

**THE PLASTIC DESIGN OF A STEEL PORTAL FRAME**

**C/1045**

**BY**

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# 1 INTRODUCTION

It is estimated that 50% of all constructional steelwork used in the UK is in the primary framework of single-storey buildings. Within this major market sector, the steel portal frame has become the most common structural form in pitched roof buildings, because of its economy and versatility for a wide range of spans. Although the use of steel portal frames is well established in the UK, there is no publication which defines best practice in this form of construction.

The guidance in this publication concentrates on the design of single-span portal frames using hot rolled steel I sections, but the general principles also apply to multi-span portals and to the use of fabricated sections.

Where possible, the guidance given has been agreed with designers, steelwork contractors and those concerned with checking for building control purposes. It deals with the issues that occur reasonably often in design practice and which are amenable to general guidance. Aspects required for concept or preliminary design are covered first, followed by more details for final design. Secondary elements, such as purlins, end gables and cladding are also reviewed.

The use of computer-aided design has made manual calculations almost redundant for regular portal frames, and therefore detailed guidance on manual methods of analysis is not included. However, tables and charts for preliminary design are presented, and reference is made to other publications for manual analysis techniques. Output from the CSC Fastrak program is included in Appendix D, as this program is widely used by steel fabricators in the UK.

Where guidance is given in detail elsewhere, for example on the design of portal frames in fire boundary conditions, established publications are referred to, with a brief explanation and review of their contents. Cross-reference is made to the relevant clauses of BS 5950-1:2000<sup>[1]</sup>.

The amendment of BS 5950-1 from the 1990 version to the 2000 version gave rise to some technical changes that affect the design of portal frames. Also, clauses were renumbered in the 2000 version. The main changes that affect detailed design of portal frames are as follows:

- Section classification
- Lateral-torsional buckling
- Equivalent uniform moment factors for buckling checks
- Sway stability.

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