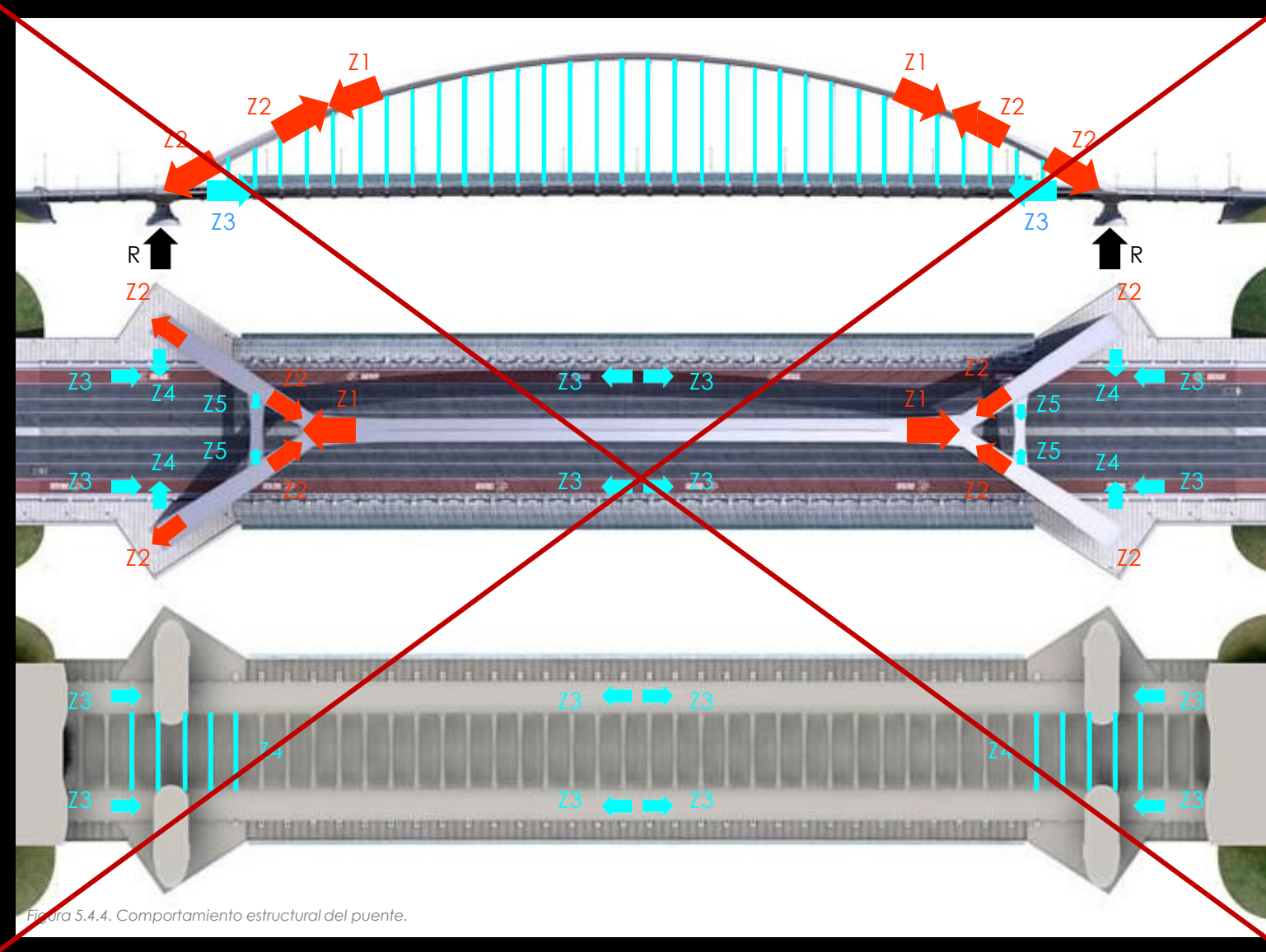


2 In plane loading – walls and beams

2.2 Stress fields with prestressing

Exercise solution

Exercise - Solution



Arrows without clear indication of the free body they act on can be confusing.

