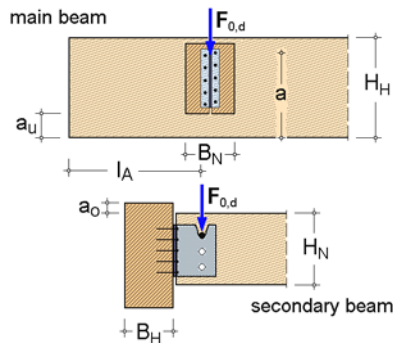


POSITION 18: CONCEALED BEAM HANGER STEEL

4H-HOLZ concealed beam hanger connection

(4H-HLZ72 Version: 1/2012-1a) (principle sketch)



calculation bases:

DIN EN 1995-1-1:2010-12 (EC5) /NA:2010-12,
BAZ Z-9.1-290 und ETA-04/0013

sizes of main and secondary beam (single-sided)

$H_H = 320 \text{ mm}$ $B_H = 240 \text{ mm}$ $a_0 = 50 \text{ mm}$

$H_N = 220 \text{ mm}$ $B_N = 120 \text{ mm}$ $a_u = 50 \text{ mm}$

$l_A = 26 \text{ mm}$ $a = 170 \text{ mm}$

service class 2

species/timber grade

main beam: coniferous timber, timber grade C24

secondary beam: coniferous timber, timber grade C24

internal forces and factors

$F_{0,d}$ force parallel to web

combinations of internal forces BT (design values)

| LK-Nr. | KLED | $F_{0,d}$ | $F_{90,d}$ | $N_{,d}$ | k_{mod} |
|--------|-----------|-----------|------------|----------|-----------|
| 1 | permanent | 1.50 kN | --- | --- | 0.60 |

connection method standard concealed beam hanger

make BT concealed beam hanger steel 120 - 2

conc. beam h. size width $b = 46.0 \text{ mm}$ height $h = 120.0 \text{ mm}$ length $l = 103.0 \text{ mm}$ st.pl.th. $t = 3.0 \text{ mm}$

dowel $d_{st} = 12.0 \text{ mm}$ $l_{st} = 120.0 \text{ mm}$ $M_{yk} = 69.1 \text{ Nm}$

nails CNA ribbed nails 4,0x60

$d_n = 4.0 \text{ mm}$ $l_n = 60.0 \text{ mm}$ $d_k = 8.0 \text{ mm}$ $l_g = 50.0 \text{ mm}$ $M_{yk} = 6.6 \text{ Nm}$

verifications

combination of internal forces 1 (design values)

| LK-Nr. | KLED | $F_{0,d}$ | $F_{90,d}$ | $N_{,d}$ | k_{mod} |
|--------|-----------|-----------|------------|----------|-----------|
| 1 | permanent | 1.50 kN | --- | --- | 0.60 |

nail anchorage capacities (withdrawal)

main beam $f_{1,k} = 6.125 \text{ N/mm}^2$ $R_{ax,k} = 1.225 \text{ kN}$ $R_{ax,d} = 0.565 \text{ kN}$

nail anchorage capacities (shear)

main beam $f_{h,k} = 18.935 \text{ N/mm}^2$ $R_{1a,k} = 1.628 \text{ kN}$ $R_{1a,d} = 0.751 \text{ kN}$

dowel anchorage capacities (shear), simplified method NA:2010-12

secondary beam $f_{h,k} = 16.507 \text{ N/mm}^2$ $R_{,k} = 4.909 \text{ kN}$ $R_{,d} = 2.678 \text{ kN}$ $t_{req} = 85.9 \text{ mm}$

load-carrying capacity concealed beam hanger (full nailing)

material safety factors $\gamma_{M,timber} = 1.30$ $\gamma_{M,steel} = 1.10$

load-carrying capacity main beam connection $R_{1,k} = R_{1a,k} + \Delta R_{,k} = 1.628 \text{ kN}$ $R_{1,d} = 0.751 \text{ kN}$ (1)

number of nails $n_{Na} = 10$ $\gamma_{M,calc} = 1.30$

$F_{1,d} = 1.50 \text{ kN}$ $R_{1,d} = 7.51 \text{ kN}$ $F_{1,d}/R_{1,d} = 0.20 \leq 1.00$ verification successful

load-carrying capacity secondary beam connection (2)

number of dowels $n_{st} = 3$ $\gamma_{M,calc} = 1.10$

$F_{1,d} = 1.50 \text{ kN}$ $R_{1,d} = 16.07 \text{ kN}$ $F_{1,d}/R_{1,d} = 0.09 \leq 1.00$ verification successful

decisive is main beam-load-carrying capacity $R_{1,d} = 7.51 \text{ kN}$

verification of splitting capacity (3)

For $a/H_H = 0.531 \leq 0.7$ verif. of splitting capacity is required.

Es the following requirement should be satisfied: $F_{90,d} / R_{90,d} \leq 1.0$

$F_{90,d}$ design value of the force component perpendicular to grain

$R_{90,d}$ design splitting capacity of the beams

$R_{90,d} = k_s \cdot k_r \cdot (6.5 + 18 \cdot a^2/H_H^2) \cdot (t_{ef} \cdot H_H)^{0.8} \cdot f_{t,90,d}$

$a = 170.0 \text{ mm}$ $H_H = 320.0 \text{ mm}$ $a/H_H = 0.531$ $a_r = 26.0 \text{ mm}$ $t_{ef} = 48.0 \text{ mm}$

$h_1 = 150.0 \text{ mm}$ $k_s = 1.000$ $k_r = 1.000$ $l_{Ag} = 26.0 \text{ mm}$ $k_g = 1.000$

$f_{t,90,k} = 0.400 \text{ N/mm}^2$ $f_{t,90,d} = 0.185 \text{ N/mm}^2$ $F_{90,d} = 1.50 \text{ kN}$ $R_{90,d} = 2.10 \text{ kN}$

$F_{90,d} / R_{90,d} = 1.50 / 2.10 = 0.71 \leq 1.0$ verification successful

LK1: all verifications successful.

summary

maximum utilization max U = 0.71, decisive load combination 1, verification 3