

# STEEL DESIGN: A CODE COMPARISON

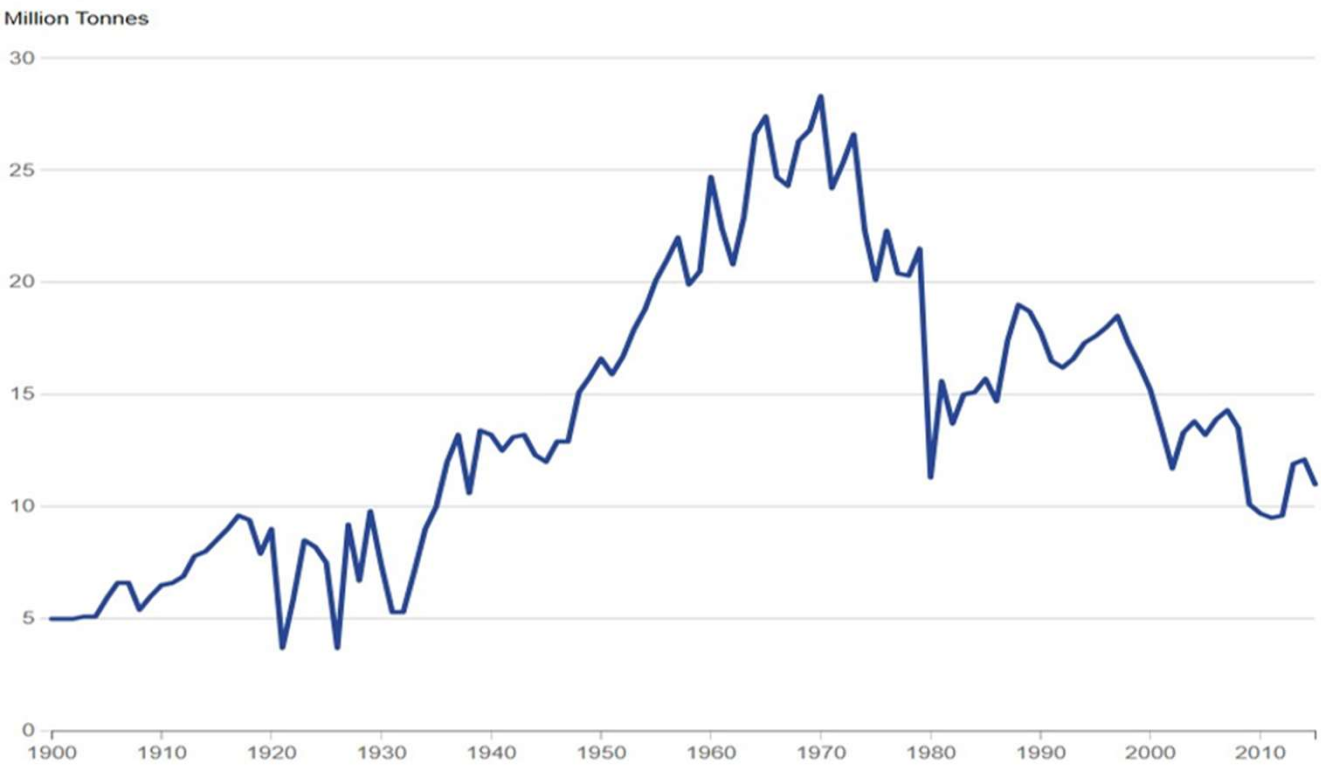
BS449 – BS5950 – EUROCODES 3

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## BACKGROUND

Steel design standards have developed over the decades through improvements in engineering practice, safety measures and material science. The improvement of design codes creates challenges when assessing existing structures that may not comply with current standards.

Since steel structure warranties commonly extend to 50 years, it is important to assess pre-1975 structures as shown the volume of steel production in the graph below to confirm their integrity and is compliant with modern day regulations.



## OBJECTIVES

- 1) Understand historic and modern steel production improvements and its effects on the structural analysis through the structural design standards.
- 2) Identify and analyse key differences between structural design standards BS449 / BS 5950 & Eurocodes 3.
- 3) Conduct a detailed structural analysis of structural members to BS 449 / BS 5950 & Eurocodes 3.
- 4) Review the analysis and critically evaluate to most suitable reinforcement technique to ensure it complies with current design codes.

