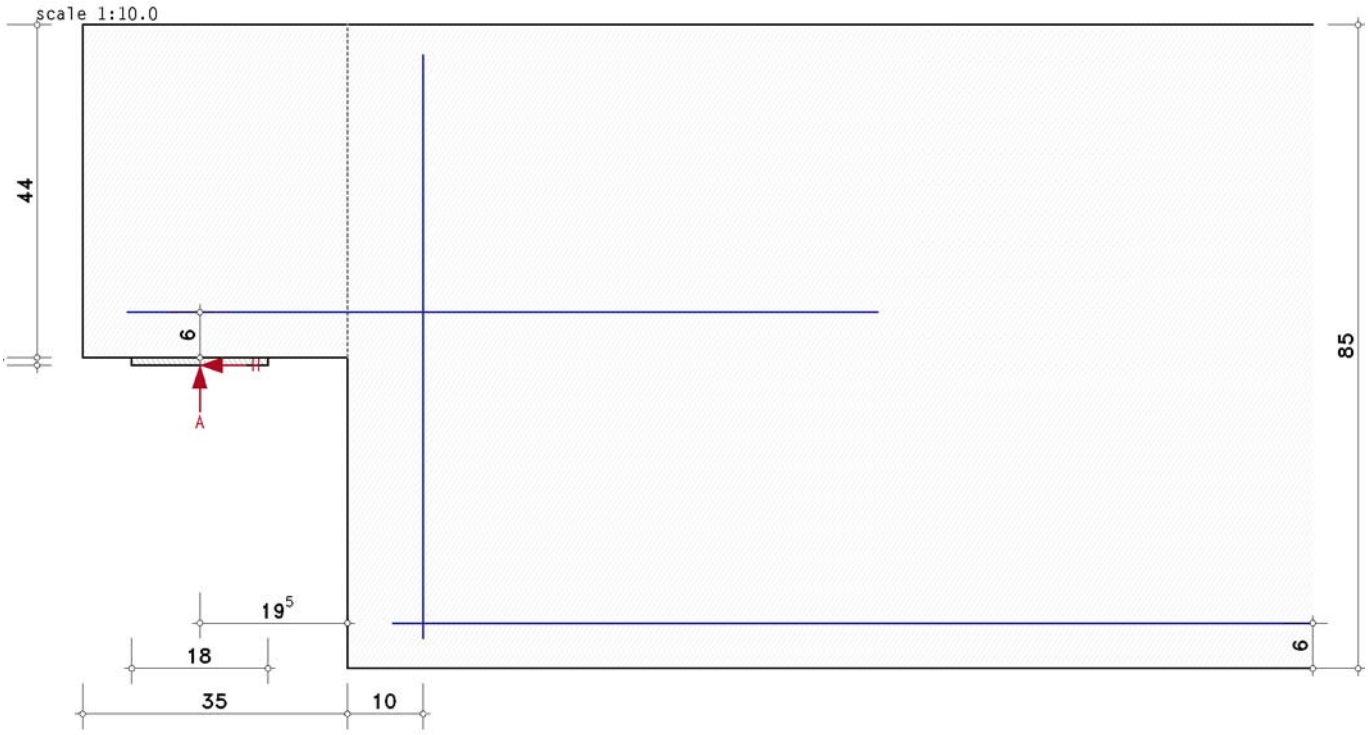
POS. 42: AVAK T.2, BSP. 14.2

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

1. input protocol



cross section (single bracket)
beams: b = 35.0 cm, h = 85.0 cm, center distance (design calculation): d_1 = 6.0 cm
bracket: l_k = 35.0 cm, h_k = 44.0 cm, center distance (design calculation): d_{1k} = 6.0 cm
bearing plate: l_p = 18.0 cm, b_p = 20.0 cm
material properties
concrete acc. to EC 2, 3.1.7(1): C35/45, ε_{c2} = -2.00‰, ε_{cu2} = -3.50‰, f_{cd} = 19.83 N/mm²
reinforcement acc. to EC 2, 3.2.7(2a): B500A, ε_{ud} = 25.0‰, 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 γ_c = 1.50, reinforcement γ_s = 1.15
parameters
Load application for Δa = 19.5 cm, Δh = 1.0 cm
design method acc. to issue 600, DAfStb
bearing bracket, load application with variant 1
bearing contact pressure: bearing joint of a plain/elastomeric bearing
design calculation values (ULS)
lc 1: A_{Ed} = 200.0 kN, H_{Ed} = 40.0 kN

2. note

general reinforcement rules are not taken into account.

