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Development of Intraction Diagrams of Steel Beam Column

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ABSTRACT

This dissertation provides an extensive concept of the development of beam column interaction diagram of steel structures in accordance with the latest code of practice (IS 800 : 2007) for general construction in steel. The project is based on the modern limit states approach of design and covers areas such as axial & bending capacities of different Indian Standard Medium weight Beam (ISMB) sections. Once the capacities are known for one type of section then it will be easier to achieve the same for other type of rolled steel & built-up sections. This project is mostly useful for design of industrial buildings as well as public buildings as it gives a quick reference to the acceptability of different steel sections as per availability according to the effective length for a given combination of load and moment.

Introduction

Iron and steel are considered as the basic raw materials for several subsidiary industries such as engineering, automobiles, locomotives, machine tools, and ship building. The unique position of iron among the metals may be attributed to its abundance and to the wide range of properties that can be imparted to it by various treatments and by alloying it with various amounts of other elements. There has been an increasing demand for structural steel for construction purposes in India. The structural steel all over the world pre-dominates the construction scenario. This material has been exhaustively used in various constructions all over the world because of its various specific characteristics that are very much ideally suited for construction. Structural steel is durable and can be well moulded to give the desired shape to give an ultimate look to the structure that has been constructed.

Although structural members are incombustible, their strength is tremendously reduced at temperatures, commonly reached in fires when the other materials in a building burn. Furthermore, since steel is an excellent heat conductor, non-fireproofed steel members may transmit enough heat from a burning section or compartment of a building to ignite materials which come into contact with them in adjoining section of the building. Due to these factors the steel frames of a building may have to be protected by materials with certain insulating characteristics. The longer and more slender the compression members, the greater in the danger of buckling. Though steel has a high strength per unit of weight, steel columns have to be stiffened against buckling resulting in uneconomical solutions sometimes.

Literature Review

Dr.T.Muralidhara Rao, S.S.Phani

The paper provides a comparative analysis between versions of steel 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. The design concept is totally changed in comparison to earlier code IS 800:1984 which is based on Elastic method. In view of this, an effort has been made to high light the critical comparison between the important clauses of IS: 800-2007 and IS: 800-1984. At a glance, the present study will provide the readers a quick and clear idea about the changes in the corresponding clauses of old (IS: 800-1984) and new (IS: 800-2007) codes of practice. Codes of practice provide the minimum requirements that a design has to satisfy. In India, Bureau of Indian Standards (B.I.S.) is the statutory body that publishes the codes of practice to be followed in the Indian Professional practice. Though the codes of practices issued by B.I.S. are revised after 20 to 25 years, the second revision of IS 800 was published in 1984. The third revision of the code was released after about 24 years, in December 2007, by the B.I.S. The material contained in the code reflects the state-of-the-art of knowledge and is based on the provisions in other international codes as well as other research publications.**Dr. N. Subramanian,** Codes of practice reflect the combined wisdom of a profession. They provide the minimum requirements that a design has to satisfy. They have a legal status, in the sense that any failure consequent to the violation of the provisions of a code can land a designer into a legal liability. However, the codes of practice do not prescribe a process of design nor they constrain the designer

from adopting the latest knowledge and developments in the profession to do the design. More recently, the provisions of the codes of practice have been incorporated in the computer aided design software to ensure the design meets the requirements of the governing code. Hence, the method of representing the code in such software can greatly affect the transparency and longevity of the software. With continuing research and development activities at an accelerated pace, there is great explosion in the generation and dissemination of knowledge in all areas of engineering. This has led to the need to revise the governing codes of practice at regular intervals, in order to reflect the more recently generated professional knowledge appropriately in the corresponding codes.**Prof.RavindraBhimarao Kulkarni** The latest version of the Code of Practice for general construction in steel IS 800:2007 is based on Limit State Method of design. The design concept is totally changed in comparison to earlier IS 800:1984 which is based on elastic method. In the present work, the detailed study of structural components as tension members by designing using Limit State Method and Working Stress Method has been carried out and submitted the comparative study of the same in the form of graphs and charts, which highlights the actual economy achieved by Limit State Method over Working Stress Method for different structural sections. The observations made based on this study are very much useful to the practicing structural engineers.

