

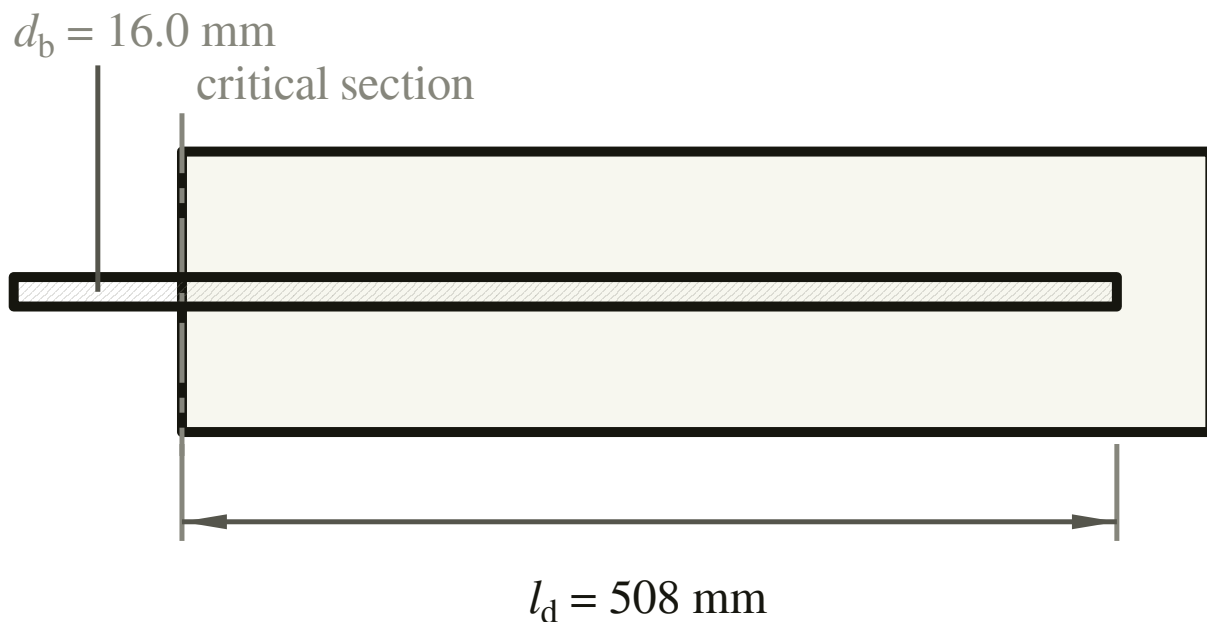
Compression development length

Development length of a reinforcing bar in compression, to CSA A23.3-24 Cl. 12.3.

Inputs

Symbol	Value	Unit	Description
f_c	25	MPa	Concrete compressive strength
f_y	400	MPa	Specified yield strength, f_{yg}
c_c	40	mm	Clear cover to the bar
s_c	100	mm	Clear spacing between bars being developed
A_{tr}	200	mm ²	Transverse steel crossing the splitting plane
s	150	mm	Spacing of the transverse reinforcement
n	2		Number of bars being developed
$A_{s,ratio}$	1		A_s required over provided, Cl. 12.3.4
rebar	15M		Bar size
coating	Uncoated reinforcement		Bar coating
conc _{density}	Normal-density concrete		Concrete density
bundle	Single bar		Bundled bars, Cl. 12.3.5

Figures



Straight bar embedded past the critical section, drawn from the values above.

Results

Quantity	Description	Value	Unit
l_d	Development length required in compression	508	mm
l_{dc}	General equation, Cl. 12.3.2	508	mm

Derivation

$$d_b = 16 \text{ mm}$$

Bar diameter | 15M

$$k_c = 1$$

Uncoated | Table 12.3

$$k_d = 1$$

Normal-density concrete | Table 12.3

Branch: $s < 12 \cdot d_b$ held

$$\begin{aligned} K_{tr} &= \frac{40 \cdot A_{tr}}{s \cdot n} && \text{Cl. 12.3.2} \\ &= \frac{40 \cdot 200 \text{ mm}^2}{150 \text{ mm} \cdot 2} \\ &= 26.67 \text{ mm} \end{aligned}$$

$$\begin{aligned} l_{dc} &= \left(\frac{k_c \cdot k_d \cdot f_y}{1.3 \cdot \left(1 + \frac{0.1 \cdot \min(K_{tr}, 1.75 \cdot d_b)}{d_b} \right) \cdot \min(\sqrt{f_c} \cdot 1 \text{ MPa}, 8 \text{ MPa})} - 21 \right) \cdot d_b \\ &\quad \text{Cl. 12.3.2, with the 8 MPa cap of Cl. 12.1.2} \\ &= \left(\frac{1 \cdot 1 \cdot 400 \text{ MPa}}{1.3 \cdot \left(1 + \frac{0.1 \cdot \min(26.67 \text{ mm}, 1.75 \cdot 16 \text{ mm})}{16 \text{ mm}} \right) \cdot \min(\sqrt{25 \text{ MPa}} \cdot 1 \text{ MPa}, 8 \text{ MPa})} - 21 \right) \cdot 16 \text{ mm} \\ &= 508 \text{ mm} \end{aligned}$$

$$\begin{aligned} l_{d,\text{single}} &= \max(l_{dc} \cdot A_{s,\text{ratio}}, 300 \text{ mm}) && \text{Cl. 12.3.1 and 12.3.4} \\ &= \max(508 \text{ mm} \cdot 1, 300 \text{ mm}) \\ &= 508 \text{ mm} \end{aligned}$$

$$k_{\text{bundle}} = 1$$

Single bar | Cl. 12.3.5

$$\begin{aligned}l_d &= l_{d,\text{single}} \cdot k_{\text{bundle}} \\&= 508 \text{ mm} \cdot 1 \\&= 508 \text{ mm}\end{aligned}$$

Cl. 12.3.5