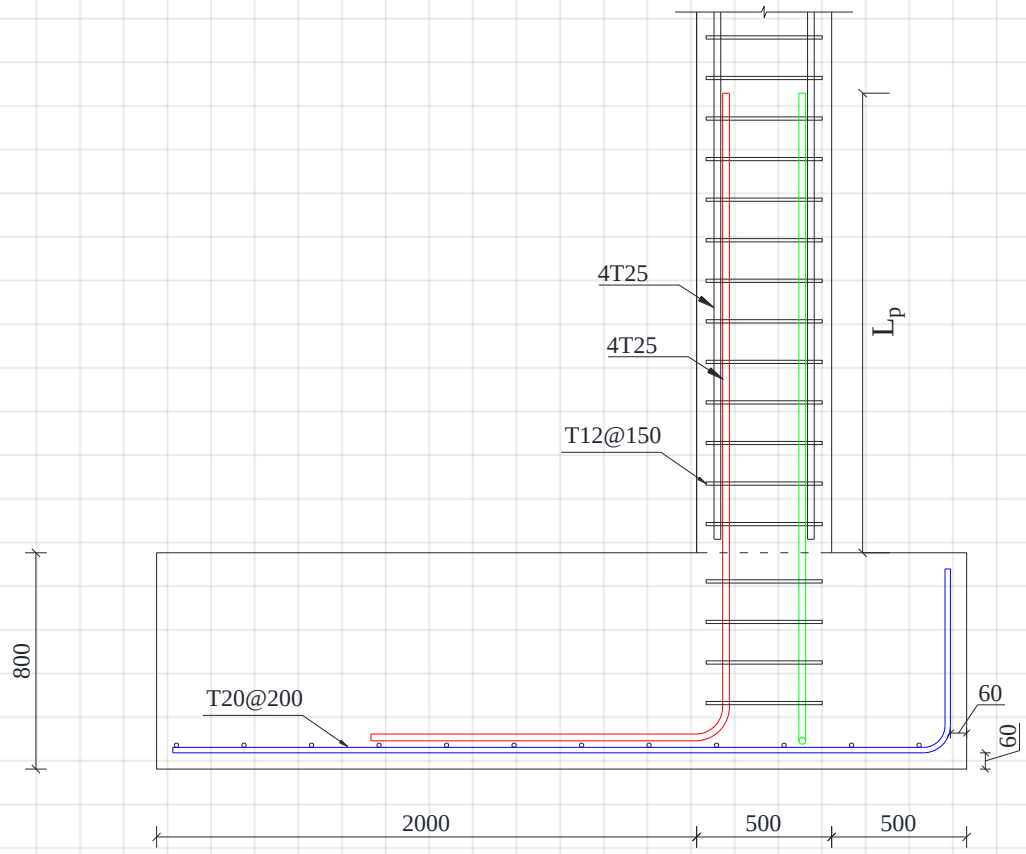
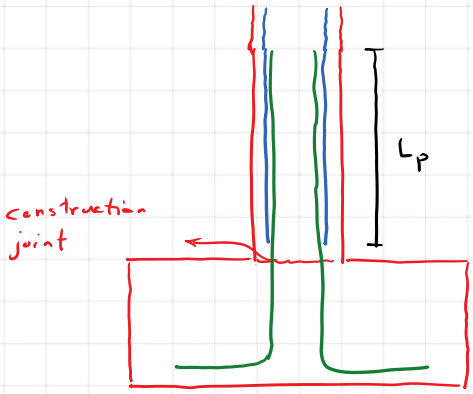
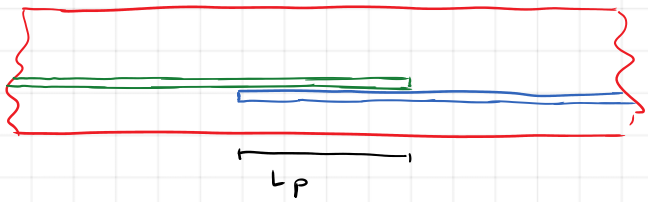
This video will teach us how to determine the lap length of the reinforced concrete element according to Eurocode 1992-1-1. In the end, a straightforward example is provided to determine the required bar length.

The example of the video:

In the previous video, we determined the anchorage length of the reinforcement of a column. Those 8T25 need to be extended from the construction joint of the foundation top level until the column reinforcement is placed and ready to be concreted. Determine the required lap length according to Eurocode 1992-1-1. Concrete class C35/45 and steel AH500.







8.7 Laps and mechanical couplers

8.7.1 General

(1)P Forces are transmitted from one bar to another by:
- lapping of bars, with or without bends or hooks;
- welding;
- mechanical devices assuring load transfer in tension-compression or in compression only.

8.7.2 Laps

(1)P The detailing of laps between bars shall be such that:
- the transmission of the forces from one bar to the next is assured;
- spalling of the concrete in the neighbourhood of the joints does not occur;
- large cracks which affect the performance of the structure do not occur.

(2) Laps:
- between bars should normally be staggered and not located in areas of high moments /forces (e.g. plastic hinges). Exceptions are given in (4) below;
- at any section should normally be arranged symmetrically.

(3) The arrangement of lapped bars should comply with Figure 8.7:
- the clear distance between lapped bars should not be greater than 4ϕ or 50 mm, otherwise the lap length should be increased by a length equal to the clear space where it exceeds 4ϕ or 50 mm;
- the longitudinal distance between two adjacent laps should not be less than 0,3 times the lap length, l_0;
- In case of adjacent laps, the clear distance between adjacent bars should not be less than 2ϕ or 20 mm.