Experimental Procedure:

In general columns are those kinds of structures which take care of axial compression loads. Beams are trusted over flexural kind of loading which induces bending moment. But practically structural members are subjected to combination of axial loading along with bending moment. The kinds of structure where both the compressive load & bending moment are of significant importance are called beam column.

Here we have considered only standard rolled steel section ISMB (Indian Standard Medium weight Beam) to develop the interaction diagram. Once the procedure is confidently developed later it will be easier to implement the same for other standard sections & built up sections.

Results and Discussions:

The interaction curves are prepared & represented in two sections for the convenience of its use.

- Taking the effective length to be constant & finding out the capacities of various sections respectively & preparing graph for different length intervals starting from 2 meters to 11 meters.
- Taking the section as constant & finding out its capacities at different effective lengths starting from ISMB 100 to ISMB 600.

Section One: (Fixed effective length)

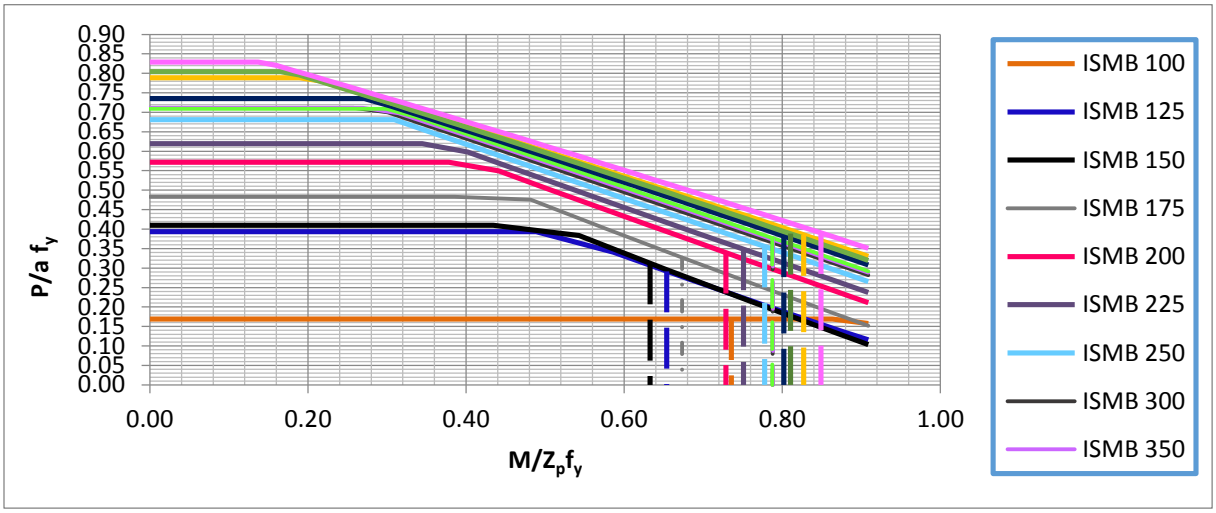

Figure 1:Interaction diagram for 2m effective length

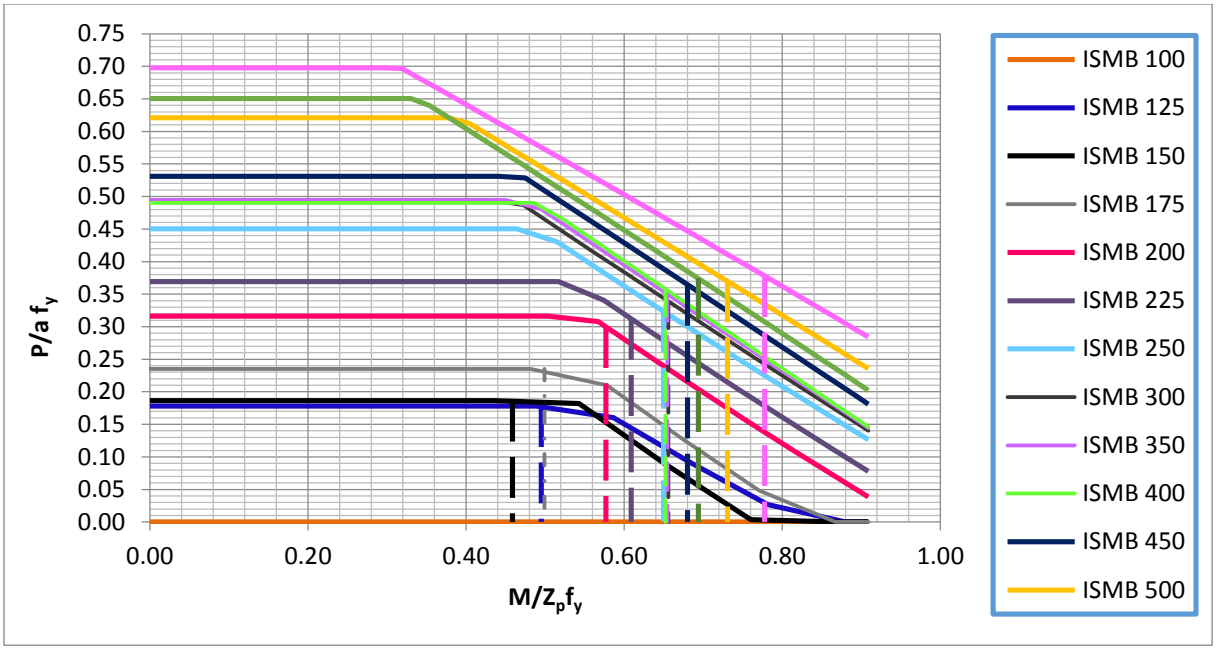

Figure 1: Interaction diagram for 3m effective length

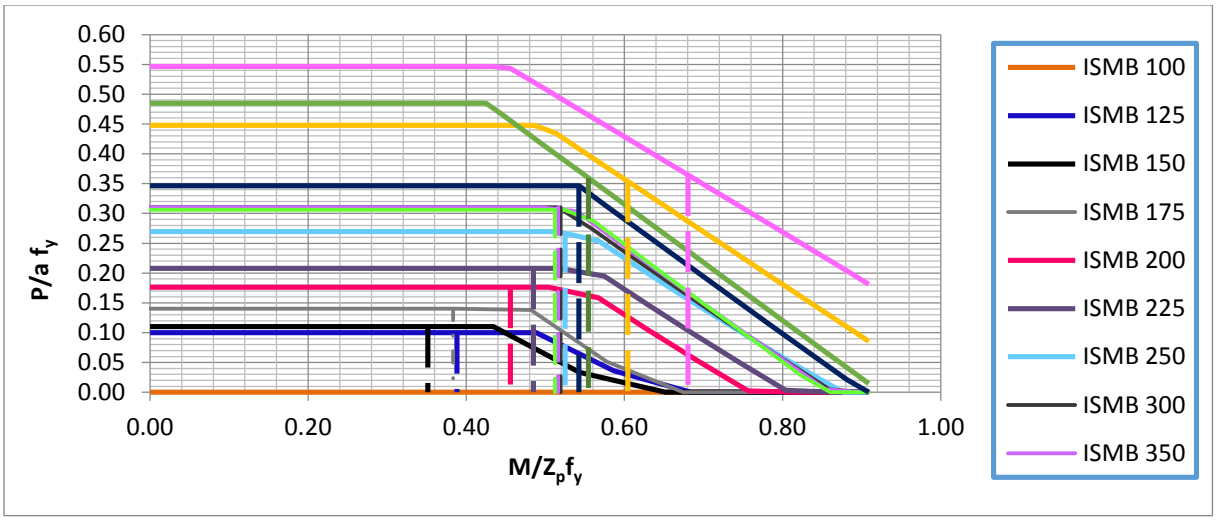

Figure 2: Interaction diagram for 4m effective length

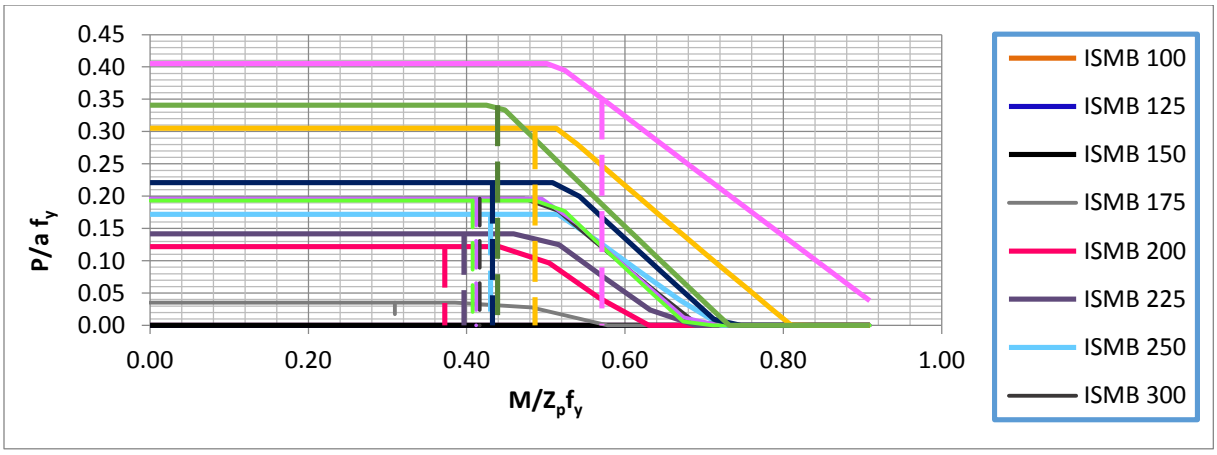

Figure 3: Interaction diagram for 5m effective length

