Design of primary beams

Dead load (g):
- g 1k = ribbed slab self-weight + secondary beam self-weight + primary beams self-weight
  = 2.65 + 0.20+1.52
  = 4.37 kN/m2
- g 2k = not structural dead loads
  = 4.31 kN/m2

Live load (qk):
- occupancy load =3 kN/m2

Snow load (qs):
- qs = 0.4 kN/m2

Spans of primary beams:
- l = 10 m

6.0– PREDIMENSIONING
q = g1k + g2k + qs + qk
= 4.37+ 4.31 + 3
= 11.68 kN

Imin= 200 * 5/384 * ql^3 / E
= 200 *5/384 * 11.68 * (10)3/210000
=14460 kN/m

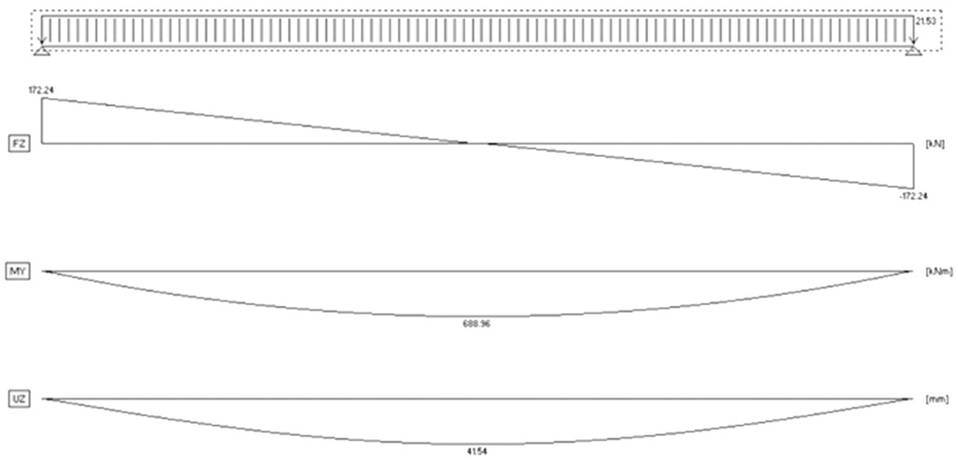
Bending moment primary beam :

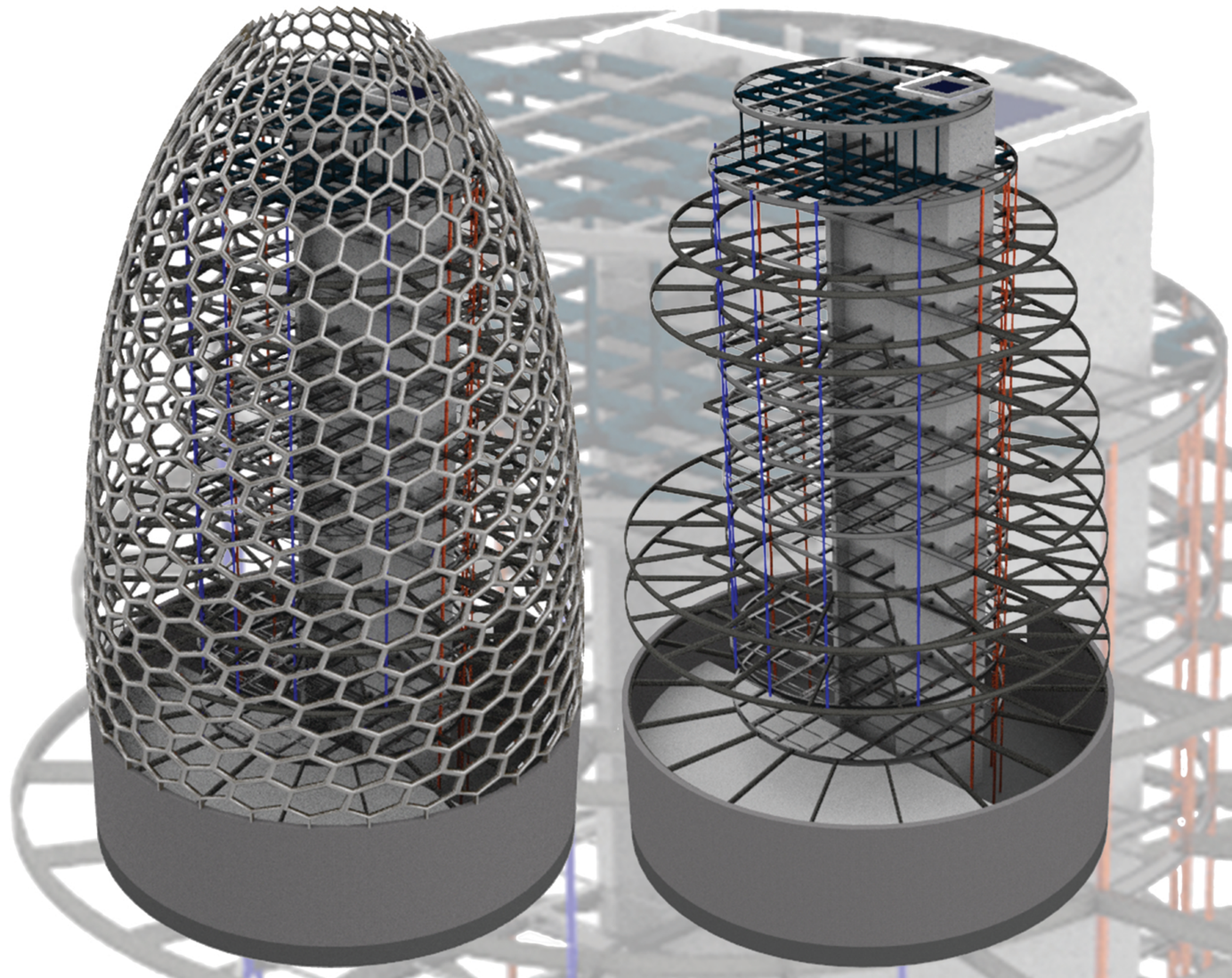
Equivalent load (qsd) :
qsd = γg1 * g1k + γg2 * g2k + γq1 * qk + γq2 * ψ * qs
  = 1.3 * 4.37 + 1.5 * 4.31 + 1.5 * 3
  =17.51 kN/m2

