

# Development of Design Tools for the Design of Steel Beams as Per Indian & International Standards

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## ABSTRACT

Steel design codes are in the process of evolution over the years. The design approach has been changing over the years. The Indian codes now follow limit state design approach in line with other inter-national codes. The latest version of the Code of Practice for general construction in steel, IS 800-2007 is based on Limit State Method of design and it supersedes the previous dated version of this code IS 800-1984 which is based on elastic method, [6]. The design based on limit state method involves many equations and parameters. Therefore the design of steel structural members and connections involves tedious equations. In this study, design tools using Microsoft excel spreadsheets and charts have been prepared for the design of flexure members which will save the time of engineer's considerably. Similar tools have also been developed for British Standards BS 5950-2000 and American Standards AISC 360-2010.

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## INTRODUCTION

Iron, in its various forms, has been in usage since several thousand years BC. The two great ancient Indian epics, Ramayana and Mahabharata, had shown the importance of iron long back and being mostly used as weapons. The Hittites Empire was the first user of iron dated 3 to 4 millenniums ago. Steel because of its different favorable circumstances has been credited as a structural configuration material. High quality /weight proportion makes steel an extremely alluring structural material for high rises or tall structures, bridges with long span, structures found on delicate ground, and structures placed in exceptionally seismic regions where strengths following up on the structure because of a tremor are all in all corresponding to the weight of the structure. Appropriately outlined steel structures can have high pliability, which is an essential trademark for opposing stun stacking, for example, impacts or seismic tremors. A ductile structure has vitality-engrossing limit and won't acquire sudden failure. It typically indicates huge noticeable avoidances before failure or breakdown. Steel structures might be raised quickly. This regularly brings about speedier budgetary result. Steel structures could be manufactured with fantastic-workmanship and thin tolerances. It's extremely extraordinary to catch wind of steel development however its exceptionally regular. Steel development of materials has turned into a requirement for the advancement. It has gotten helpful for the business and business divisions for a long time of time.

## LITERATURE REVIEW

Elhouar (2012) put forward that design charts and tables are more efficient in carrying out the tasks as compared to advanced programs. He produces unraced design beam charts as an MS Excel spreadsheet application similar to the AISC Manual of Steel Construction. He insists on using these tools to their fullest as we find that with a minimum number of inputs beam design chart is obtained. These charts are an extremely helpful complex set of curves that were handled to encourage the structural designer's occupation of selecting a satisfactory cross area for an unraced beam segment of length  $L_b$  and subjected to a bending moment  $M_u$ .

AISC 360 (2010) provides a treatment for design of steel beams in accordance to Load and Factor Design provisions. The code provides a detailed overview of the design equations both for ultimate state condition and serviceability criteria.

Kulkarni and Patil (2011) indicated the utilization of charts as configuration helps for selecting steel sections. Design charts for Indian Standard Channel Section is displayed based on IS 800:2007. Corresponding to each length and for a given section the factored load value is determined using the design equations of the code. Thereafter varying the effective length other factored load values are obtained and a graph is plotted between factored load and effective span.

## EXPERIMENTAL WORK DEVELOPMENT OF DESIGN TOOL

**The design sheet created facilitates the work of selecting an appropriate section for steel beam.**

To use this spreadsheet, the steps are:

**Step1:** If the user has to go for Indian Standards for beam design, choose the „INDIAN CODE“ option. A macro named „Indian“ come into operation. In the drop down box a set of Standard rolled I sections will be displayed. Select any section.

**Step2:** Click on the command „Design As Per Indian Code“. Now the macro „IndianDS“ runs and user is taken to a new sheet „Design IC“. In this sheet the section is matched from sheet „IC“ and properties are displayed.

**Step3:** The user is required to fill the parameters along with the.

**Step4:** After finishing the above work, a detailed result is displayed indicating the status of the section. If the section is unsafe revise the section.

### EXCEL SHEET FOR DESIGN OF BEAMS AS PER BS 5950:2000

**Step1:** If the user has to go for British Standards for beam design, choose the „BRITISH CODE“ option. A macro named „British“ come into operation. In the drop down box a set of British Universal sections will be displayed. Select any section.

**Step2:** Click on the command „Design As Per British Code“. Now the macro „BSdesign“ runs and user is taken to a new sheet „Design BS“. In this sheet the section is matched from sheet „UC“ and properties are displayed.

**Step3:** The user is required to fill the parameters along with the support condition.

**Step4:** After finishing the above work, a detailed result is displayed indicating the status of the section. If the section is unsafe revise the section.