3. design calculation

3.1. lc 1

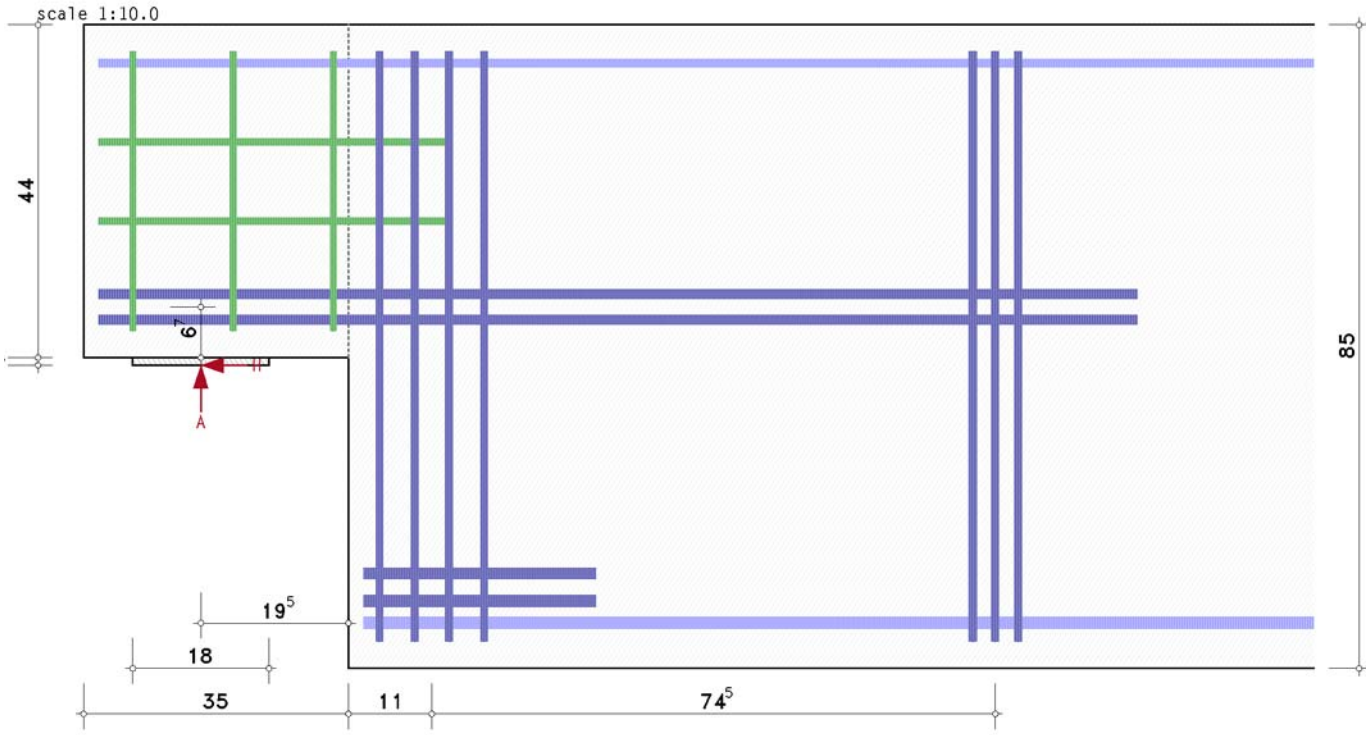
variant 1
beam cross-section
width b = 35.0 cm, height h = 85.0 cm
bracket cross-section
height h_k = 44.0 cm
bearing plate
length l_p = 18.0 cm, width b_p = 20.0 cm
axis distances
d_1 = 6.0 cm, d_{1k} = 6.0 cm (z_k = 33.9 cm, z_Q = 34.2 cm)
e_1 = 10.0 cm ⇒ $e = \Delta a + e_1$ = 29.5 cm
design calculation acc. to issue 600, DAfStb
design calculation values: A = A_v = 200.00 kN (Δa = 19.5 cm), H = A_h = 40.00 kN (Δh = 1.0 cm)
bearing contact pressure (plain/elastomeric bearing): σ_p = 5.56 N/mm² < $\sigma_{Rd,max}$ = 16.86 N/mm² ok
verification of compression strut: V_{Ed} = 200.0 kN < $V_{Rd,max}$ = 733.2 kN ok
tensile reinforcement horizontal: Z_{A+H} = 222.55 kN ⇒ req $A_{s,h}$ = 5.12 cm²

