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Code for Design of Steel Structures

钢结构设计规范

GB50017—2003

Beijing 2005

Foreword

According to the requirement of the document Jian Biao [1997] No.108 of the Ministry of Construction, the Beijing Central Engineering and Research Incorporation of Iron and Steel industry, together with relevant design, education and research institutions, formed a revising-drafting group and proceeded a comprehensive revision of the **“Code for design of steel structures” GBJ17-88**. In the process of the work, an overall revision program was mapped out, and quite a few design codes of foreign countries have been consulted. Solicitation of opinions from all sides was carried out upon completion of the first draft. After many amendments, by putting forward successively the first draft, the draft for seeking opinions and that for reviewing, and upon the performance of tentative design projects by ten-odd participating units for comparison between the new and old codes, the final draft for approval of the **“Code for design of steel structures” GB50017-2003** was completed in December 2001. The major amendments of this revision are as follows:

1. The provisions regarding “classification of weld quality”, originally Clause 1.0.5 in the Commentary of the former code, has been moved to the text as Clause 7.1.1 of Chapter 7 of the Code. Moreover, the classification principle and specific rule have been added.
2. According to the requirement of the document Jian Biao [1996] No.626 “Prescription for writing standard of construction work”, clauses of “Glossary” have been added and compiled together with “Symbols” into Chapter 2. the contents of “Materials”, Chapter 2 of the former version, are put into Chapter 3, as Section 3.3 “Material Selection”.
3. According to the new National Standards of structural steel, steel grades Q235, Q345, Q390 are recommended and Q42 is added. Requirements for material quality guarantee that various steel structures shall meet are more complete than before. The condition of applicability of 0°C notch toughness guarantee for Q235 steel has been added and the principle of using Z-direction steel and weathering steel prescribed as well. Meanwhile, the design indices of steels have been somewhat adjusted.
4. In Chapter 3, a section on “Load and calculation of load effects” has been added, emphasizing the appropriateness of using the elastic second-order analysis approach for un-braced pure frames, which considers the effect of deformation on internal forces. Amplification factor for crane transverse horizontal load in the former code has been deleted and calculation formula of transverse horizontal force caused by sway of crane been given instead.
5. The amendments to the Section “Provisions for deformation of structures and structural members” are:
 - 1) In the text of the Code, design principle solely is mentioned, whereas a table on limiting values of deformation is given in the Appendix.
 - 2) The limiting values of deformation may be suitably modified according to requirement and experience. The calculation of crane girder deflection under un-factored wheel loads of only one crane is prescribed.
6. Formulas for calculation local stability of girder webs have been significantly altered

from the former code, considering no more the webs as fully elastic and perfect, but taking account of the effect of inelastic deformation and geometric imperfection. Furthermore, calculation method for taking account of web post-buckling strength is given, and the restraining factors to webs have been adjusted as well. The formulas for determining stiffener spacing according to fully elastic plate in the former code have been deleted.

7. The classification of sections of axially loaded compression members has been enlarged to include I-and box section with component plates of thickness $t \geq 40\text{mm}$ and the relevant φ factor of class d has been added.
8. The approach to calculating flexural-torsional buckling about the axis of symmetry of struts with mono-symmetric section has been added.
9. The method for calculating forces in lateral bracings used to reduce the unsupported length of compression members or compression flanges has been amended. Also amended is the approach to determining the out-of-plane effective length of cross-diagonals.
10. Frames are distinguished into three categories, namely un-braced pure frames, strongly braced frames and weakly braced frames, and the approach to calculating the effective lengths of these various frames has been given.
11. An approach to determining column effective length of un-braced pure frames and weakly braced frames containing leaning columns have been added;
12. The number of stress cycle, n , has been amended as follows: fatigue calculation shall be carried out when n is equal to or larger than 5×10^4 (in the former code, fatigue calculation is required only when n is equal to or larger than 10^5). Besides, minor amendments to the classification of members and connections for fatigue calculation have been adopted.
13. The limiting value of web depth-thickness ratio in T-section struts, and that of beam-columns with web free edge under tension, has been amended.
14. Two sections on “beam-to-column rigid connection” and “calculation of plate elements in joints” have been added, the main contents of which are:
 - 1) Provisions regarding column web or flange thickness requirements in case no transverse stiffeners are provided to the column in a beam-to-column rigid joint.
 - 2) Strength calculation of plate elements under combined tension and shear, that of truss gusset plates and relevant stability calculation method and prescription.
15. Provisions regarding plate bearing, spherical bearing and composite rubber and steel support have been replenished.
16. Prescriptions on design and detailing of inserted column base, imbedded column base and wrapped column base have been added.
17. Prescriptions on design and detailing requirements of large-span roof structures has been added;
18. Prescription on requirement of improving the brittle fracture resistance of structures in