Med :
= qsd * l2/8
= 17.51 * (10) 2/ 8
= 218.88

MRd :
= Wpl * fyk / γmo
= 2884* 103* 355 / 1.05
= 976.06

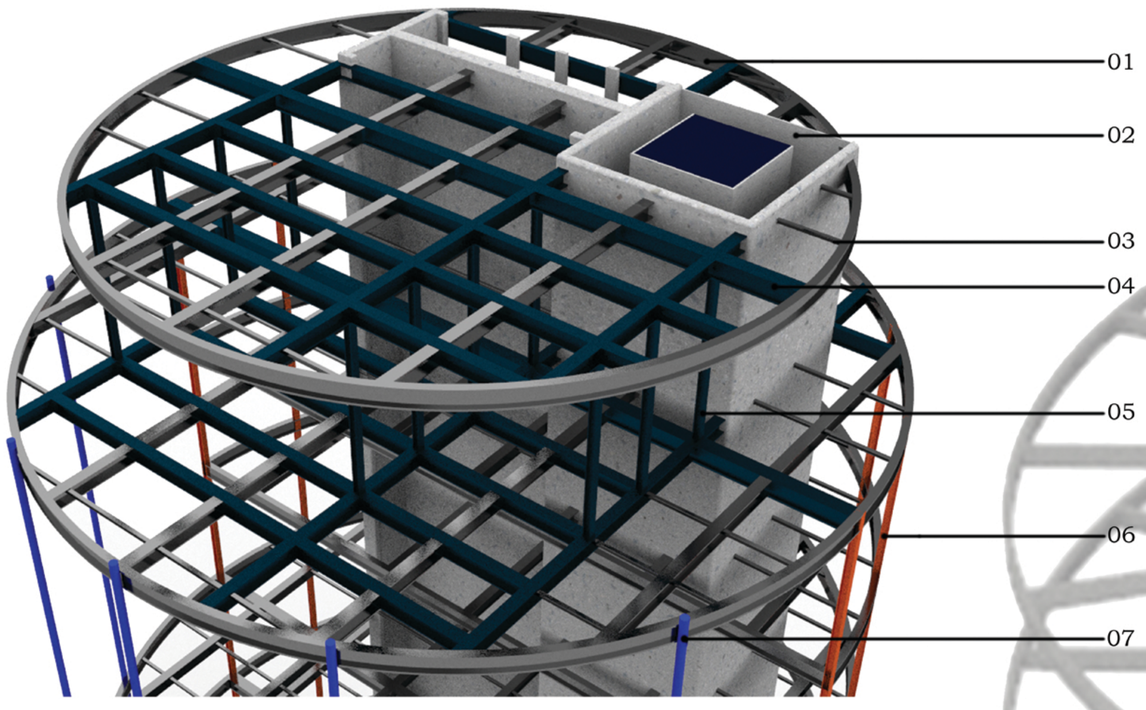
Med / MRd <1 →verified
218.88/ 976.06= 0.22