vertical: Z_V = 200.00 kN ⇒ req $A_{s,v}$ = 4.60 cm²
anchoring of $A_{s,h}$: $Z_{V,1}$ = 107.35 kN ⇒ req $A_{s,v1}$ = 2.47 cm² at z_3 = 74.5 cm
tensile splitting reinforcement: $A_{sb,h}$ and $A_{sb,v}$ constructive for $\Delta a/d_k > 0.5$ and $V_{Ed} < V_{Rd,c}$ = 219.95 kN
anchoring of bottom reinforcement req $A_{s,h1}$ = req $A_{s,h}$ = 5.12 cm²
total: $A_{s,h}$ = 5.12 cm², $A_{s,v}$ = 4.60 cm², $A_{s,h1}$ = 5.12 cm², $A_{s,v1}$ = 2.47 cm² at z_3 = 74.5 cm
(ΣA_{st} = 9.72 cm²)

4. final result

maximum reinforcement: $A_{s,h}$ = 5.12 cm², $A_{s,v}$ = 4.60 cm², $A_{s,h1}$ = 5.12 cm², $A_{s,v1}$ = 2.47 cm² at z_3 = 74.5 cm

5. selected reinforcement



calculation of the required anchorage lengths: calculate bonding conditions
concrete cover to vertical stirrup reinforcement $c_{v,v}$ = 3.5 cm
concrete cover to main reinforcement $c_{v,h}$ = 2.0 cm
bottom reinforcement above rod reinforcement, 2Ø12, exst A_{so} = 2.26 cm²
bottom reinforcement bottom rod reinforcement, 6Ø16, exst A_{su} = 12.06 cm²
anchorage length: req l_v = 21.9 cm > exst l_v = 16.4 cm ⇒ anchoring $A_{s,h1}$ req. !!
main reinforcement 1. Lage:1Ø14, D_{min} = 5.6 cm, exst $A_{s,h}$ = 3.08 cm²
(U-bents, 2-shear) 2. Lage:1Ø14, D_{min} = 5.6 cm, exst $A_{s,h}$ = 3.08 cm², d_v = 3.4 cm
exst $A_{s,h}$ = 6.16 cm² > req $A_{s,h}$ = 5.12 cm² ok
anchorage lengths: bracket req l_v = 17.5 cm < exst l_v = 22.5 cm ok
beams l_v = 37.5 cm
length of U-bents: l_s = 145.5 cm
tensile splitting reinforcement horizontal 2Ø10 (U-bents, 2-shear), exst $A_{sb,h}$ = 3.14 cm²
anchorage length: l_v = 10.0 cm ⇒ length of U-bents: l_s = 46.6 cm
tensile splitting reinforcement vertical 3Ø8 (stirrup, 2-shear), exst $A_{sb,v}$ = 3.02 cm²
vertical reinforcement 4Ø10 (stirrup, 2-shear), exst $A_{s,v}$ = 6.28 cm² > req $A_{s,v}$ = 4.60 cm² ok
anchoring horiz. 2Ø16 (U-bents, 2-shear), exst $A_{s,h1}$ = 8.04 cm² > req $A_{s,h1}$ = 5.12 cm² ok
anchorage length: req l_v = 16.4 cm ≤ exst l_v = 16.4 cm ok
lap length l_v = 30.7 cm
anchoring vertical 3Ø10 (stirrup, 2-shear), exst $A_{sb,v1}$ = 4.71 cm² > req $A_{sb,v1}$ = 2.47 cm² ok
center distance exst d_{1k} = 6.70 cm > clc d_{1k} = 6.0 cm !! with minimum bar distance each layer
center distance exst e_1 = 11.00 cm > clc e_1 = 10.0 cm !! with bar distance d_h = 4.60 cm > min d_h = 3.0 cm ok

check center distance, calculation model does not correspond to the design !

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 for 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