

-ve reinforcement

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exterior
support

For the -ve reinforcement at the
discontinuous support,

$$L_d = 152 \text{ cm}, \text{ Available} \approx 45 \text{ cm}$$

∴ A standard hook is required, but must
be checked.

$$l_{dh} = \frac{0.24 (1.0) (420) (2.5)}{(1.0) (\sqrt{28})}$$

$$\times 0.7$$

$$\times \frac{17.45}{19.63}$$

$$= 29.63 \text{ cm (use } 30 \text{ cm)}$$

$$> 8d_b = 20 \text{ cm}$$

$$> 15 \text{ cm}$$

$$\therefore l_{dh} = 30 \text{ cm}$$

$$\text{Available} = 45 \text{ cm}$$

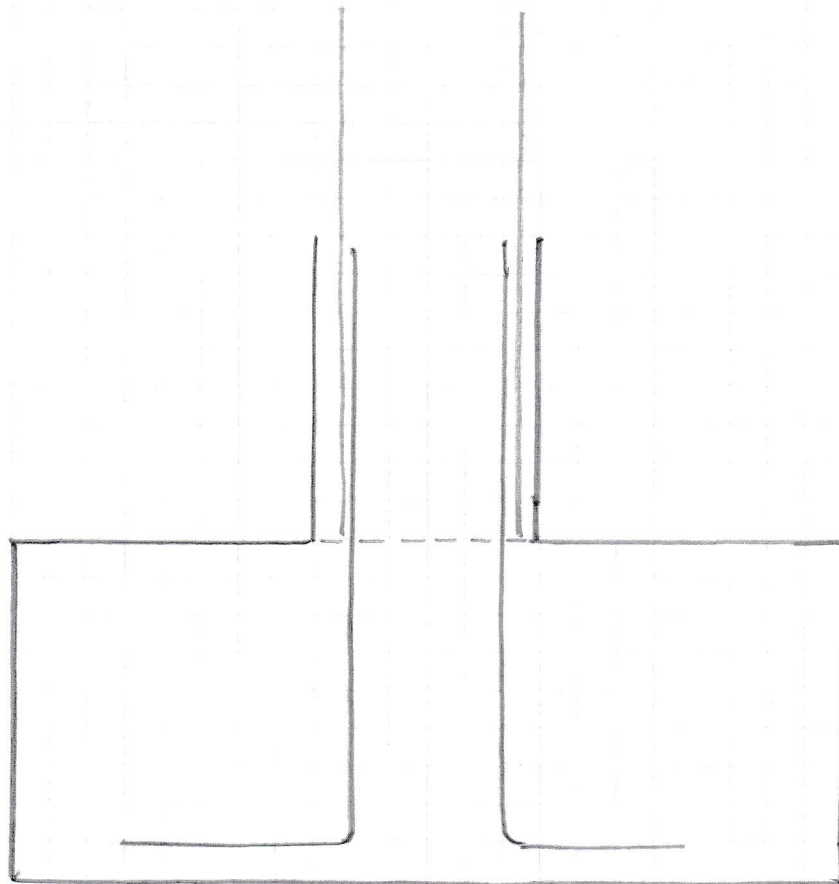
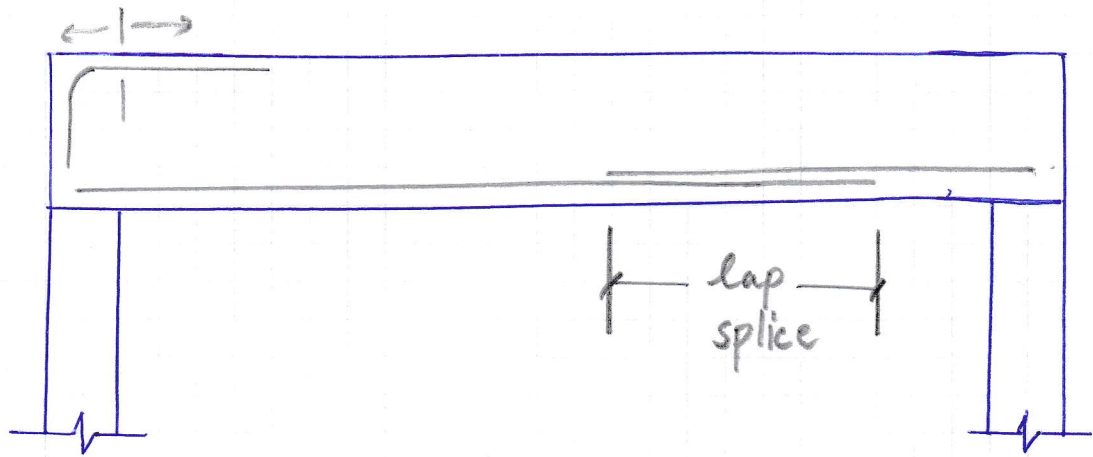
∴ OK

