REINFORCED CONCRETE
BEAM DESIGN
ACCORDING TO TS500

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OUTLINE

- Introduction
- Object and Scope of the Program
- Limitations of the Program
- Input Data
- Structure of the program
- Example Problem
- Conclusion

OBJECT AND SCOPE OF THE PROGRAM

- REINFORCED CONCRETE
BEAM DESIGN v1.0 (TS500-2000)

- To compute the tension and compression reinforcements of beam with given material strengths under a given moment in accordance with TS500-2000

- It is also possible to calculate the shear reinforcement

LIMITATIONS OF THE PROGRAM

- Valid only (+) moment in the span

(-) moments in the supports.

- Valid only for beams; depth < 600 mm
- Does not consider hanger bars area.

INPUT DATA

- Material strengths
  - Concrete compressive strength (fck)
  - Steel yield strength (fyk)
- Dimensions of cross section
  - Web Width (bw)
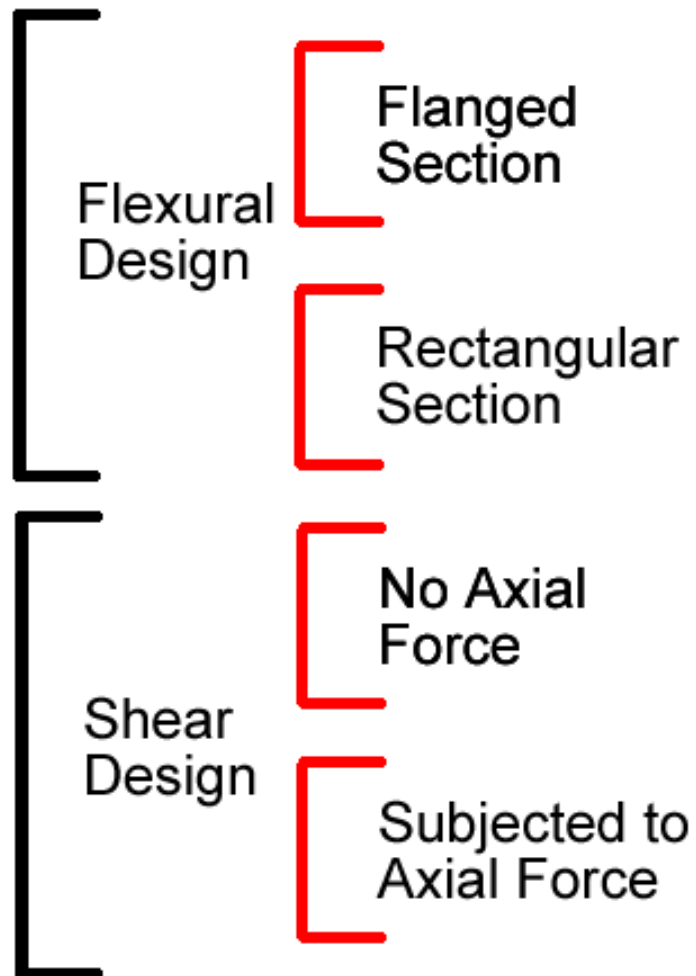 - Section Depth (h)
  - Flange thickness (t)
  - Clear cover

INPUT DATA

- Force and Moments
  - Support 1 Moment (Md1)
  - Span Moment (Md2)
  - Support 2 Moment (Md3)
  - Shear force (Vd)
  - Axial force (Nd)
- Bentbar availability

STRUCTURE OF THE PROGRAM

- Flexural Design
  - Flanged Section
  - Rectangular Section
- Shear Design
  - No Axial Force
  - Subjected to Axial Force

FLEXURAL DESIGN

$$K = \frac{b_w * d^2}{M_d}$$

$is\ K > K_l\ ?$

$is\ K > K_m\ ?$

$$A_{s(ref)} = \frac{M_d}{f_{yd}*j*d}$$

$$jd \rightarrow Max\left(d - \frac{t}{2}; 0{,}9d\right) \quad \text{(for T-Beam)}$$

j=0.861 (for rectangular beams)

