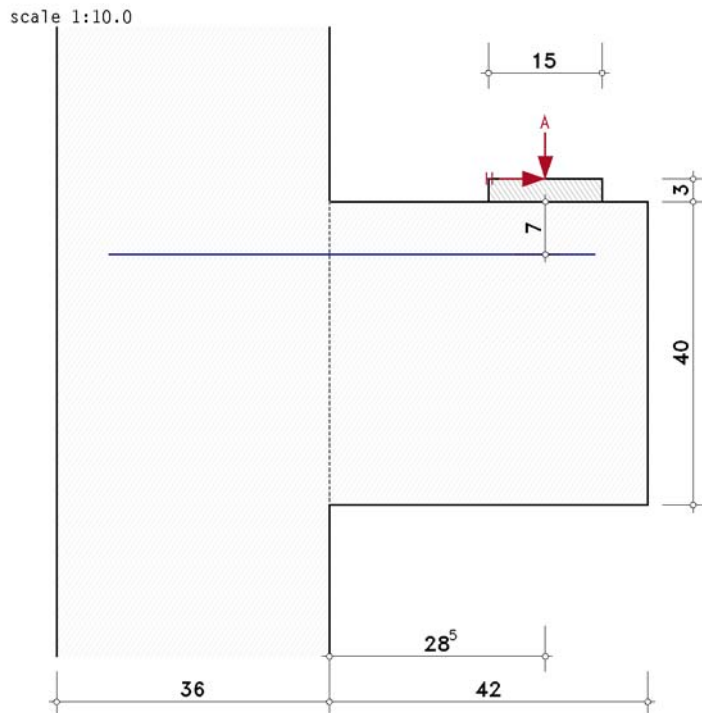


POS. 14: HEFT 599, 11.5.2

dimensioning a load bracket EC 2 (1.11), NA: Deutschland

1. input protocol



cross section (single bracket)

bracket on a column

column: $b = 30.0$ cm, $h = 36.0$ cm

bracket: $l_k = 42.0$ cm, $h_k = 40.0$ cm, center distance (design calculation): $d_{1k} = 7.0$ cm

bearing plate: $l_p = 15.0$ cm, $b_p = 20.0$ cm

material properties

concrete acc. to EC 2, 3.1.7(1): C40/50, $\varepsilon_{c2} = -2.00\text{‰}$, $\varepsilon_{cu2} = -3.50\text{‰}$, $f_{cd} = 22.67$ N/mm²

reinforcement acc. to EC 2, 3.2.7(2a): B500A, $\varepsilon_{ud} = 25.0\text{‰}$, $f_{yd} = 434.78$ N/mm², $f_{td} = 456.52$ N/mm², $E_s = 200000.0$ N/mm²

material safety factors

design situation: basic combination

design resistance: concrete $\gamma_c = 1.50$, reinforcement $\gamma_s = 1.15$

parameters

Load application for $\Delta a = 28.5$ cm, $\Delta h = 3.0$ cm

design method acc. to issue 600, DAfStb

load bracket, direct load application

bearing contact pressure: dry bearing joint

design calculation values (ULS)

lc 1: $A_{Ed} = 250.0$ kN

2. note

general reinforcement rules are not taken into account.

3. design calculation

3.1. lc 1

note (dry bearing joint): $H = 0.00$ kN $< 0.2 \cdot A \Rightarrow H = 0.2 \cdot A = 50.00$ kN !!

direct load application

bracket cross-section

length $l_k = 42.0$ cm, width $b_k = 30.0$ cm, height $h_k = 40.0$ cm

bearing plate: length $l_p = 15.0$ cm, width $b_p = 20.0$ cm

center distance

$d_{1k} = 7.0$ cm $\Rightarrow d_k = 33.0$ cm ($z_V = 29.7$ cm, $z_{A+H} = 27.4$ cm)

load

$A = 250.0$ kN at $\Delta a = 28.5$ cm, $H = 50.0$ kN at $\Delta h = 3.0$ cm

method acc. to issue 600, DAfStb

bearing contact pressure (dry bearing joint): $\sigma_p = 8.33$ N/mm² $< \sigma_{Rd,max} = 9.07$ N/mm² ok

verification of compression strut: $V_{Ed} = 250.0$ kN $< V_{Rd,max} = 594.0$ kN ok

tension belt reinforcement: $z_{A+H} = 327.8$ kN $\Rightarrow \text{req } A_{s,h} = 7.54$ cm²

