

Tekla Structures 21 SR1 (64-Bit) Crack - [FirstUploads] Setup Free

RC CORBEL DESIGN
In accordance with EN 1992-1-1:2004 incorporating Corrigenda January 2008 and the UK national annex
Tedds calculation version 1.0.53

Corbel geometry
Width of the corbel: $a = 460$ mm
Depth of the corbel at front face of column: $b = 350$ mm
Depth at front face of corbel: $h_c = 600$ mm
Chartered corner: $h_{char} = 350$ mm, $d_{char} = 35$ mm

Load plate geometry (Bearing)
Width of the bearing: $b_{bearing} = 120$ mm
Depth of the bearing: $d_{bearing} = 350$ mm
Height of the bearing: $h_{bearing} = 25$ mm

Concrete details
Characteristic compressive cylinder strength: $f_{ck} = 30$ N/mm²
Partial factor for concrete – Table 2.1N: $\gamma_c = 1.5$
Compressive strength coefficient – cl.3.1.6(1): $\alpha_{cc} = 0.85$
Design compressive concrete strength – exp.3.15: $f_{cd} = \alpha_{cc} \times f_{ck} / \gamma_c = 17.00$ N/mm²
Node in compression factor k_1 – cl.6.5.4(4a): $k_1 = 1.00$
Node in compression factor k_2 – cl.6.5.4(4b): $k_2 = 0.85$
Node in compression factor k_3 – cl.6.5.4(4c): $k_3 = 0.75$
Strength reduction factor – cl.6.5.2(2): $\psi = [1 - f_{cd} / 250 \text{ N/mm}^2] = 0.88$

Reinforcement details
Characteristic yield strength of reinforcement: $f_{yk} = 500$ N/mm²

Partial factor for reinforcing steel – Table 2.1N
Design yield strength of reinforcement: $f_{td} = f_{yk} / \gamma_s = 435$ N/mm²

Loads
Vertical force: $F_{Ed} = 400.0$ kN
Horizontal force: $H_{Ed} = 80.0$ kN
Distance from the face of the column to F_{Ed} : $a_s = 200$ mm

Reinforcement
Number of bars for main tension: $N = 2$
Diameter of bars for main tension: $D_{main} = 32$ mm
Area of main tension provided: $A_{s,main} = N \times s \times (D_{main}^2) / 4 = 1608$ mm²
Nominal cover to reinforcement: $c_{nom} = 50$ mm
Depth to main reinforcement: $d = h_c - c_{nom} - D_{main} / 2 = 534$ mm
Distance to main reinforcement: $d_1 = c_{nom} + D_{main} / 2 = 66$ mm

Node N.1
Strength reduction factor – cl.6.5.2(2): $\psi = 0.880$
Nodes in compression stress cl.6.5.4 (4)(a): $\sigma_{s1} = k_1 \times \psi \times F_{Ed} = 14.96$ N/mm²
 $X1 = F_{Ed} / (\sigma_{s1} \times b) = 76.4$ mm
N.1 is located from the outer side of the column: $X1 / 2 = 38.2$ mm
Taking moments about A: $M_a = F_{Ed} \times (d - Y1 / 2) - F_{Ed} \times (a_s + X1 / 2) + H_{Ed} \times (h_{bearing} + 41)$
Substitution of $F_{Ed} = Y1 \times \sigma_{s1} \times b$: $Y1 = -1.02 + (C2^2 - 4 \times C1 \times C3)^{0.5} / (2 \times C1) = 38.0$ mm
 $Y1 / 2 = 19.0$ mm
N.1 is located from the bottom of the corbel
Angle of inclination: $\theta = \arctan((d - Y1 / 2) / (a_s + X1 / 2)) = 65.2^\circ$
NOTE: The angle of inclination θ is within the limits $1 < \tan \theta < 2.5$

Lever arm
Lever arm at the outer side of the column: $z = d - Y1 / 2 = 515$ mm

Bearing stress check at node N.2
Strength reduction factor – cl.6.5.2(2): $\psi = 0.880$
Safe bearing stress – cl.6.5.4(4) b: $\sigma_{b,safe} = k_3 \times \psi \times F_{td} = 12.72$ N/mm²
Actual bearing stress: $\sigma_b = F_{Ed} / (b_{bearing} \times h_{bearing}) = 9.52$ N/mm²
PASS: Design force at bearing is less than the maximum design bearing resistance

Compression strut stress check at node N.2
Horizontal concrete compression force at N-1: $F_{c1} = Y1 \times b \times \sigma_{s1} = 199.2$ kN
Strut force: $F_u = F_{c1} \times \cos(\theta) + F_{Ed} \times \sin(\theta) = 446.6$ kN
 $u = 2 \times (c_{nom} + D_{main} / 2) = 132$ mm
From Fig.6.27: $b_s = b_{bearing} \times \sin(\theta) + u \times \cos(\theta) = 164.3$ mm
Minimum allowable distance – Fig. 6.27: $d_{s,allow} = 2 \times (c_{nom} + D_{main} / 2) + c_{nom} + D_{main} / 2 = 198.0$ mm
Actual distance: $d_{s,actual} = a - b_{bearing} / 2 = 200.0$ mm
PASS: Distance from edge of the bearing to front face of the corbel is greater than required (Fig. 6.27)
Concrete strut stress: $\sigma_c = F_u / (b_s \times b) = 7.77$ N/mm²

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