## METHODOLOGY

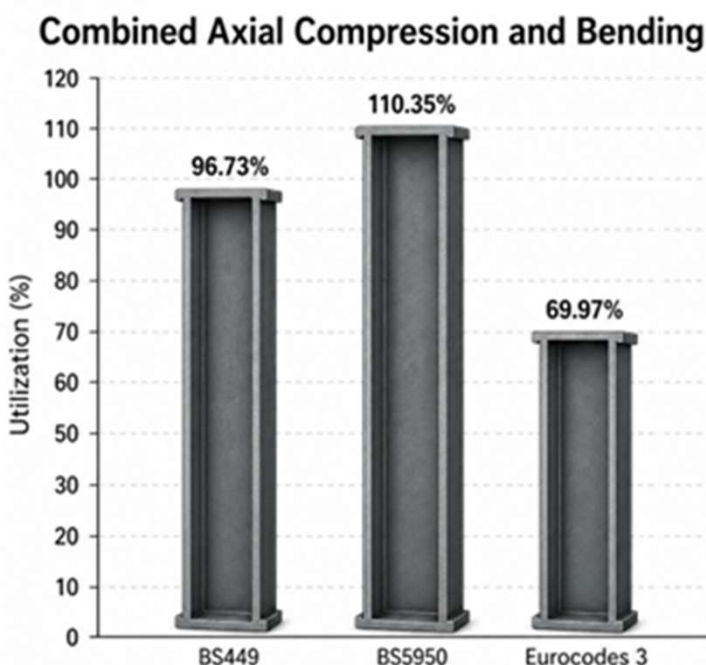
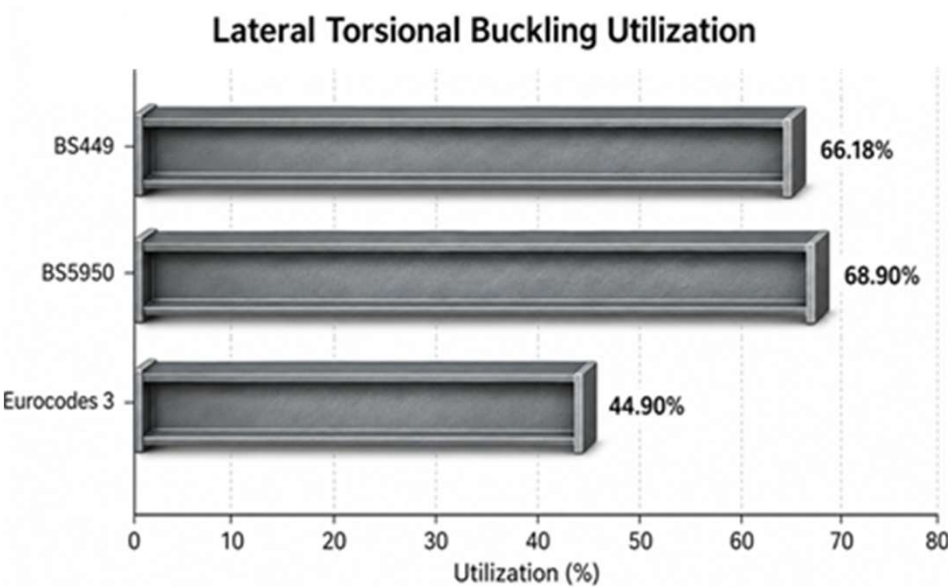
The study undertakes two separate analysis. The first considers the design of an “unrestrained simply supported beam”, using the same applied loads for all analysis but assessed in accordance with the relevant design code.

Following this, the loads from the beam analysis are transferred to the second analysis, which considers a “column in simple construction”. A variation of -5kNm was applied in the opposite direction in the X & Y axis for some eccentricity & an additional axial load applied to the top of the column this is the total of all the reactions together.

This approach provides a clear overview of the results under each design code, allowing for a more accurate side-by-side comparison.

## RESULTS

The driving outcome for unrestrained simply supported beam design is lateral torsional buckling, with combined axial compression and bending for the column in simple construction. The results of this analysis is shown in the below charts:-



## CONCLUSION

The study concludes that the modern standard Eurocodes 3 has the most economical design in comparison to the two earlier standards, this is ultimately down to the loads applied to member being factored in accordance with a robust load combinations, along with utilizing the ultimate strength of the member properties.

The surprise through the analysis is that the same applied loads but under BS5950 has an increase in utilization for both the Beam and column design this was because the increase in loads (43.58% Increase) outweighs the increase by changing design philosophy (10.65% Increase). This shows that additional reinforcement would be required for these members when undertaking analysis to BS5950.

When failing under lateral torsional buckling then changing the design philosophy to a restrained beam will add rigidity to the beam and reduce the buckling effect. This can be achieved by adding additional horizontal member at the midspan of the member. An alternative solution is to increase the flange thickness.

For column design, the governing factor is the axial compression of the member and the bending in the weak axis. To increase the capacity for both factors is to provide structural modification by welding plates between the column flanges, ultimately boxing the member and increasing the members cross section area.

