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Author:	Bong-Soo Jeon, Senior Partner, Jeon and Associates
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Introduction to Korea Building Code(Draft)

Jeon, Bong-Soo, P.E., KIRA*

*Senior Partner, Jeon and Associates, Seoul, Korea
Former Vice President of KSSC
Chair, KBC Committee of AIK

Abstract
The draft of the Korean Building Code (KBC) is briefly described in this document to enable the reader to study the systems of building codes in Korea. The KBC draft was developed by the Architectural Institute of Korea (AIK) and supported by the Ministry of Construction and Transportation (MOCT) in 2003. The draft establishes minimum regulations for building systems using prescriptive provisions, which are composed of four provisions with 27 chapters, including General Provisions, Fire Safety Provisions, Structural Provisions, and Mechanical, Electrical, Plumbing, and Environmental Systems Provisions. This model code is expected to be consistent with those of other countries with regard to the application of the provisions. To enhance and legalize architects' and engineers' use of this code, the MOCT is taking legal steps to provide some articles and clauses in the building acts.

Keywords: super-high-rise apartment; location; view; Common institution; plan

The draft of the Korean Building Code (KBC) was developed by the Architectural Institute of Korea (AIK) and supported by the Ministry of Construction and Transportation (MOCT) in 2003. The main purpose of the KBC draft is to provide a set of regulations for building systems consistent with and inclusive of the scope of existing codes and regulations. The KBC draft, as a model code, establishes provisions consistent with the scope of a building code towards providing adequate protection for public health, safety, and welfare. Minimum regulations for building systems were established using prescriptive provisions based on the principles applicable for new materials and building designs in the KBC draft. The KBC draft is composed of four provisions with 27 chapters, namely:

- General Provisions (4 chapters);
- Fire Safety Provisions (9 chapters);
- Structural Provisions (7 chapters); and
- Mechanical, Electrical, Plumbing, Environmental, and Conveying Systems Provisions (7 chapters).

This model code is expected to be consistent with those of other countries in the application of provisions. To make the use of this code by architects and engineers legal and practical, the MOCT is taking legal steps to provide some articles and clauses in the building act, enforcement, and ordinance.

General Provisions (Chapters 1 to 4)

This provision includes administration, a glossary and symbols, occupancy classifications and special detailed requirements based on occupancy.

Fire Safety Provisions (Chapters 5 to 13)

Fire Safety Provisions include the fire-resistance-rated construction, fire zoning, interior finishes, fire protection systems, means of egress, accessibility, exterior walls, roof assemblies, and the gypsum board.

Structural Provisions (Chapters 14 to 20)

Structural Provisions consists of the structural design, structural tests, special inspections, foundations, concrete structures, masonry structures, structural steel, and wood structures.

All the existing structural codes provided by the Enforcement Ordinance of Building Acts (EOBA) and Structural Standards were transferred to the Structural Provisions of the KBC.

The code for the design of structural steel buildings, based on the limit state design philosophy, is in Chapter 19 (Structural Steel) of the KBC. Other codes related to structural steel buildings are also presented in this chapter.

The other codes related to structural steel buildings in Chapter 19 of the KBC are:

- The Code for the Design of Structural Steel Buildings based on the Allowable Stress Design method in Section 1912;
- The Code for the Design of Structural Tubular Pipes in Section 1913;
- The Code for the Design of Cold-formed Steel Structures in Section 1914;
- The Code for the Design of Steel and Concrete Composite Buildings in Section 1915; and
- Guidelines for Non-destructive Testing for Welding in Section 1916.

Mechanical, Electrical, Plumbing, Environmental, and Conveying Systems Provisions (Chapters 21 to 27)

The design codes for inner building environments, the energy efficiency of buildings, and electrical, mechanical, plumbing, information technology, and conveying systems of buildings are specified in these provisions.

1. Design Methods and Philosophies

1.1 Available Design Methods

Currently, both the Allowable Stress Design (ASD) method and the Limit State Design (LSD) method are used for structural steel building designs.

- ASD (Allowable Stress Design): Standards (a), (c), (d), and (e) in Section 2.2
- USD (Ultimate Strength Design) or PD (Plastic Design): None
- LSD (Limit State Design) or LRFD (Load and Resistant Factor Design): Standard (b) in Section 2.2

1.2 Minimum Design Loads for Buildings

1.2.1 Load combinations

Section 1401 (General) of the KBC describes the definitions of specified loads, general design requirements specified in the building laws, and load combinations.

- Load combinations using strength design for concrete buildings:
  U = 1.4D + 1.7L
  U = 0.75(1.4D + 1.7L + 1.7W)
  U = 0.9D + 1.3W
  U = 0.75(1.4D + 1.7L + 1.8E)
  U = 0.9D + 1.4E
  Etc.

- Load combinations using the limit state design for steel buildings:
  U = 1.4D
  U = 1.2D + 1.6L + 0.5(L or S)
  U = 1.2D + 1.6(L or S) + (0.5L or 0.8W)
  Etc.