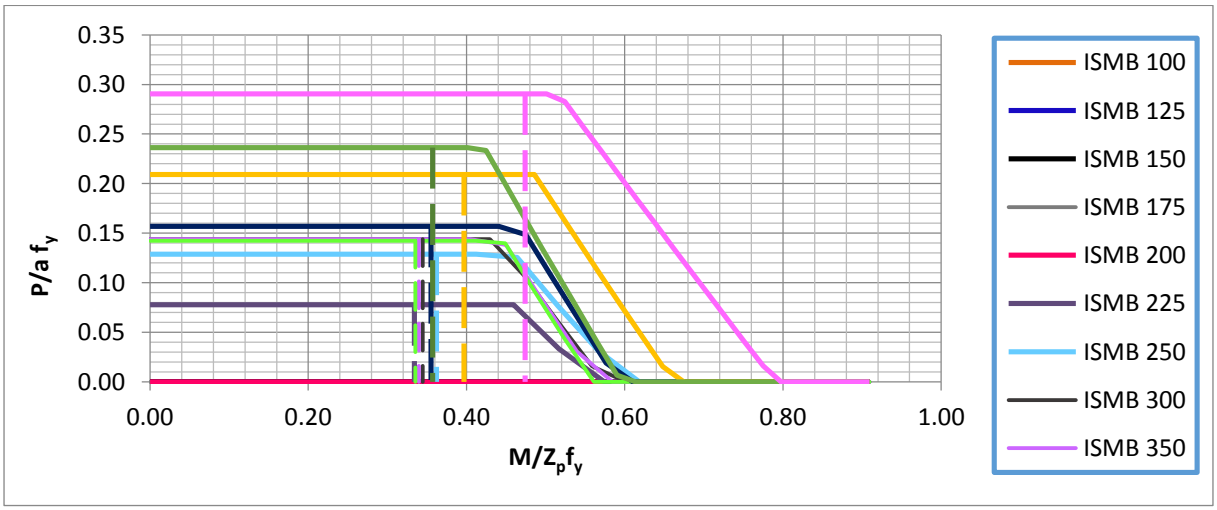

Figure 4: Interaction diagram for 6m effective length

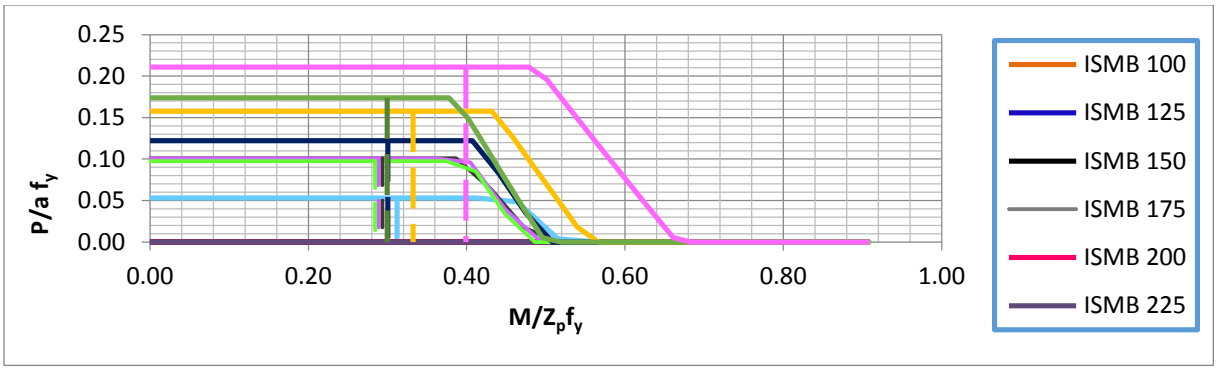

Figure 5: Interaction diagram for 7m effective length

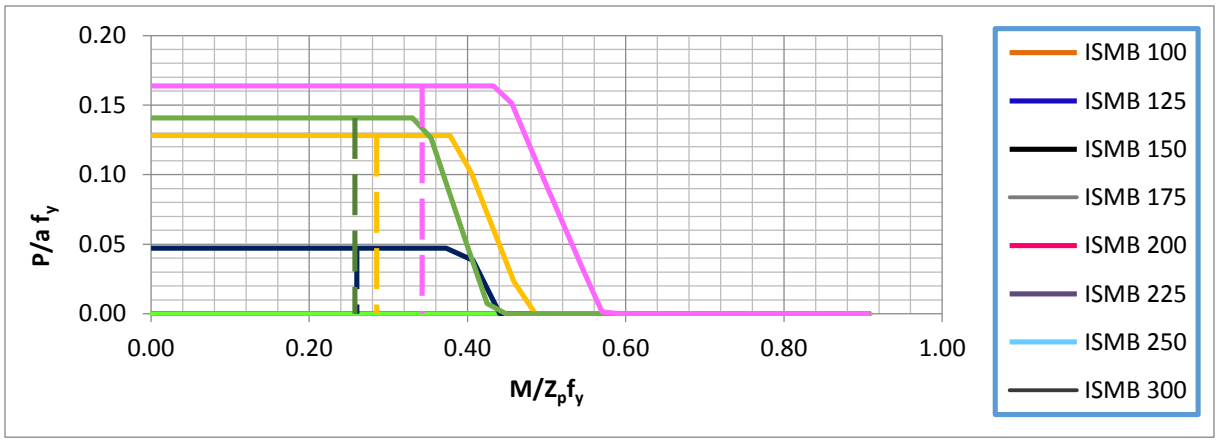

Figure 6: Interaction diagram for 8m effective length

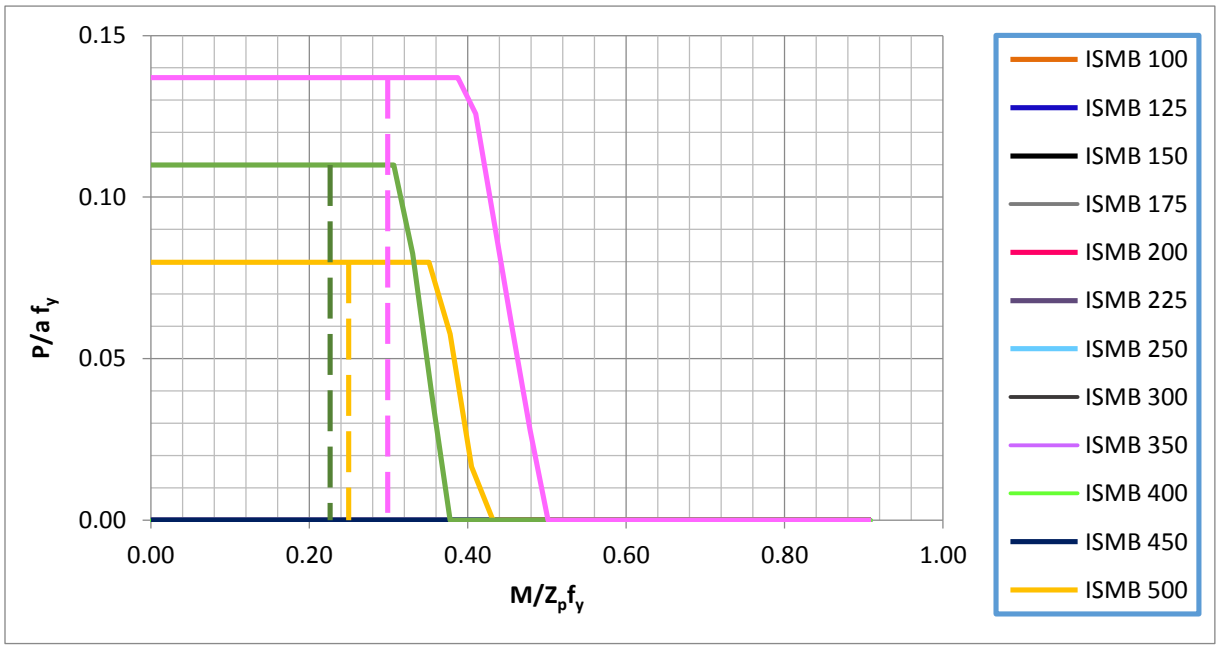

Figure 7: Interaction diagram for 9m effective length

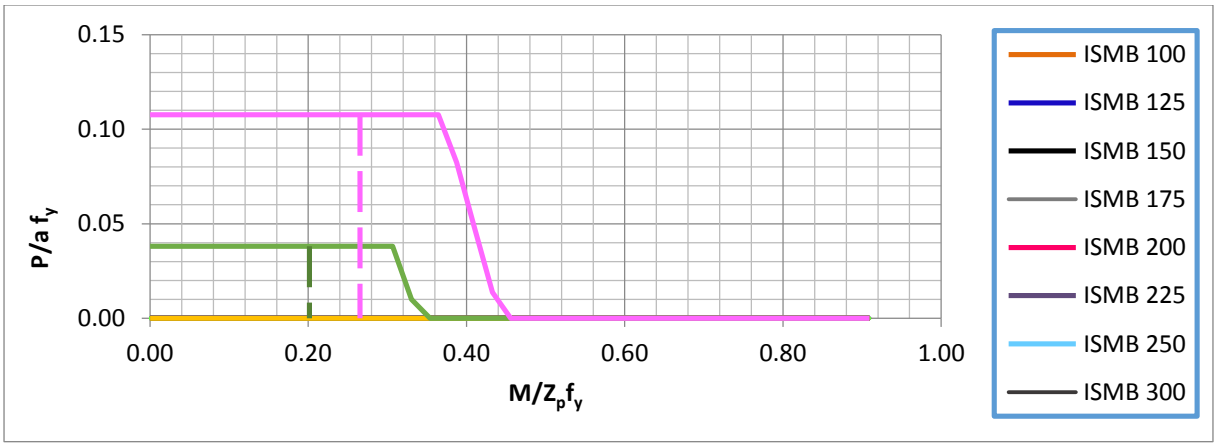

Figure8: Interaction diagram for 10m effective length

Conclusions:

Now with the help of the interaction curves developed under this project work enables us to figure out the acceptability & hindrance of using different Indian Standard Medium weight Beam sections in any steel structures. We can check the safety of the sections under any designed circumstances as well as the sections can be economized without much rigorous calculations. We can explain the influence of the effective length on any steel column & how the capacities are decreased with increase in length.

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