

STUDY ON THE USE OF TAPERED SECTION IN STEEL PORTAL FRAMED STRUCTURES

B.H.D.Y. Madunoraj

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Department of Civil Engineering

University of Moratuwa

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Abstract

Plastic design of portal frame has become popular in these days. But, most of Sri Lankan designers adopt elastic design. This may be due to the scarcity of analytical and design software dealing with plastic theory. Unlike the elastic analysis, there is no perfect way of plastic analysis. Reactions for the plastic analysis are calculated after analyzing a number of collapse mechanisms.

BS 5950 does not give clear guide lines for the portal frame with tapered section. But Appendix G gives some recommendations for the design of tapered members.

In this research, an attempt is made to design portal frame with tapered section both plastically and elastically. Later I have identified that plastic analysis is much difficult with the tapered members as it is much difficult to detect the exact position of the plastic hinge. Then elastic design was done with portal frame with tapered section. Portal frame was analyzed with GRASP software. Variable cross section properties were taken into account by dividing the members into small elements. Design was done with the guide lines given in BS 5950 and in particular appendix G.

Two excel programmers were developed to design portal frame with uniform section and tapered section. A large number of portal frames were designed using these programmers covering a span range of 20m to 50m for the spacing of 4.5m, 6.0m and 7.5m.

Finally a comparison was done with tapered elastic and uniform plastic designs. It has been found that portal frames with tapered section need less steel than that for the uniform section. But an economical range is identified for the tapered section portal frame after considering the welding cost. This economical range is identified considering the cost per frame basis.

DECLARATION

The work included in this thesis in part or whole has not been submitted for any other academic qualification at any institution.

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