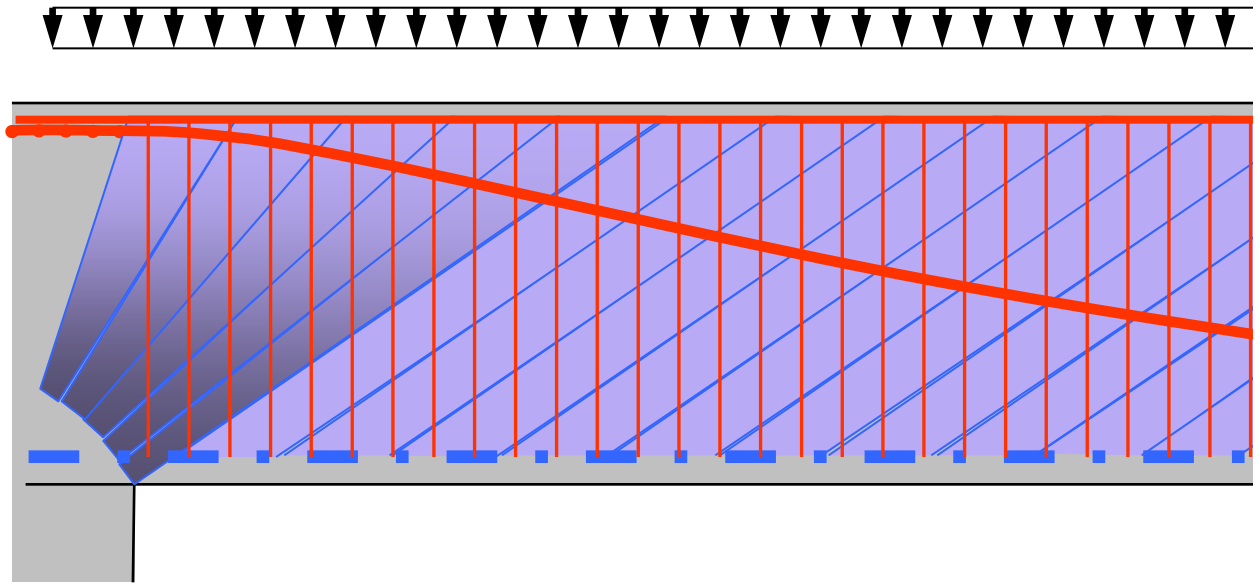
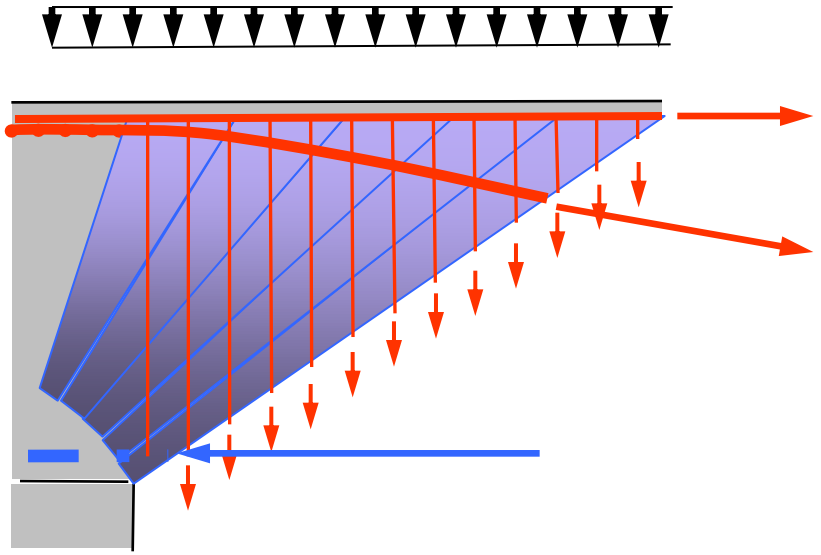
Prestressing 3 Shear

Literatures :
- Polycopié *Structures en béton : Conception, dimensionnement et vérification* chap. 6
- *Prestressed Concrete Bridges*, C. Menn
- TGC 7, *Dimensionnement des structures en béton*
- TGC 8, *Dimensionnement des structures en béton*

Shear

Self-equilibrated state of stresses (prestressing considered on the side of the resistance)
The systeme is composed by the concrete with the tendon

