Design Manual for Effective Use of Parallel Flange Sections

Prepared For JSPL

A structural engineer's responsibility is to design the structural members of buildings, bridges, dams, offshore platforms etc, with maximum efficiency and minimum cost satisfying the strength and stiffness requirement. Selecting the good structural arrangement, design methodology and choosing the right structural sections of required strength can achieve the economy and efficiency in use. Also, the present Indian standard medium sections are available in one size only for each beam depth. However, in case of parallel flange beams (in view of the Universal Rolling Technology) more number of beams having the same beam depth but with varying flange and web thickness, flange widths and weight per unit length will be available giving more flexibility to the designers & economy to the end user. This helps customers to choose from more options in terms of unit weights and sectional properties.

Consultants, designers and fabricators made use of these sections because of their substantial cost benefit over conventionally available tapered beams or built up sections. These sections are available in different grades with yield strength of 250 to 450 Mpa. These sections can be welded without any preheating. Parallel flange I-Sections ranges from 200x100 mm to 900x300 mm and column sections from 150x150 mm to 400x400 mm are also used leading to significant economy in steel construction.

These sections are divided in 3 categories as per IS: 12778-2004. They are Narrow parallel Flange sections (NPB), Wide Parallel Flange Sections (WPB) and Bearing Pile Sections. The NPB's are mostly used as beam members, WPB's are used for both Beams and Columns and Bearing Pile Sections are used for Compression members. Also PF sections are available as per international standards such as UB, UC, IPE etc.

Manufactured as per Indian & International standards, these sections are superior in terms of strength, efficiency, higher axial and bending load bearing capacity, workability and economy vis-à-vis conventional tapered flange beams. These Parallel Flange Beams & Columns enable complex fabrications in high volumes due to inherent functional advantages of these sections. When used under bending load, steel savings between 10-25% are achieved, as beams of lower sectional weight can be used. The load carrying capacity of parallel flange I sections under direct compression are much higher than that of I sections available today. Also connections to the flanges are simpler since no tapered washers etc. are required.

JSPL assigned INSDAG the consultancy job for Preparation of a manual for efficient use of parallel flange sections. This design manual prepared by INSDAG contains statical properties of parallel flange sections, design of members subjected to compression, bending and combined forces. Also strength tables for different structural grades have been given for the benefit of

designers. Comparison tables are provided to give an idea of how parallel flange sections are better compared to conventionally available ISMB sections.

Axial Compression Capacities of Parallel Flange Sections

To compare the compression load carrying capacity between tapered and parallel flange section compression capacities are calculated for different grades of steel i.e. Fe 250, Fe 300, Fe 350 and Fe 410 confirming to IS: 2062 and different effective spans ranging from 1 to 10m.

Bending Capacities of Parallel Flange Sections

An independent exercise of comparing the bending capacity of ISMB members and various parallel flanged members for span varying from 3 m to 12 m and yield strength of material varying from 250 MPa to 450 MPa has been carried out and the results have proved that the parallel flanged sections are much more effective.

Usefulness of Design Manual Prepared by INSDAG

The Design Manual is therefore very useful for the designer to find the compression as well as the uniaxial and biaxial bending capacities of a parallel flange and conventional tapered section very easily and quickly form the capacity table depending on the length of the member. Different types of tables for the effectiveness and economy comparison ISMB and parallel flange sections are also readily available for the designers to choose appropriate and economic section for different structural members.