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Analysis of the Shear Force in an internal Beam-Column Connection and the Factors significantly affecting its Magnitude

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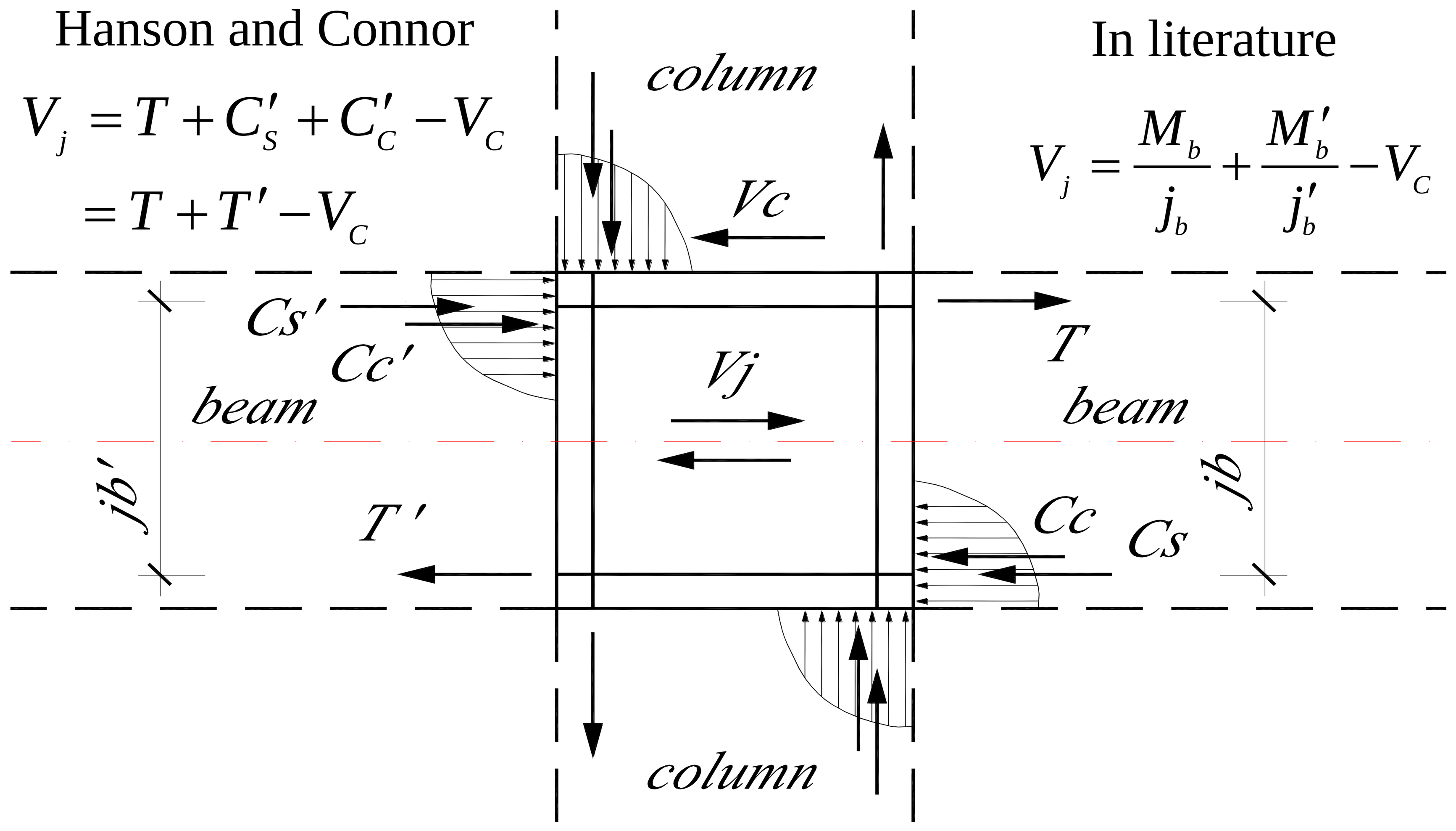
INTRODUCTION & AIM