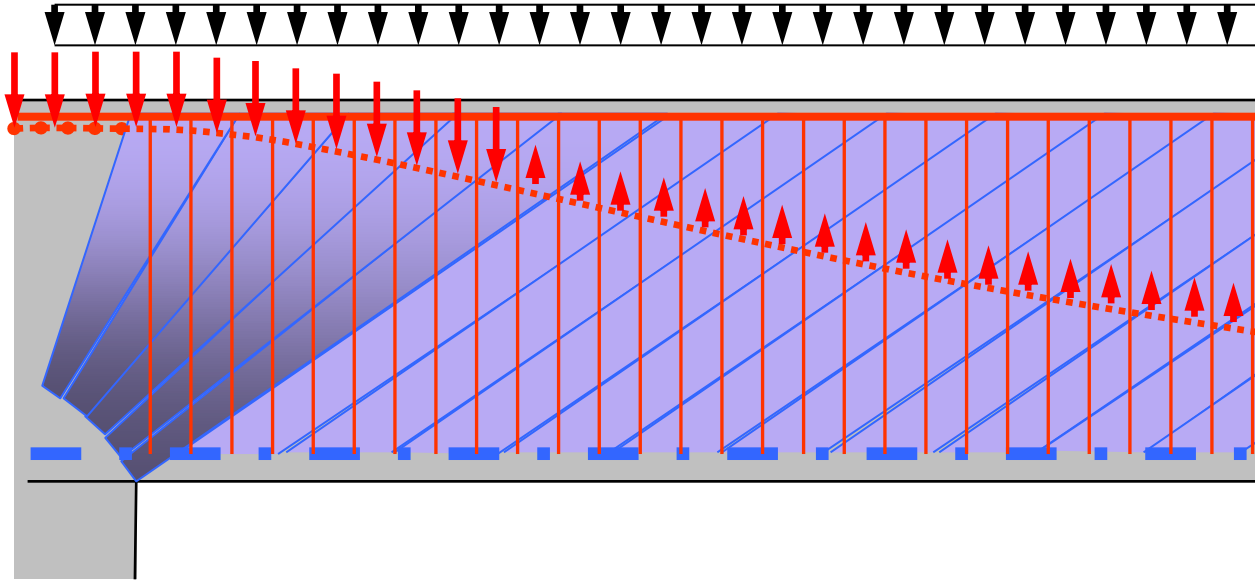


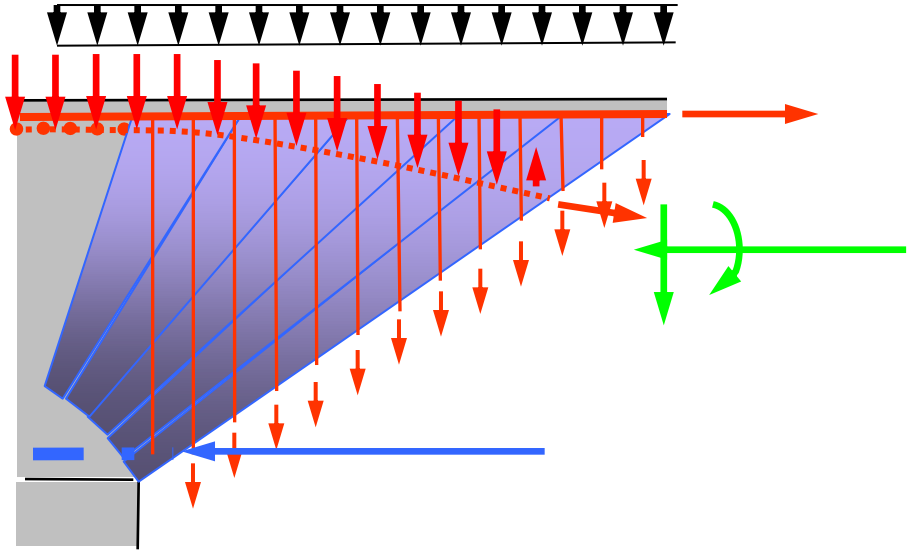


Shear

Self-equilibrated system of Forces (prestressing considered as external action)