To the right of the face of the supports,

$$\text{available} = \overset{148}{\cancel{126}} + 57 = \overset{205}{\cancel{183}} \text{ cm}$$

$$> L_d = 152 \text{ cm}$$

∴ OK



a) Compute actual ϕM_n for each bar grouping, 5, 4, and 2 bars

b) Determine which bars must extend entirely across the span and into the support.

ACI $\frac{1}{3}$ positive reinforcement in simple members at least 6" (15 cm).

c) ϕM_n diagram closest to the factored moment M_u diagram - determine the order of cutting the remaining bars.

d) Restrictions:

ACI d or $12d_b$, whichever is greater

e) Special conditions:

ACI

Points B and C have bars terminated in a tension zone - shear strength is reduced. If these bars were bent up and anchored in the compression zone, no further investigation would be necessary.

Notes: * Hooks are not effective in compression
* For lap splices, use a lap length = $1.3L_d$

CODE

25.4.9 *Development of deformed bars and deformed wires in compression*

25.4.9.1 Development length ℓ_{dc} for deformed bars and deformed wires in compression shall be the greater of (a) and (b)

- (a) Length calculated in accordance with 25.4.9.2
- (b) 200 mm

25.4.9.2 ℓ_{dc} shall be the greater of (a) and (b), using the modification factors of 25.4.9.3:

$$(a) \left(\frac{0.24 f_y \psi_r}{\lambda \sqrt{f'_c}} \right) d_b$$

$$(b) 0.043 f_y \psi_r d_b$$

25.4.9.3 For the calculation of ℓ_{dc} , modification factors shall be in accordance with Table 25.4.9.3, except ψ_r shall be permitted to be taken as 1.0.

Table 25.4.9.3—Modification factors for deformed bars and wires in compression

| Modification factor | Condition | Value of factor |
|-------------------------------------|---|-----------------------------|
| Lightweight λ | Lightweight concrete | 0.75 |
| | Lightweight concrete, if f'_{cr} is specified | In accordance with 19.2.4.3 |
| | Normalweight concrete | 1.0 |
| Confining reinforcement ψ_r | Reinforcement enclosed within (1), (2), (3), or (4): (1) a spiral (2) a circular continuously wound tie with $d_b \geq 6$ mm and pitch 100 mm (3) No. 13 bar or MD130 wire ties in accordance with 25.7.2 spaced ≤ 100 mm on center (4) hoops in accordance with 25.7.4 spaced ≤ 100 mm on center | 0.75 |
| | Other | 1.0 |

25.4.10 *Reduction of development length for excess reinforcement*

25.4.10.1 Reduction of development lengths defined in 25.4.2.1(a), 25.4.3.1(a), 25.4.6.1(a), 25.4.7.1(a), and 25.4.9.1(a) shall be permitted by use of the ratio ($A_{s,required}/A_{s,provided}$), except where prohibited by 25.4.10.2. The modified development lengths shall not be less than the respective minimums specified in 25.4.2.1(b), 25.4.3.1(b), 25.4.3.1(c), 25.4.6.1(b), 25.4.7.1(b), and 25.4.9.1(b).

25.4.10.2 A reduction of development length in accordance with 25.4.10.1 is not permitted for (a) through (e).

COMMENTARY

R25.4.9 *Development of deformed bars and deformed wires in compression*

R25.4.9.1 The weakening effect of flexural tension cracks is not present for bars and wires in compression, and usually end bearing of the bars on the concrete is beneficial. Therefore, shorter development lengths are specified for compression than for tension.

R25.4.9.2 The constant 0.043 has units of mm^2/N .

The term λ is provided in the expression for development in 25.4.9.2 recognizing that there are no known test data on compression development in lightweight concrete but that splitting is more likely in lightweight concrete.

R25.4.9.3 The development length may be reduced 25 percent when the reinforcement is enclosed within closely spaced spirals, ties, or hoops.

R25.4.10 *Reduction of development length for excess reinforcement*

R25.4.10.1 A reduction in development length is permitted in limited circumstances if excess reinforcement is provided.

R25.4.10.2 The excess reinforcement factor ($A_{s,required}/A_{s,provided}$), applicable to deformed bars without heads, is not applicable for headed bars where force is transferred through