Hanson and Connor

$$V_j = T + C_S' + C_C' - V_C$$
$$= T + T' - V_C$$

In literature

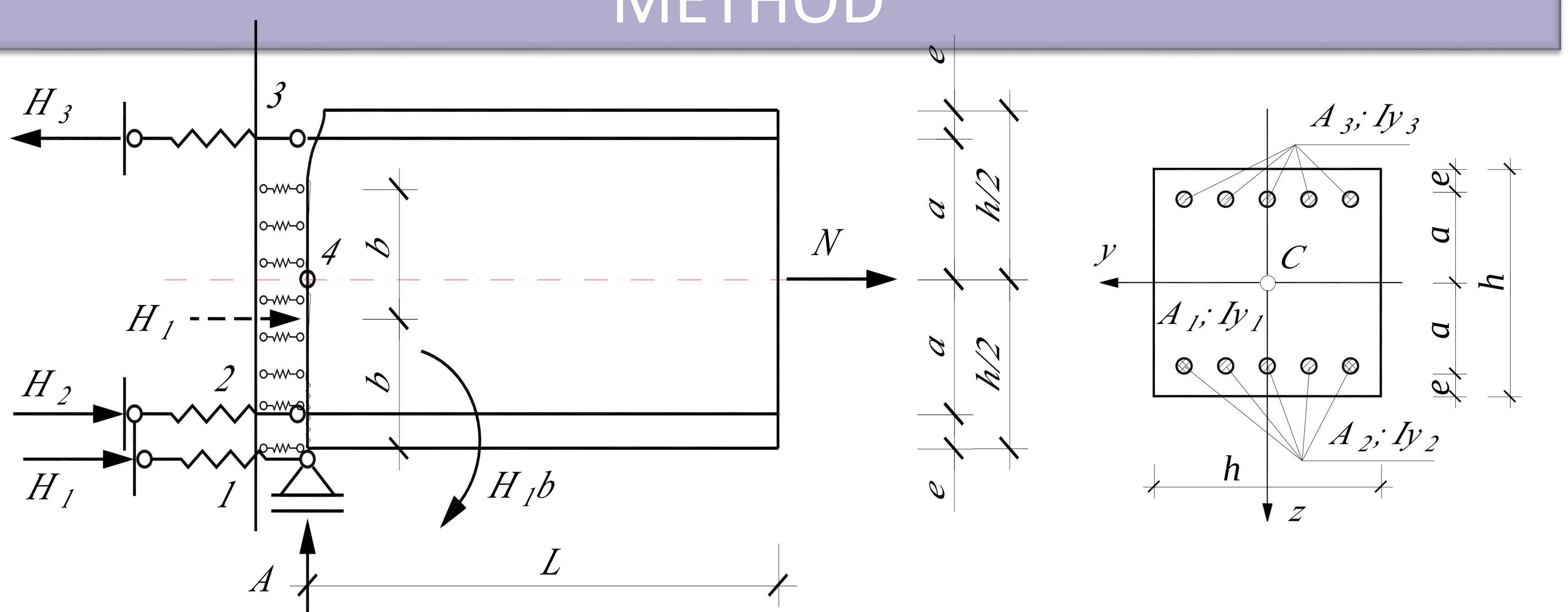
$$V_j = \frac{M_b}{j_b} + \frac{M_b'}{j_b'} - V_C$$



The determination of the shear force in Eurocode 8 becomes capacitive.

