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Cl.:8.15.2 Development of reinforcing bars and deformed wire in tension

Cl.: 8.15.2.3: Development length

Case 1: components containing minimum stirrups or ties within l.d or slabs and walls with a clear spacing of not less than 2.db between bars being developed

$$l_{d1} := 0.18 \cdot k_1 \cdot k_2 \cdot k_3 \cdot \frac{f_y}{f_{cr}} \cdot d_b$$

Case 2: all other cases

$$l_{d2} := 0.24 \cdot k_1 \cdot k_2 \cdot k_3 \cdot \frac{f_y}{f_{cr}} \cdot d_b$$

Select which case is it

$$l_d := l_{d1}$$

$$l_d := \text{Max}\left(l_d, 300 \ mm\right)$$

Table 8.8
Minimum development length of
and deformed wire in t
(See Clause 8.15.2.3.)

Cases
Components containing minimum stirrups or tie (Clause 8.9.1.3 or 8.14.4.3) within ℓ_d or slabs and walls with a clear spacing of not less than 2c between bars being developed
Other cases

Cl.: 8.15.2.4 Modification factors

The following modification factors shall be used in calculating the development length specified in
Clauses 8.15.2.2 and 8.15.2.3:

(a)Bar location factor, k1:
(i) 1.3 for horizontal reinforcement placed so that more than 300 mm of fresh concrete
is cast in the component below the development length or splice; and
(ii) 1.0 for other cases.

(b) Coating factor, k2:
(i) 1.5 for epoxy-coated reinforcement with a clear cover less than 3db or a clear
spacing between bars being developed less than 6db;
(ii) 1.2 for all other epoxy-coated reinforcement; and
(iii) 1.0 for uncoated reinforcement.

(c) Bar size factor, k3:

(i) 0.8 for 20M and smaller bars and deformed wires; and

(ii) 1.0 for 25M and larger bars.

The product k1k2 need not be taken greater than 1.7.

$$k_3 := \begin{cases} 0.8 & \text{if} \quad d_b \leq 2 \\ 1.0 & \text{otherwise} \end{cases}$$

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Cl.: 8.15.9.3 Splices of deformed bars and deformed wire in tension

Lap splices of deformed bars and deformed wire in tension shall be classified as Class A or Class B in accordance with Table 8.11. The minimum length of lap shall be 1.0ld for Class A splices and 1.3ld for Class B splices, but not less than 300 mm. In this regard, the development length, ld, shall be calculated in accordance with Clause 8.15.2.1, but without the modification factors for excess reinforcement specified in Clause 8.15.2.5.

Table 8.11
Classification of lap splices in tension
(See Clause 8.15.9.3.)

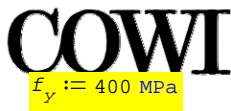| (A_s provided)/(A_s required)	Maximum percentage of A_s spliced within required splice length	
	50	100
≥ 2	Class A	Class B
< 2	Class B	Class B

$$k_{spl} := 1.3$$

Concrete:

$$f'_c := 35 \text{ MPa}$$

$$f_{cr} := \text{Min}\left(0.4 \cdot \sqrt{f'_c \text{ MPa}}, 3.2 \text{ MPa}\right) = 2.366 \text{ MPa}$$

Steel:

COWI

$f_y := 400 \text{ MPa}$

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$d_{b10} := 11.3 \text{ mm}$ $d_{b15} := 16 \text{ mm}$ $d_{b20} := 19.5 \text{ mm}$ $d_{b25} := 25.2 \text{ mm}$ $d_{b30} := 29.9 \text{ mm}$

$$l_d\left(d_{b\#}\right) := \left. \left| l_d \right|_{\left\{ d_b = d_{b\#} \right.} \right. \qquad\qquad l_{spl}\left(d_{b\#}\right) := \left. \left| k_{spl} \cdot \left(\left. l_d \right|_{\left\{ d_b = d_{b\#} \right.} \right) \right. \right.$$

Development length:

$l_d\left(d_{b15}\right) = 389 \text{ mm}$ $l_d\left(d_{b20}\right) = 475 \text{ mm}$ $l_d\left(d_{b25}\right) = 767 \text{ mm}$ $l_d\left(d_{b30}\right) = 910 \text{ mm}$

Splice length:

$l_{spl}\left(d_{b15}\right) = 506 \text{ mm}$ $l_{spl}\left(d_{b20}\right) = 617 \text{ mm}$ $l_{spl}\left(d_{b25}\right) = 997 \text{ mm}$ $l_{spl}\left(d_{b30}\right) = 1183 \text{ mm}$