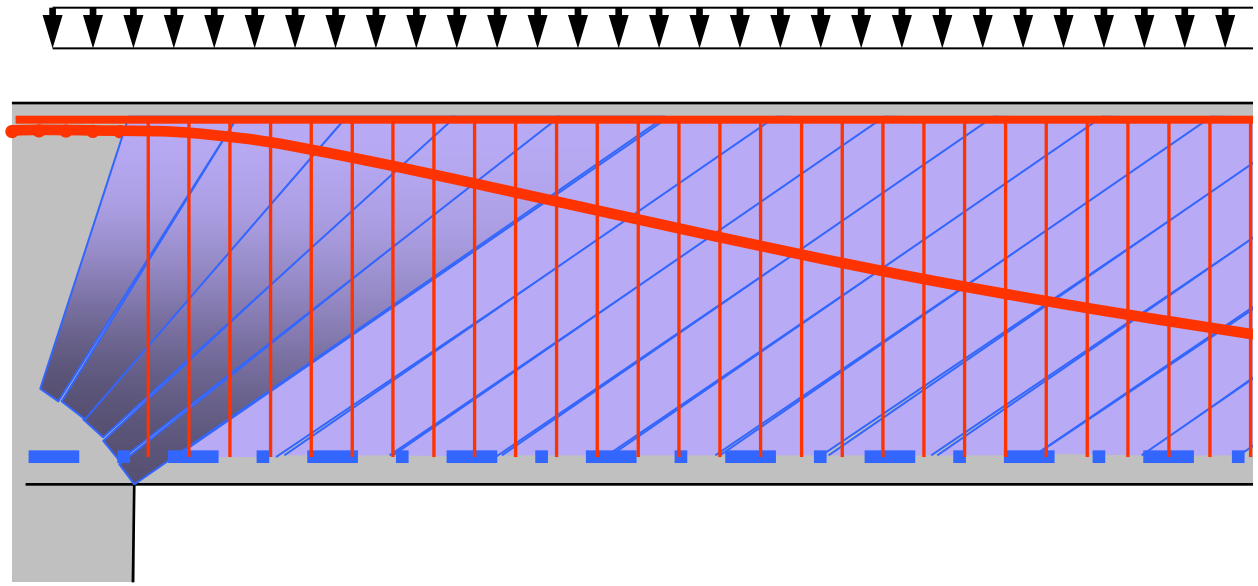
Forces exerted by active part of the tendon on the concrete





Shear

Inclination of the compression field



Shear

Inclination of the compression field α et strength reduction factor for concrete cracked k_c

$$\frac{A_{sw}}{s} z \cdot f_{sd} \geq V_d \tan\alpha$$

$$-\sigma_{cd} = \frac{V_d}{b_w \cdot z} \frac{1}{\sin\alpha \cos\alpha} \leq k_c \cdot f_{cd}$$

$$N_{Td} = \frac{M_d}{z} + \frac{V_d}{2} \cot\alpha$$

SIA 262:2013 – Level of Approximation 1 (LoA 1) $V_{Rd,c} = b_w z\, k_c f_{cd} \sin\alpha \cos\alpha$

$$k_c = 0.55$$

L'inclinaison minimale du champ de compression α_{min} vaut :

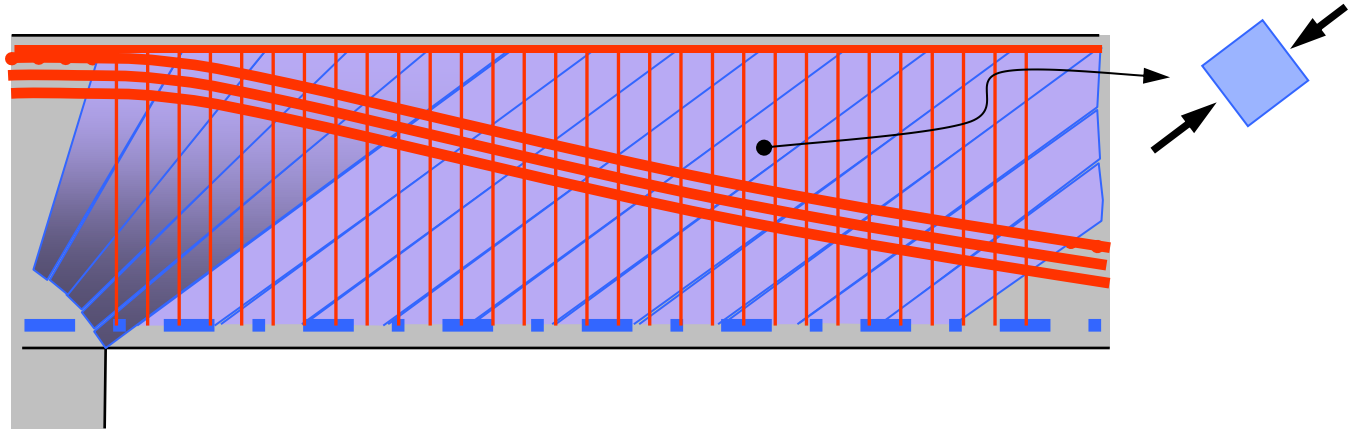
- α_{min} = 30° en cas normal
- α_{min} = 25° si l'âme est soumise à une force normale de compression importante
- α_{min} = 40° si l'âme est soumise à une force normale de traction ou si des déformations plastiques des membrures sont attendues dans la zone de poutre considérée.