$$V_{jhd} = \gamma_{Rd}\left(A_{s1} + A_{s2}\right) f_{yd} - V_c$$

METHOD



Load $\quad M_b = P.L \rightarrow \quad P = 50\ kN$

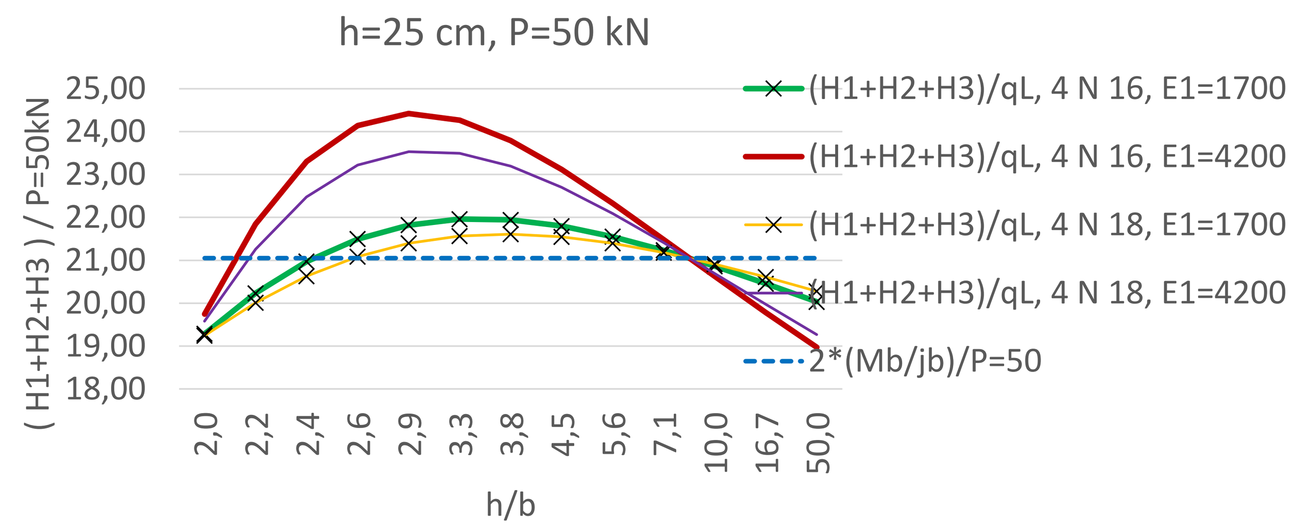
uniformly distributed load $\quad q = 0.50\ kN/cm'$

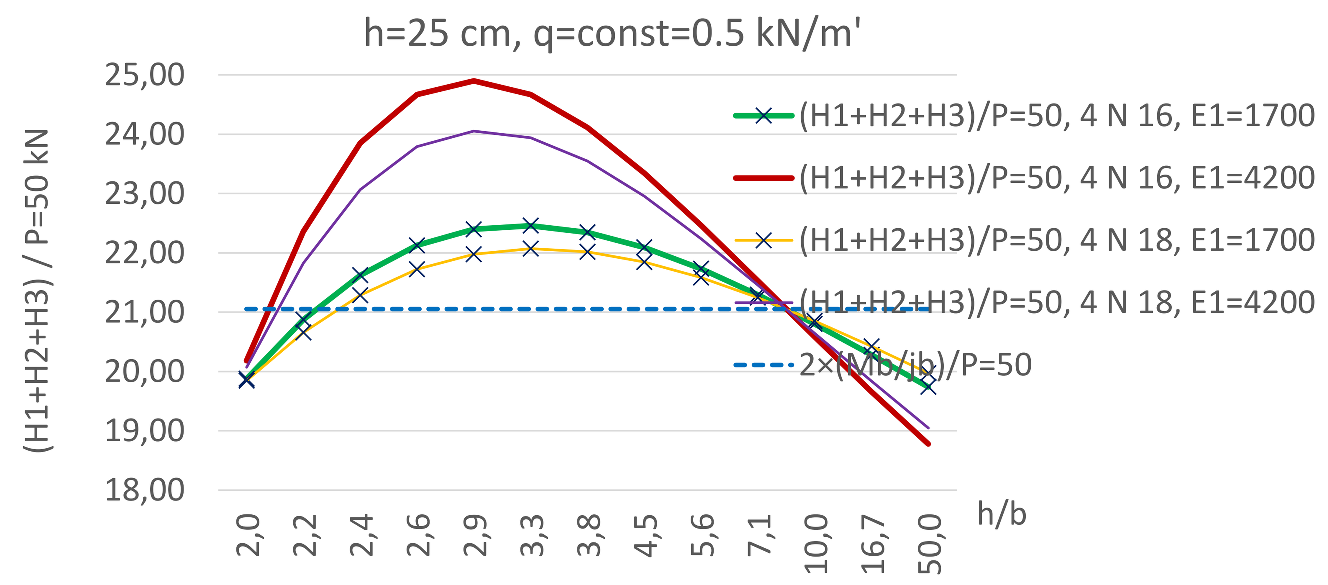
linearly distributed load $\quad q = 1.50\ kN/cm'$