cold region has been added.

- 19.** The reduction factor 0.9 to the design value of strength of steel and connection for plastic design and steel-concrete composite beams, as prescribed in the former code, has been deleted.
- 20.** Formulas for calculating the strength of circular tube spatial nodes have been added. Method for calculating the strength of rectangular or square tube planar nodes and relevant detailing requirements have been supplemented.
- 21.** The Chapter 11 “Light steel structures of round bars and small angles” of the former code has been deleted.
- 22.** The following issues regarding steel-concrete composite beams have been supplemented: method for calculating the negative moment portion of continuous composite beams, calculation and detailing peculiarity of composite beams with concrete flange cast on profiled steel sheeting, design requirement for composite beams with partial shear-resisting connection and deflection calculation of composite beams.

In this Code, the provisions printed in bold type are compulsory ones and shall be strictly implemented.

The Code will be administered by the Ministry of construction, which is responsible for the explanation of compulsory provisions, while the Beijing Central Engineering and Research Incorporation of Iron and Steel industry will be responsible for explanation of concrete contents. Users are solicited to sum up experiences in the course Code implementation. Comments and suggestions on this Code are requested to send to the Administrative Group of the National Standard “Code for design of steel structures”, Beijing Central Engineering and Research Incorporation of Iron and Steel industry (Address: 4 Baiguang Road, Beijing, postcode 100053; FAX: 010-83587996)

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1 General

- 1.0.1** This Code intends to implement the technical-economic policy of the State in the design of steel structures, by using advanced technology and ensuring economy, reasonableness, safety, suitability for use and good quality of the structures.
- 1.0.2** This Code applies to the design of steel structures of industrial and civil buildings and allied engineering structures, among which members made of cold-formed steel shapes and their connections shall comply with the current national standard “Technical code of cold-formed steel shapes and their connections shall comply with the current national standard “Technical code of cold-formed thin wall steel structures” GB50018.
- 1.0.3** The design principles of this Code are based on the “Unified standard for reliability design of building structures” GB50068. Loadings and their combination values assumed in designing with this code shall comply with the current national standard “load code for the design of building structures” GB50009. Buildings and engineering structures in seismic region shall furthermore comply with the current national standards “Code for seismic design of buildings” GB50011, "Seismic ground motion parameter zonation map of China" GB 18306 and “Design code for anti-seismic of special structures” GB50191.
- 1.0.4** In designing steel structures, designers shall consider the real situation of the project, select reasonably the material, the structural scheme and detailing measures. The requirements of strength, stability and stiffness of the structure during transportation, erection and service, as well as requirements of strength, stability and stiffness of fire protection and corrosion resistance shall be fulfilled. Typical and standardized structures and structural members shall be adopted in preference, the amount of fabrication and erection work shall be reduced.
- 1.0.5** In the design documents of steel structures shall be indicated the design service life of the building structures, the steel grade, the category (or grade) of connection materials and mechanical properties, chemical composition and additional items of guarantee of the steel. Moreover, the weld type and the class of weld quality, the location of end planning for close fitting and its quality requirement shall also be indicted.
- 1.0.6** The design of steel structures with special requirements and those under special circumstances shall furthermore comply with the relevant current national codes.

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