(this is not a good example of “explaining the force flow”)

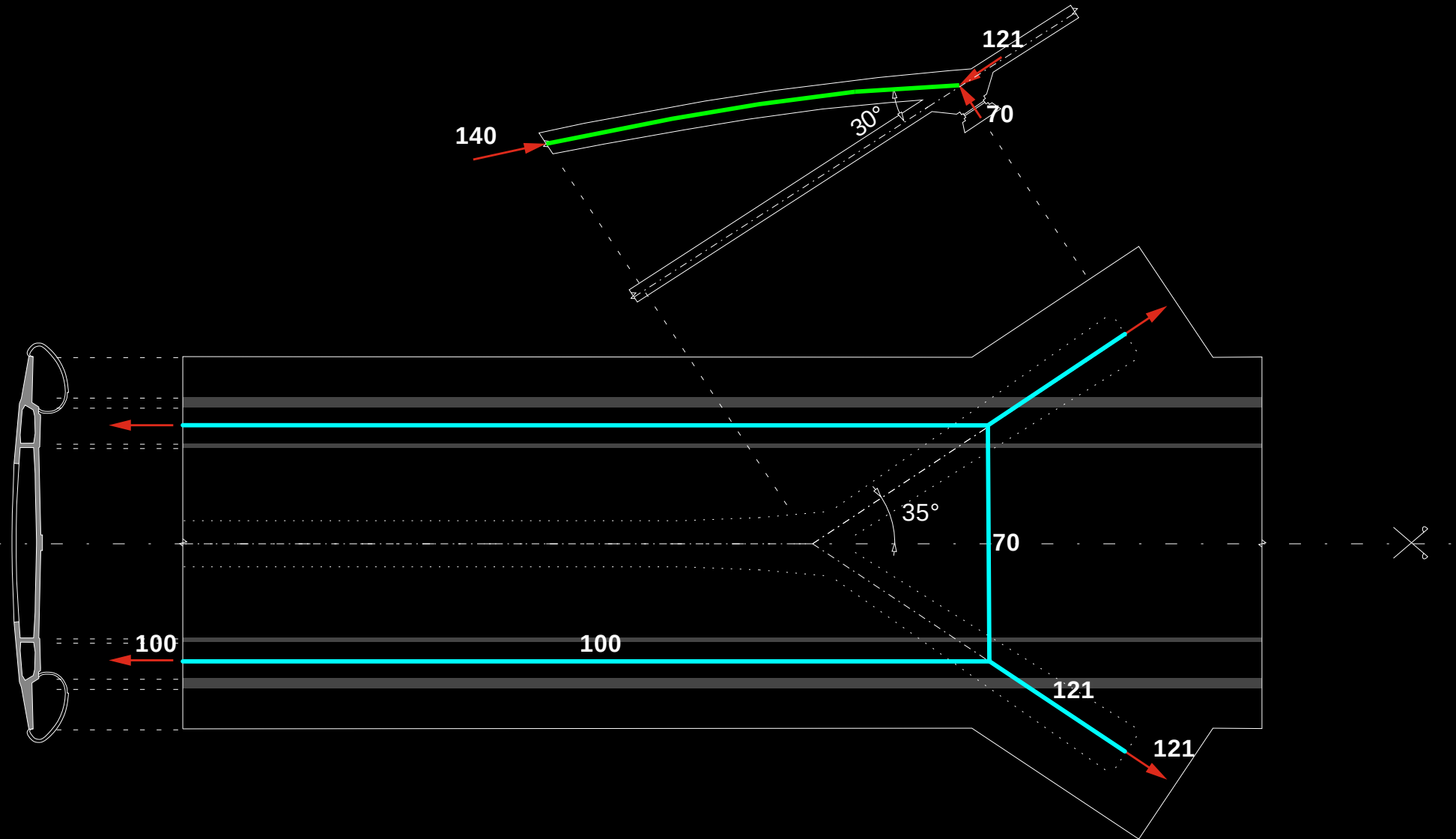
- always **indicate the system** (free body) the forces act on
- for example, isolating a node with all forces acting on it