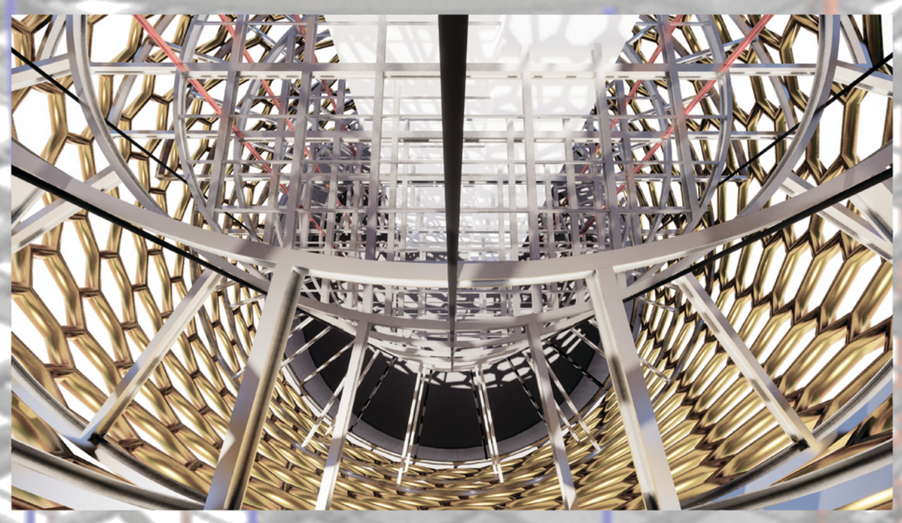
FACADE FRAME

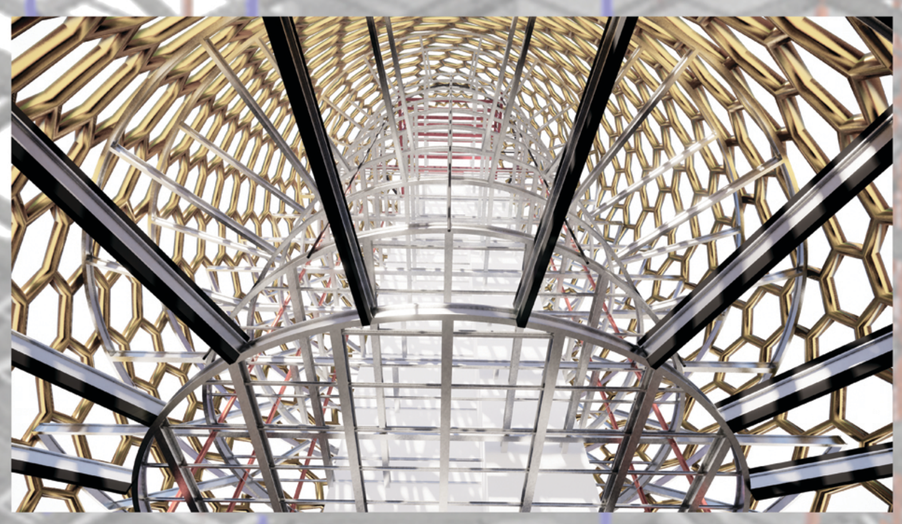
PRIMARY & SECONDARY BEAMS



COMPONENTS :

1. Primary Beam
2. Shear Wall
3. Secondary Beam
4. Vierendeel Beam
5. Vierendeel Column
6. MAin Column
7. Suspended Element





Design of columns

Datas:
- h = 5 m
- Ainfl = 3.6 m*10 m
  = 36 m2

Cross section selected:
HE 220 B
- A = 9100 mm2
- S355→FE510
- σadm = 240 N/mm2

Equivalent load (N) :
N= ((γg1 * g1k) +(γg2 * g2k)+(γq1 * qk) +(γq2 * qs))*(Ainfl *n° floors)
  = ((1.3 * 5.05)+ (1.5 * 4.31) +(1.5 * 3))*(3.6*10*10)
  =63072 kN/m2

σmax :
= N/Acolumn
= 63072000/ 9100
= 6390.98

σmax / σadm <1 →verified
6930.98 / 63072 = 0.10

l0 = l * 80%
  = 500 cm *80%
  = 400 cm

Stressadm= 20

Stressmax= l0/a
  = 400 / 22
  = 18.18

stressmax / stressadm <1 →verified
18.18 / 20 = 0.90

Design of tension element (suspended slab)

Dead load (g):
- g 1k = ribbed slab self-weight + secondary beam self-weight
  = 2.65 + 0.20
  = 2.85 kN/m2
- g 2k = not structural dead loads
  = 5.18 kN/m2

Live load (qk):
- occupancy load = 5 kN/m2
Total load (q):

qsd =(γg1 * g1k + γg2 * g2k + γq1 * qk + γq2 * ψ * qs) *Nfloors suspended
  = (1.3 * 2.85 + 1.5 * 5.18+ 1.5 * 5) *9
  =170.73 kN/m2

Area slab:
Aslab= 400 m2
(*considering bigger area)

Safety coefficient:
fyd= fy/γ
  = 355 / 1.05
  = 33.80 kN/cm2

Axial load:
Nd = qsd * Aslab
  = 170.73*400
  = 68292 kN

Area of cable:
AULS= N / fyd
= 68292 / 33.80
= 20.20 cm2

Elongation:
Δtot = ∑I * Ni *l /E *Aprofile
  = 9* ((2.85+5.18+5)*9) * 45 / 210000 * 15.6
  = 9* 117.27 * 45/ 210000 * 15.6
  = 14.90 mm

Δadm = 50mm
Δtot / Δadm <1 →verified
14.90 / 50 = 0.29

VIERENDEEL TRUSS

COLUMNS AND SHEAR WALLS

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prof. Giovanni Dotelli (Material)
prof. Lavinia Chiara Tagliabue (BIM)
prof. Francesco Romano (MEP)

ME PROPOLIS

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