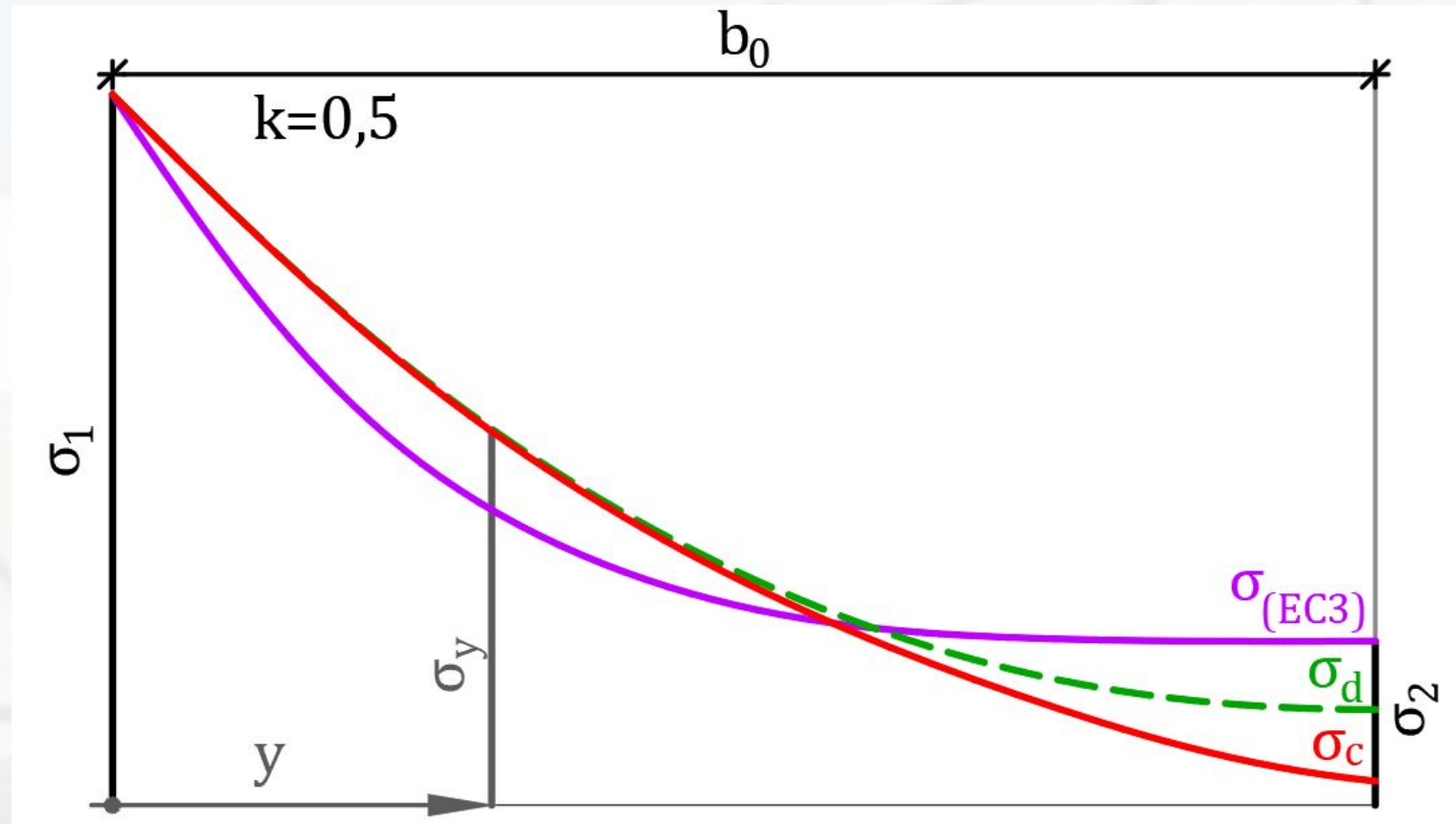
Diagram of transverse direct stresses along the longitudinal edge of model 2

## "Au" approach for unequally loaded girders





## Conclusion



**Thank you for your attention**

Prof. Dr. eng. Encho Dulevski  
Dr. eng. Vasil Nikolov  
Dr. eng. Alexander Jiponov

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