Exercise - Solution

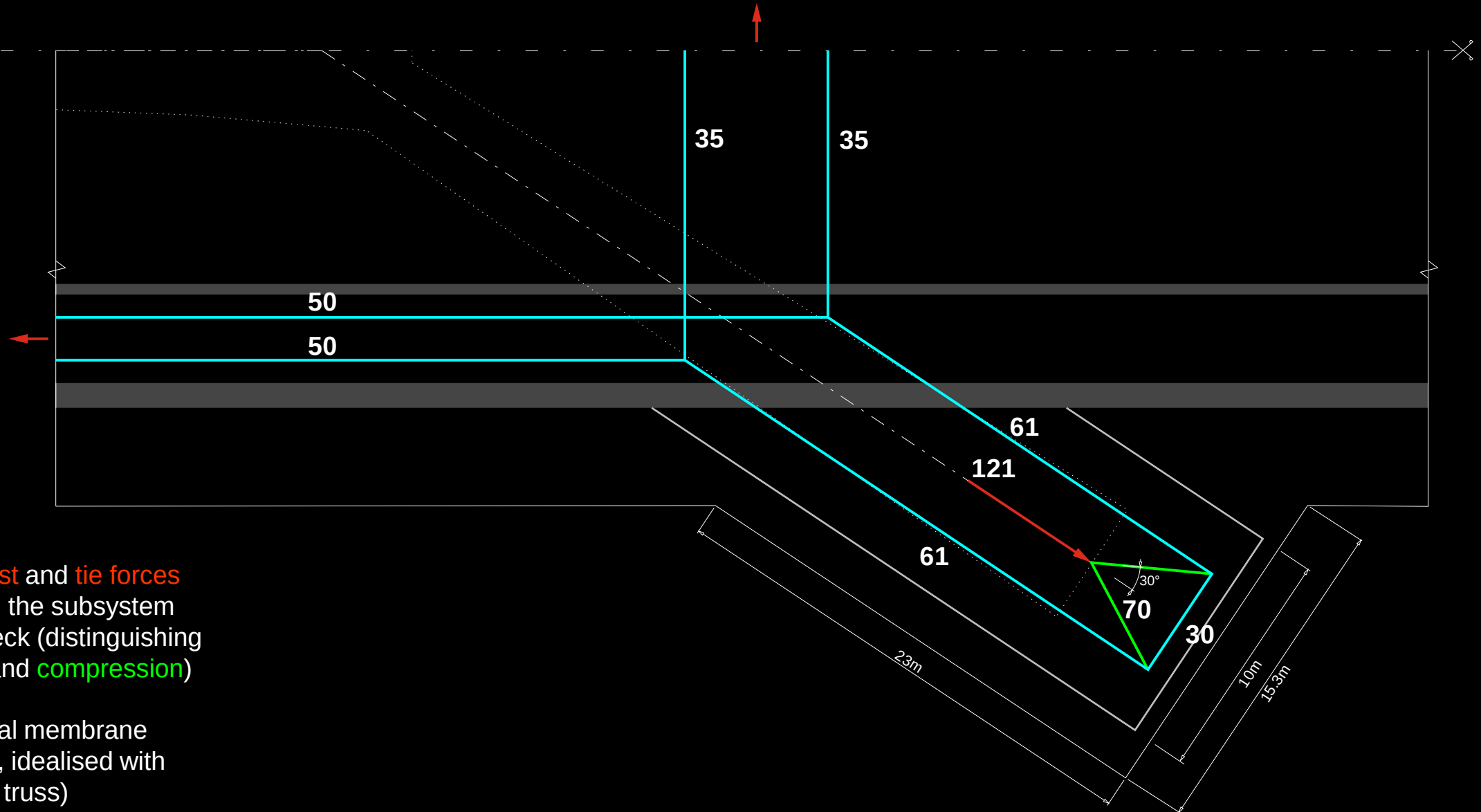
arch compression
acting on the subsystem
arch

arch thrust and tie forces
acting on the subsystem
bridge deck

(horizontal membrane
structure, idealised with
a simple truss)