Shear

Verification of the concrete compressive strut

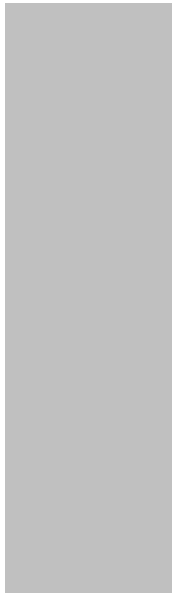
$$V_{Rd,c} = b_w z\, k_c f_{cd} \sin\alpha \cos\alpha$$

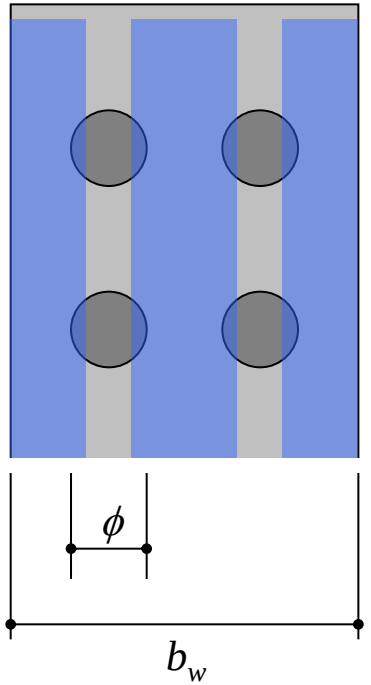
$$b_{w,eff} = b_w - k \cdot \sum \phi$$



Ducts

- Non-grouted: k =1.2
- Grouted plastic: k =0.8
- Grouted steel: k =0.5





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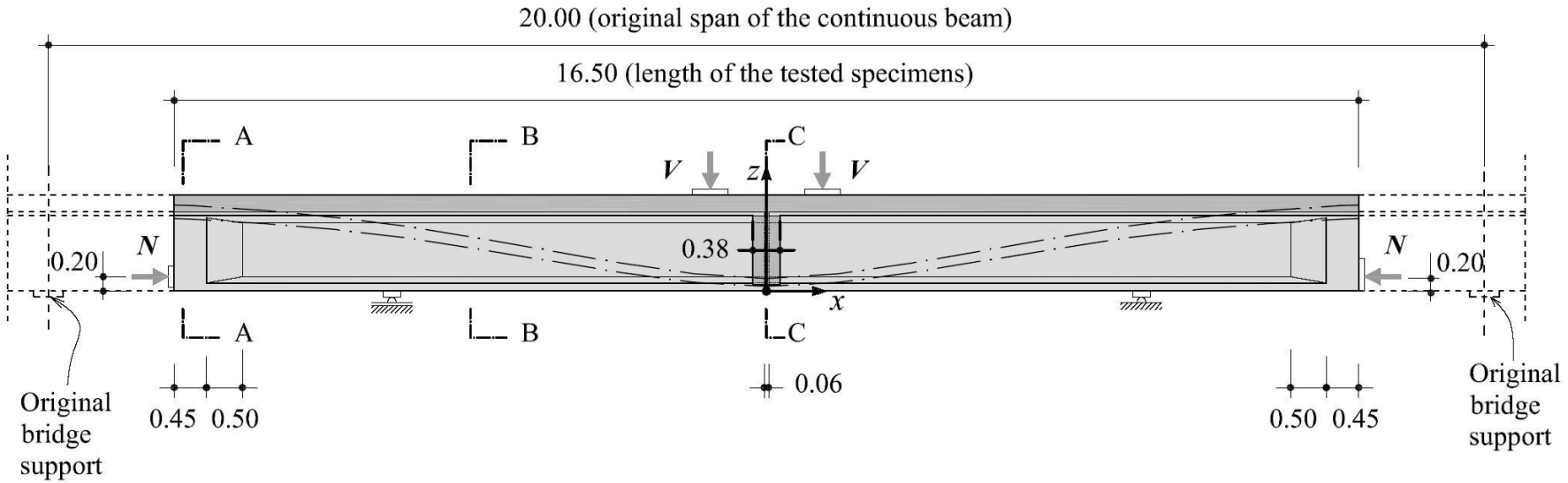
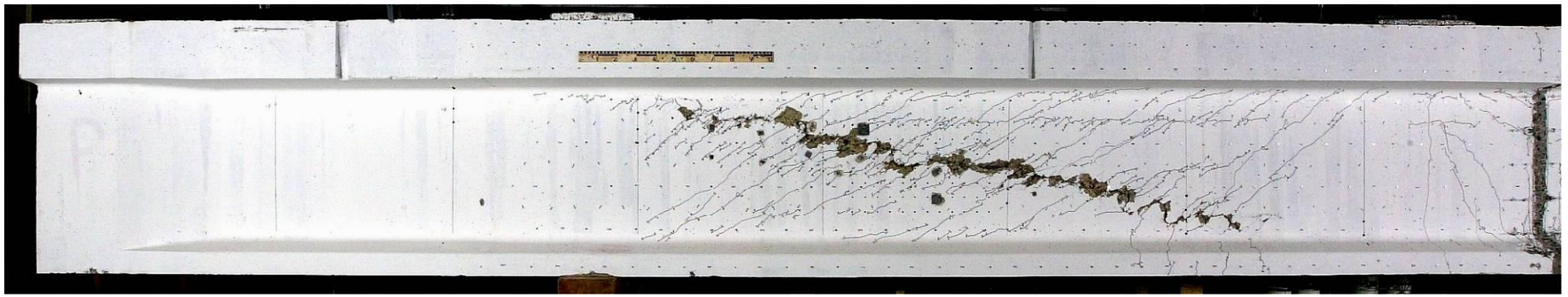
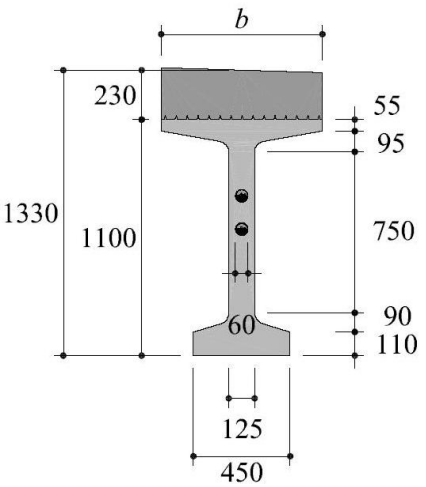
Verification of the concrete compressive strut