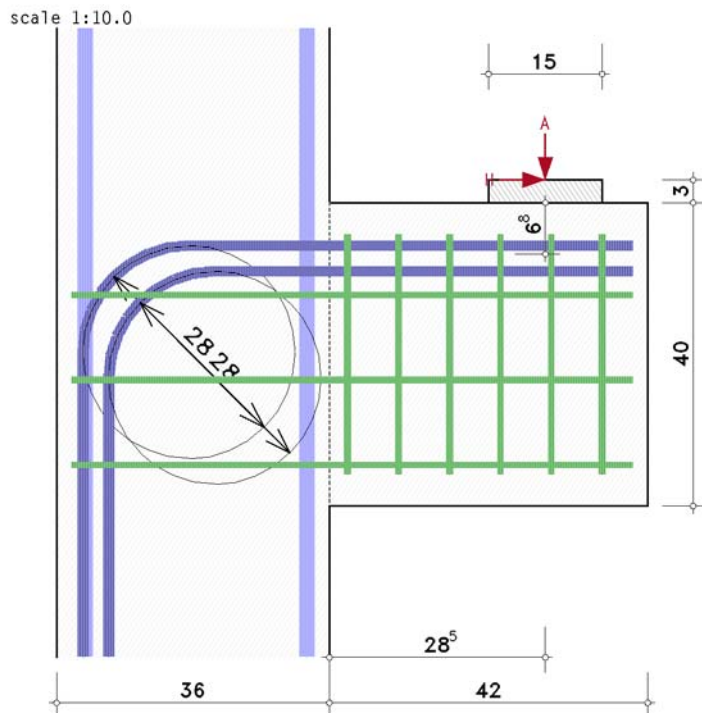
tensile splitting reinforcement: vertical stirrup reinforcement ($A_{sb,h}$ constr.)

for $\Delta a > 0.5 \cdot h_k = 20.0 \text{ cm}$ and $V_{Ed} > V_{Rd,ct} = 50.0 \text{ kN} \Rightarrow \text{req } A_{sb,v} = 4.02 \text{ cm}^2$
 total: $A_{s,h} = 7.54 \text{ cm}^2$, $A_{sb,v} = 4.02 \text{ cm}^2$ ($\Sigma A_{st} = 7.54 \text{ cm}^2$)

4. final result

maximum reinforcement: $A_{s,h} = 7.54 \text{ cm}^2$, $A_{sb,v} = 4.02 \text{ cm}^2$

5. selected reinforcement



calculation of the required anchorage lengths: bonding conditions good

concrete cover to vertical stirrup reinforcement $c_{v,v} = 4.2 \text{ cm}$

concrete cover to main reinforcement $c_{v,h} = 2.0 \text{ cm}$

column reinf. left $4\text{Ø}20$, exst $A_{sl} = 12.57 \text{ cm}^2$

column reinf. right $4\text{Ø}20$, exst $A_{sr} = 12.57 \text{ cm}^2$

main reinforcement 1. Lage: $2\text{Ø}14$, $D_{\min,hor} = 5.6 \text{ cm}$, $D_{\min,ver} = 28.0 \text{ cm}$, exst $A_{s,h} = 6.16 \text{ cm}^2$

2. Lage: $1\text{Ø}14$, $D_{\min,hor} = 5.6 \text{ cm}$, $D_{\min,ver} = 28.0 \text{ cm}$, exst $A_{s,h} = 3.08 \text{ cm}^2$, $d_v = 3.4 \text{ cm}$

exst $A_{s,h} = 9.24 \text{ cm}^2 > \text{req } A_{s,h} = 7.54 \text{ cm}^2$ **ok**

anchorage lengths: bracket req $l_v = 15.7 \text{ cm} < \text{exst } l_v = 19.0 \text{ cm}$ **ok**

column $l_v = 47.2 \text{ cm}$

dimension of 1. U-bent: $l_{v,hor} = 73.2 \text{ cm}$, $l_{v,ver} = 75.2 \text{ cm}$

tensile splitting reinforcement horizontal $3\text{Ø}8$ (stirrup, 2-shear), exst $A_{sb,h} = 3.02 \text{ cm}^2$

tensile splitting reinforcement vertical $6\text{Ø}8$ (stirrup, 2-shear), exst $A_{sb,v} = 6.03 \text{ cm}^2 > \text{req } A_{sb,v} = 4.02 \text{ cm}^2$ **ok**

center distance exst $d_{1k} = 6.80 \text{ cm} < \text{clc } d_{1k} = 7.0 \text{ cm}$ **ok** with minimum bar distance each layer

design resistance ensured

6. regulations

EN 1990, Eurocode 0: Grundlagen der Tragwerksplanung;

Deutsche Fassung EN 1990:2002 + A1:2005 + A1:2005/AC:2010, Ausgabe Dezember 2010

EN 1990/NA, Nationaler Anhang zur EN 1990, Ausgabe Dezember 2010

EN 1992-1-1, Eurocode 2: Bemessung und Konstruktion von Stahlbeton- und Spannbetonbauteilen -

Teil 1-1: Allgemeine Bemessungsregeln und Regeln für den Hochbau;

Deutsche Fassung EN 1992-1-1:2004 + AC:2010, Ausgabe Januar 2011

EN 1992-1-1/NA, Nationaler Anhang zur EN 1992-1-1, Ausgabe April 2013

Erläuterungen zu DIN EN 1992-1-1 and DIN EN 1992-1-1/NA, Teil 1

Deutscher Ausschuss für Stahlbeton, Heft 600, Beuth Verlag GmbH, 2020

Erläuterungen zu DIN 1045-1

Deutscher Ausschuss für Stahlbeton, Heft 525, Beuth Verlag GmbH, 2003