SHEAR DESIGN

$$\rho = \frac{A_s}{b_w d} \geq \rho_{min} = \frac{f_{ctd}}{f_{yd}}$$

$$V_{cr} = 0.65 * f_{ctd} * b_w * d * (\psi)$$

$$V_c = 0.52 * f_{ctd} * b_w * d * (\psi)$$
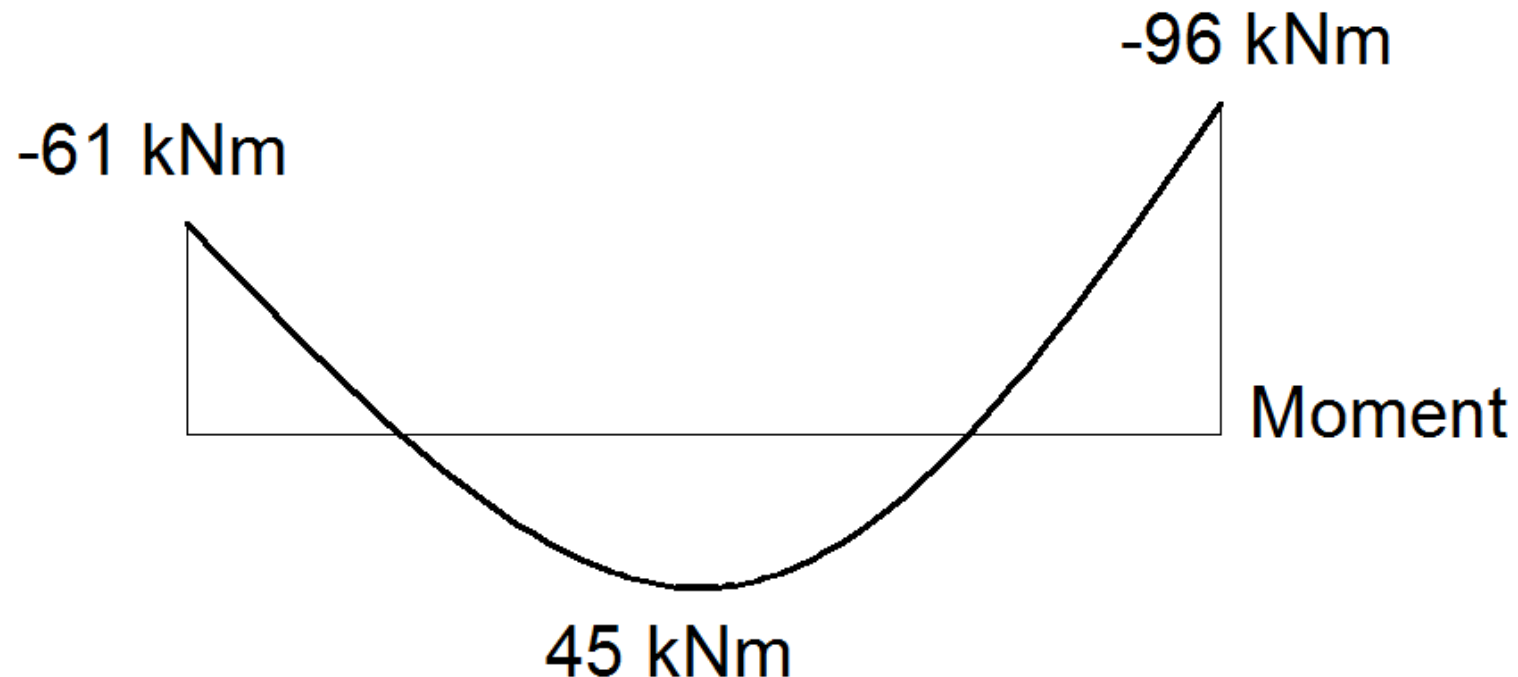
$$V_{max} = 0.22 * f_{cd} * b_w * d$$

$$V_{cr} < V_d' < V_{max} \quad minimum \; requirement$$

$$\left(\frac{A_{sw}}{s}\right) min = 0.3 * \frac{f_{ctd}}{f_{ywd}} * b_w$$

$$\frac{A_{sw}}{s} = \frac{V_d' - V_c}{f_{ywd} * d} \qquad max(s) = \frac{d}{2}$$

EXAMPLE PROBLEM

-96 kNm

-61 kNm

Moment

45 kNm

Vd= 93 kN, Nd=100 kN, S420 Rebar, S220 Stirrups, C16 Concrete

Preliminary Design Beam= 250x400, Slab thickness 120 mm

REFERENCES

➤ Ersoy, U., Ozcebe, G., & Tankut, T. (2008). Reinforced concrete. Ankara: Middle East Tecnical University.

➤ TOPÇU, P. D. A. (n.d.). *Betonarme 1 ders notları*. Retrieved from http://mmf2.ogu.edu.tr/atopcu/index_dosyalar/Betonarme1.htm

➤ TS500/February 2000-Requirements for Design Construction of Reinforced Concrete Structures