(4) When the provisions comply with (3) above, the permissible percentage of lapped bars in tension may be 100% where the bars are all in one layer. Where the bars are in several layers the percentage should be reduced to 50%.

All bars in compression and secondary (distribution) reinforcement may be lapped in one section.

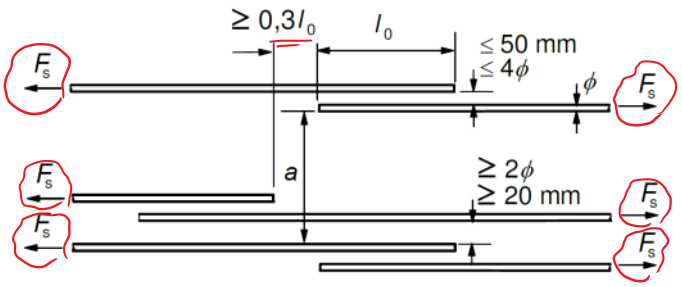


Figure 8.7: Adjacent laps

8.7.3 Lap length

(1) The design lap length is:

$$l_0 = \alpha_1\ \alpha_2\ \alpha_3\ \alpha_5\ \alpha_6\ l_{b,rqd} \geq l_{0,min} \qquad (8.10)$$

where:

$l_{b,rqd}$ is calculated from Expression (8.3)

$$l_{0,min} > \max\{0{,}3\ \alpha_6\ l_{b,rqd};\ 15\phi;\ 200\ mm\} \qquad (8.11)$$

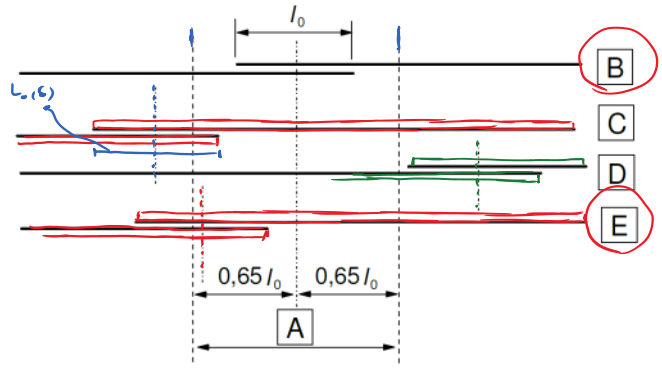
Values of α_1, α_2, α_3 *and* α_5 may be taken from Table 8.2; however, for the calculation of α_3, $\Sigma A_{st,min}$ should be taken as $1{,}0 A_s(\sigma_{sd}/f_{yd})$, with A_s = area of one lapped bar.

α_6 = $(\rho_1/25)^{0,5}$ but not exceeding 1,5 nor less than 1,0, where ρ_1 is the percentage of reinforcement lapped within 0,65 l_0 from the centre of the lap length considered (see Figure 8.8). Values of α_6 are given in Table 8.3.

Table 8.3: Values of the coefficient α_6

Percentage of lapped bars relative to the total cross-section area	< 25%	33%	50%	>50%
α_6	1	1,15	1,4	1,5

Note: Intermediate values may be determined by interpolation.



$\frac{2}{4}$ lapped bars

50 % → $\alpha_6 = \left(\frac{50}{25}\right)^{0.5} = \sqrt{2} = 1.4$

A Section considered B Bar I C Bar II D Bar III E Bar IV

Example: Bars II and III are outside the section being considered: % = 50 and α_6 =1,4

Figure 8.8: Percentage of lapped bars in one lapped section

Lap length

8.7.3(1)

When using a value of 2.0 for the factor α_6, it may be considered that the requirement in clause 8.7.2(3) for the longitudinal distance of the lap slice is met and the bars may be lapped at the same cross-section pursuant to clause 8.7.2(4).

When calculating the lap length of bars in compression a value of 1 may be adopted for factor α_6.

8.7.4 Transverse reinforcement in the lap zone

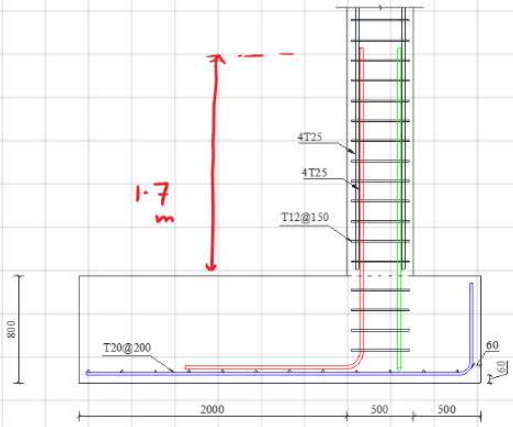
8.7.4.1 Transverse reinforcement for bars in tension

8.7.4.2 Transverse reinforcement for bars permanently in compression

8.7.5 Laps for welded mesh fabrics made of ribbed wires

8.7.5.1 Laps of the main reinforcement

8.7.5.2 Laps of secondary or distribution reinforcement



$$l_0 = \alpha_1 \cdot \alpha_2 \cdot \alpha_3 \cdot \alpha_5 \cdot \alpha_6 \cdot l_{b,rqd} \geq l_{0,min}$$

$\alpha_1 = 1$

$\alpha_6 = 2$, $l_{b,rqd} = 850\,mm$

$$\rightarrow l_0 = 1700\,mm \geq l_{0,min} = \max\{0.3\alpha_6 l_{b,rqd}; 15\phi; 200\,mm\}$$

$0.3\alpha_6 l_{b,rqd} = 510$, $15\phi = 375$

$l_0 = 1700\,mm$