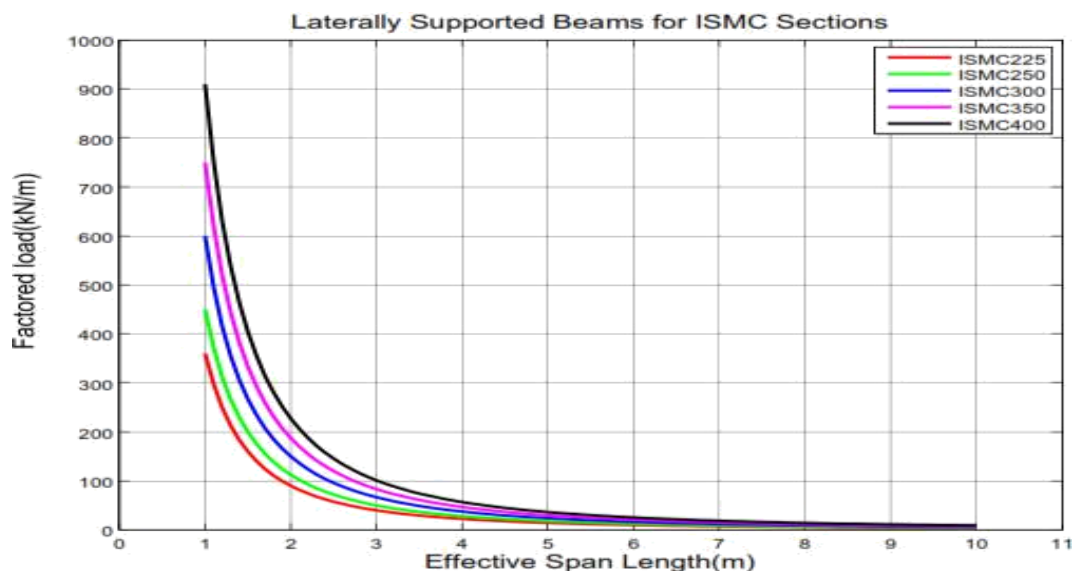


Figure 1 Factored load vs effective span length graph for ISLC sections

### RESULT

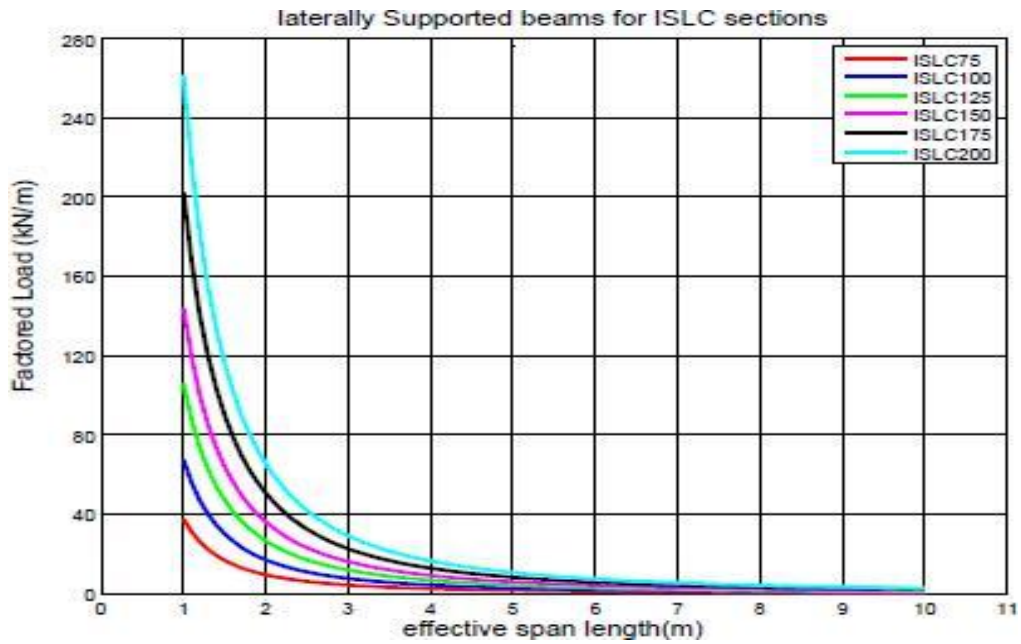


Figure 2 factored load vs effective span length graph for ISMC sections

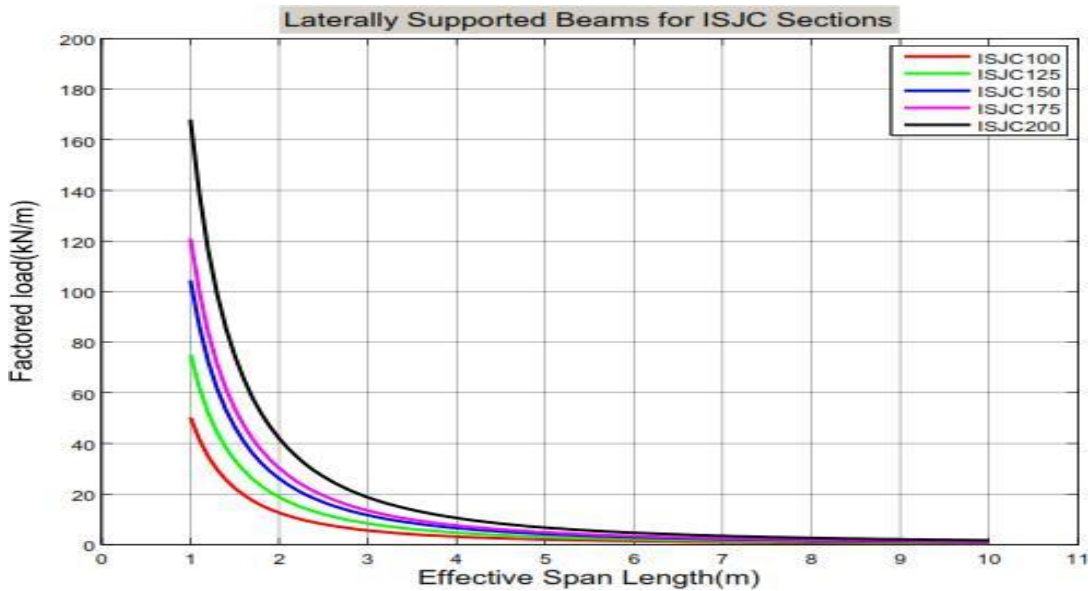


Figure 3 factored load vs effective span length graph for ISJC sections

### CONCLUSION

The objective of this study demands the development of design tools for three prominent standard code groups, Indian Standard, British Standard, and American Standard. Applying the guidelines discussed in second chapter design aids using spreadsheets and charts are developed. Soundly working of these tools are demonstrated by carrying out an example which is being verified with the help of staad output. Charts have been prepared for the purpose of selecting steel sections straightforwardly. The design tools are proven to be much significant and valuable.

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