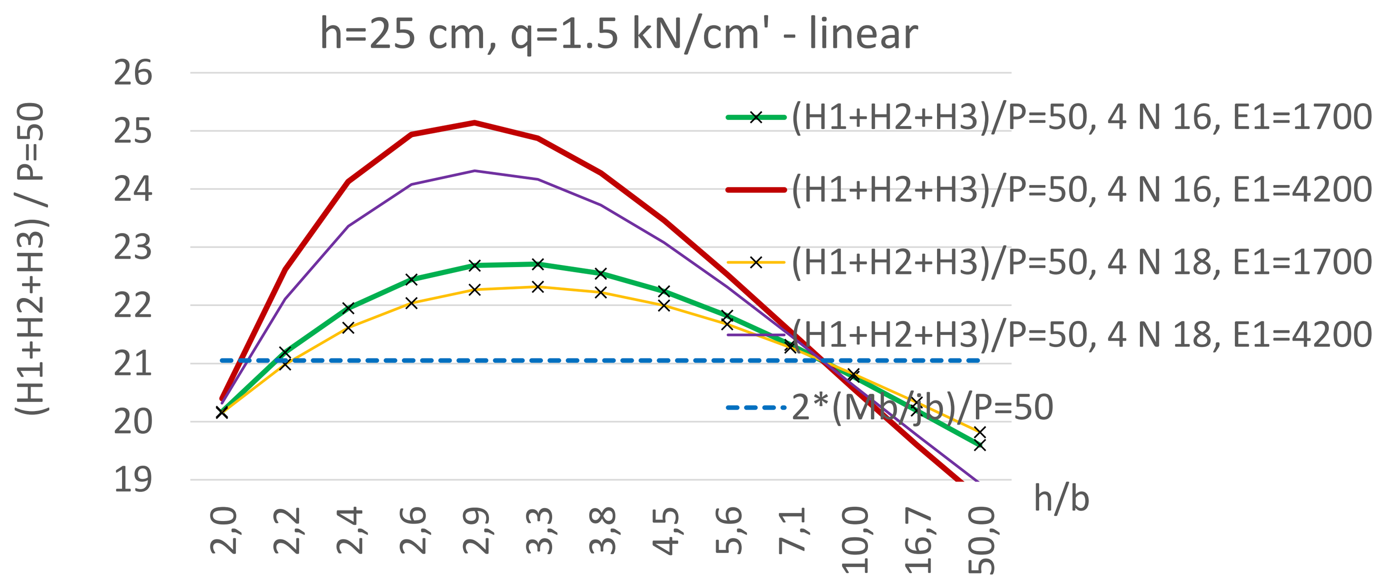
$$M_b / j_b + M_b' / j_b' = \text{const}$$

$$\gamma_{Rd}\left(A_{s1} + A_{s2}\right) f_{yd} = \text{const}$$

RESULTS & DISCUSSION







Comparison of shear force parameters for different loads, when varying the elastic moduli and the number of reinforcing bars in the beam.

Load	E_1	Bars	$\frac{\left(\frac{M_b}{j_b}+\frac{M_b'}{j_b'}\right)-\left(H_3+H_2+H_1\right)}{\left(H_3+H_2+H_1\right)}100\%$
P=50 kN	E_1=1700kN/cm²	4 fi 16	-4,13 %
		4 fi 18	-2,57 %
	E_1=4200kN/cm²	4 fi 16	-13,78 %
		4 fi 18	-10,54 %
q=const=0,5 kN/m'	E_1=1700kN/cm²	4 fi 16	-6,26 %
		4 fi 18	-4.61 %
	E_1=4200kN/cm²	4 fi 16	-15,45 %
		4 fi 18	-12,48 %
q=0,75 kN/m' - linear	E_1=1700kN/cm²	4 fi 16	-5,74 %
		4 fi 18	-4,06 %
	E_1=4200kN/cm²	4 fi 16	-15,04 %
		4 fi 18	-12,00 %

CONCLUSION

A comparison of the magnitude of the shear force in a cantilever beam from different loads has been made. The magnitudes of the loads have been determined based on an equal moment at the end of the beam.

The comparisons made show different magnitudes of shear force from different loads. Therefore, the type of load has an impact on the final value of the shear force.

Higher strength concretes lead to an increase in the magnitude of the support reaction in the beam, which takes into account the influence of the concrete cross-section. This also leads to larger values of the shear force. Therefore, the contribution of the concrete cross-section to the magnitude of the shear force is unjustifiably neglected in the current standards.

Increasing the area of the longitudinal reinforcement of the beam leads to a decrease in the shear force.

The analyses performed show the need to calculate the magnitudes of the forces leaving the beam. These calculations must take into account the actual load, the intended strength of the concrete and the actual values of the diameters and number of longitudinal reinforcing bars of the beam.