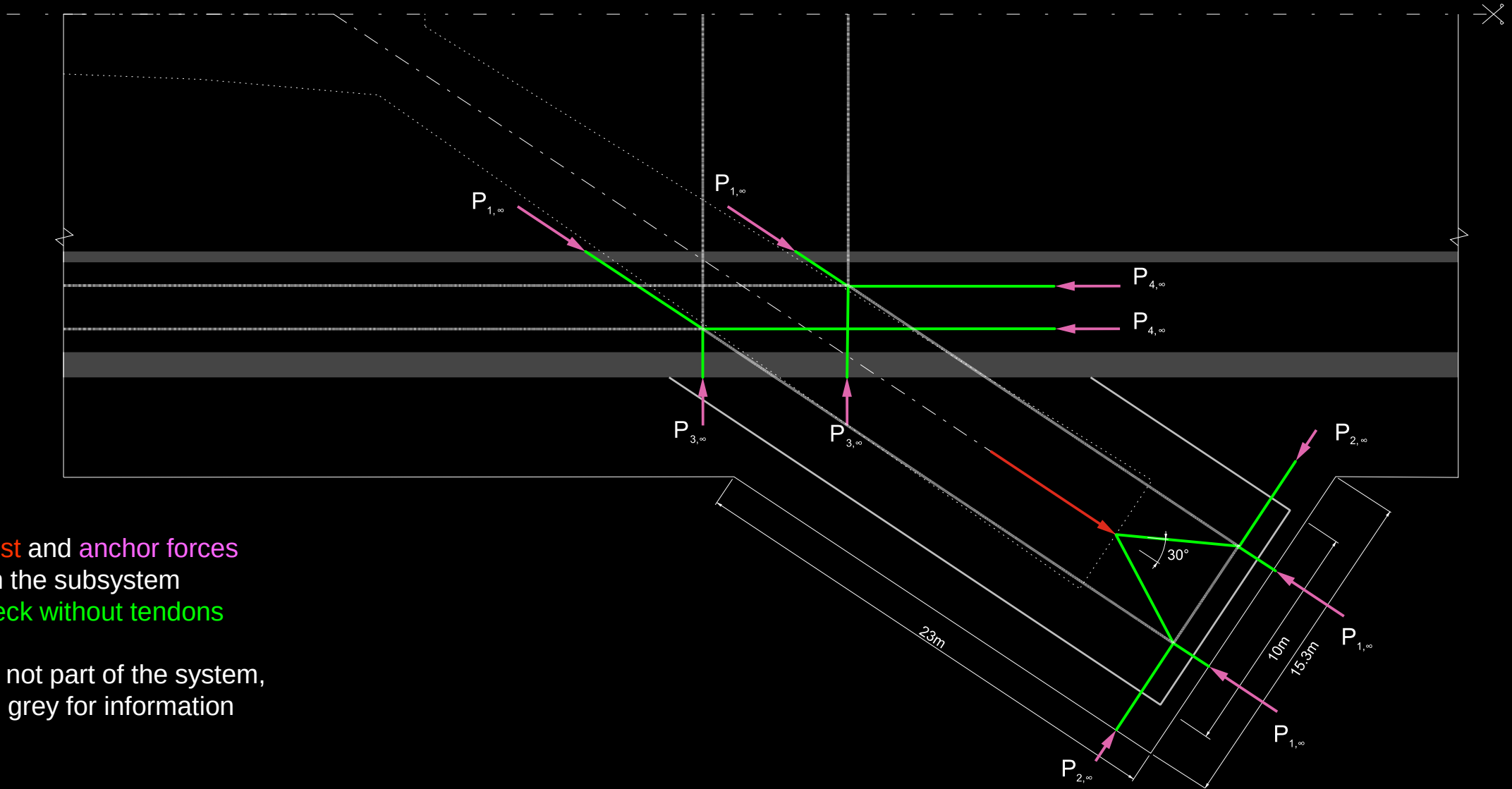
Exercise - Solution



arch thrust and tie forces
acting on the subsystem
bridge deck (distinguishing
tension and compression)

(horizontal membrane
structure, idealised with
a refined truss)

Exercise - Solution



arch thrust and anchor forces
acting on the subsystem
bridge deck without tendons

(tendons not part of the system,
shown in grey for information
only)

Exercise - Solution

$$2 \cdot P_{1,\infty} = 0.7 \cdot 0.85 \cdot f_{pk} \cdot A_p \geq F_{1,d} = 121 \text{ MN}$$

$$A_{p,erf} = 109334 \text{ mm}^2$$

Choice: 40x19 Ø0.6" ($A_{p,i} = 150 \text{ mm}^2$)

