Punching shear calculation for column 1 for load case 305

Notes:

1) As per Clause 6.4.2 of the Eurocode, for the punching shear check done at a distance of 2d from the face of the column / pedestal, the shape of the punching perimeter for a rectangular column or rectangular pedestal is a rounded rectangle. But in SFA, a rectangular shape is presently used. This will be changed in a future version of the program so that the profile of the perimeter will be as per the code.

2) As per section 6.4.4 (2) of the code, the punching force should be calculated as the downward force from the column minus the upward force due to the soil pressure below the slab. Presently, the upward force due to soil pressure below the slab is not subtracted from the downward force.

Input:

Pedestal size = 700 mm (length) X 700 mm (breadth) X 1900 mm (height)

Thickness of slab = 800 mm

Load from column at top of pedestal:

Fy = -265.84 kN

Fx = -16.97 kN

Fz = -1.74 kN

Mx = -2.3 kN.m

Mz = 53.09 kN.m

Moments at bottom of slab

MX = -2.3 - 1.74*(1.9 + 0.8) = -6.998 kN-m

MZ = 53.09 - [-16.97 * (1.9 + 0.8)] = 98.909 kN-m

Distance from center of column to edge of footing

Along global X = 0.6 m

Along global Z = 0.6 m

Diameter of bar provided for flexure = 16 mm

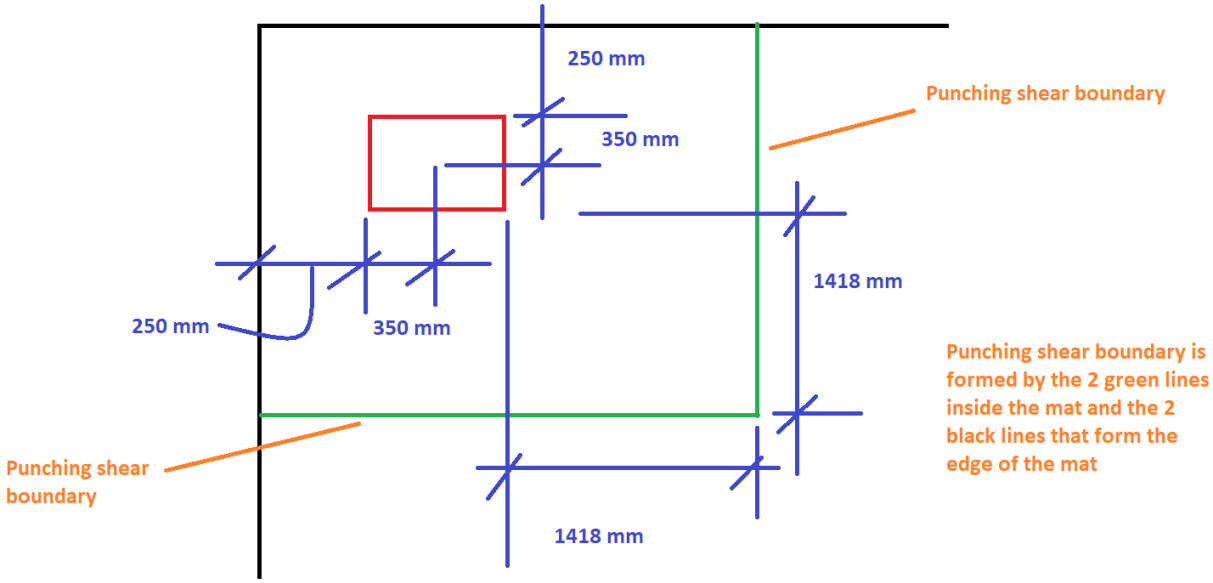
Clear cover for bottom steel = 75 mm

Effective depth top of bottom-most reinforcement layer = 800 - 75 - 16 = 709 mm

Distance from edge of pedestal to edge of mat = 600 - 700/2 = 250 mm

As per clause 6.4.2 of EC2, punching shear is to be checked at a distance of 2.0d from the face of the column. Since 2d = 2 * 709 = 1418 mm is more than 250 mm, only 2 sides of the boundary are effective in resisting punching.

Thus, the punching shear boundary has only 2 sides.



Calculation of Beta per equation 6.43

ex = Abs(Mz/FY) = 98.909/265.84 = 0.37206 m

ez = Abs(Mx/FY) = 6.998/265.84 = 0.02632 m

bx = 0.6 + 0.35 + 1.418 = 2.368 m

bz = 0.6 + 0.35 + 1.418 = 2.368 m

Beta = 1.0 * 1.8 * [(0.37206/2.368)^2 + (0.02632/2.368)^2] = 1.28352

Punching perimeter = 2.368 + 2.368 = 4.736 m

Punching stress without the moment effect = 265.84 / (4.736 * 0.709) = 79.17031983 kN/m2

Punching stress after considering the moment effect = 79.17031983 * 1.28352 = 101.617 kN/m2