Shear

Inclination of the compression field α et strength reduction factor for concrete cracked k_c

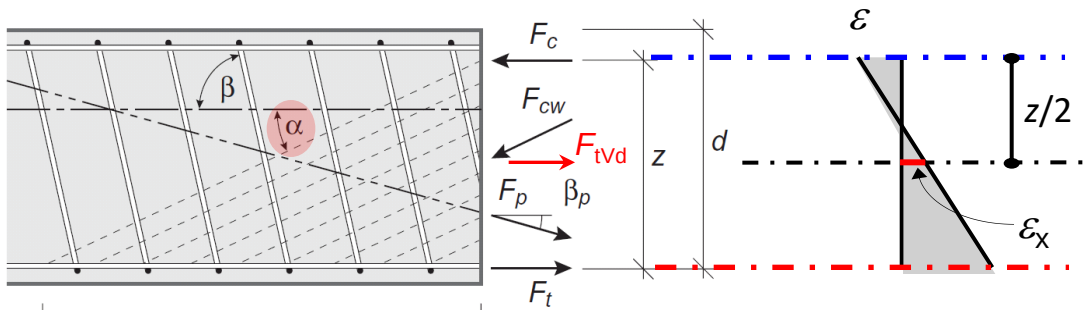
SIA 262:2013 – LoA 2

$$V_{Rd,c} = b_w z k_c f_{cd} \sin\alpha \cos\alpha$$

Inclination of the compression field α

$$20° + 10\,000\,\varepsilon_x \le \alpha \le 45°$$

$$\varepsilon_x \ge 0$$



factor for concrete cracked k_c

$$k_c = \frac{1}{1{,}2 + 55\varepsilon_1} \le 0{,}65$$

avec

$$\varepsilon_1 = \varepsilon_x + (\varepsilon_x + 0{,}002)\cot^2\alpha$$