$$A_p = 114000 \text{ mm}^2$$

$$2 \cdot P_{1,\infty} = 126.2 \text{ MN} > F_{1,d} \quad \text{ok}$$

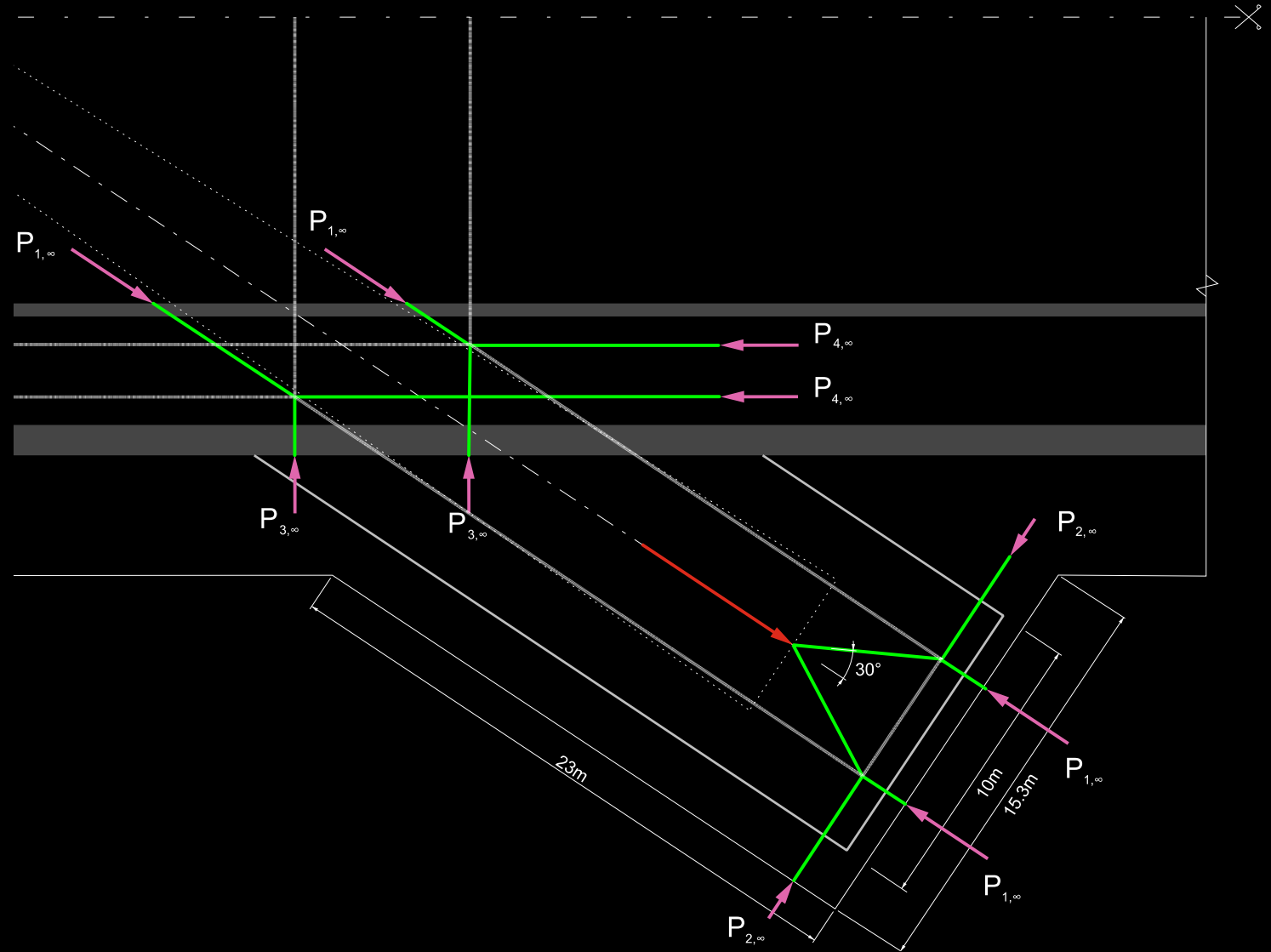
$$2 \cdot P_{1,0} = 148.4 \text{ MN}$$

$$\sigma_{c,p,0} = \frac{2 \cdot P_{1,0}}{10 \text{ m} \cdot 0.8 \text{ m}} = 18.6 \text{ MPa} < 0.8 \cdot f_{cd} \quad \text{ok}$$

$P_{2,\infty}$: Choice: 10x19 Ø0.6"

$2 \cdot P_{3,\infty}$: Choice: 22x19 Ø0.6"

$2 \cdot P_{4,\infty}$: Choice: 31x19 Ø0.6"



J



Exercise - Solution