1.2.2 Dead loads

Section 1402 (Dead loads) describes only the definitions of dead loads.

1.2.3 Live loads

Section 1403 (Live loads) describes the definitions of live loads, uniformly distributed and concentrated live loads, and reductions in live loads.

1.2.4 Snow loads

Section 1404 (Snow loads) deals with the definition of snow loads, ground snow loads, flat roof snow loads, sloped-roof snow loads, unbalanced roof snow loads, drifts on roofs and in-on-snow surcharge loads.

1.2.5 Wind loads

Section 1405 (Wind loads) deals with general information on winds loads, design wind loads on resisting systems, roofs and claddings, design velocity pressures, gust effect factors, pressures and efficiencies, importance factors, exposure categories, topographic effects, and enclosure classifications.

1.2.6 Earthquake loads

Section 1406 (Earthquake loads) deals with general information on earthquake loads, seismic base shears, equivalent lateral force procedures, modal analysis procedures, and non-building structures.

1.2.7 Other loads

In Section 1407, soil and hydraulic pressures, temperature loads, stored material pressures, and loads due to conveying vehicles are specified.

1.3 Structural Analysis in the Design Methods

The tools for linear, non-linear and dynamic analysis and design , MIDAS family software, were developed by MIDAS IT Co., Ltd., Korea in accordance with the structural design codes of KBC, AISC, AIJ, EURO, and other countries with super graphic environments for users, including structural material-take-ups.

STAAD PRO, SAP2000 and ETABS 6.1 for structural analyses and member design, PCA for column design and SAFE for slab design, developed in the foreign countries, are also used by practicing structural engineers.

1.4 Design Methods Accepted in the Design Codes

Currently, the allowable stress design method and the limit state design method are used together for the Code for the Design of Structural Steel Buildings based in Korea. However, there appears to be a progressive tendency to shift from the ASD method to the LSD method.

1.5 Durability of Buildings

The durability of structural steel buildings is not currently specified in any section or chapter in the Code for Design of Structural Steel Buildings. However, it is partially considered in the Serviceability chapter of the codes.

2. Specific Considerations in Design for Earthquake, Wind, and Fire Resistances

2.1 For Earthquake Loads

The specific design procedures for the seismic design of structural steel buildings are specified in Sections 1406.2.1 to 1406.2.11 in the KBC draft, as follows:

1) Determining period of the structures to get the base shear forces;
2) Horizontal shear distribution;
3) Checking overturning;
4) Drift determination and P-delta effects;
5) Seismic-force-resisting systems;
6) Checking story drift limitation;
7) Building separation; and
8) Building configurations.

Dynamic analysis procedures for the seismic design of buildings in Section 1406.4 are specified as follows:

1) Modeling;
2) Mode shapes;
3) Modal properties;
4) Modal base shear;
5) Modal story shears and moments; and
6) Horizontal shear distribution.

Specifications for non-building structures are also available in Section 1406.5.

2.2 For Wind Loads

Wind loads for the design of structural steel buildings are specified in the Code for the Design of Structural Steel Buildings, as follows:

1) Design wind loads for main wind load resisting systems;
2) Design wind loads for roof systems;
3) Design wind loads for components and claddings;
4) Design velocity pressures;
5) Gust effect factors for main wind load resisting systems; and
6) Pressures and loads coefficients.

4.3 For Fire Resistances

The provisions for fire-resistance-rated construction, specified in Chapter 5 of the KBC, control the materials and assemblies used for structural fire resistance and fire-resistance-rated construction separation of adjacent spaces to safeguard against the spread of fire and smoke within a building and the spread of fire to or from buildings.

3. Quality Control in Steel Construction

The provisions for cooperation, rejections, inspection of welding, inspection of slip-critical high-strength bolted connections, and identification of steel for quality control are provided in the Code for the Design of Structural Steel Buildings based on the allowable stress design method and the Code for the Design of Structural Steel Buildings based on the limit state design method.

The fabricator shall provide quality control procedures to the extent that the fabricator deems necessary to ensure that all work is performed in accordance with this code and Section 08000 (Steel Work) of the Korean Architectural Standard Specification (KASS) issued by AIK/MOCT.

4. Examples of Code Applications

Structural calculations for the Kwangmyoung high-speed railway station
(See Appendix.)

5. Conclusions

1) As all the structural design codes are currently under the EOBA, their revision require tremendous time and effort. To maximize the effectiveness of the processing of revisions so as to keep up with innovative and advanced technologies in structural design, the AIK drafted the KBC supported by the MOCT. In addition, international trends in changes in the role of the main body of preparing and reviewing structural design codes from a governmental organization to a non-governmental organization such as AIK support this suggestion.
2) For structural steel design in Korea, the Allowable Stress Design (ASD) method and the Limit State Design (LSD) method are concurrently used. However, practical engineers are progressively tending to shift from the ASD method to the LSD method using SI unit system.
3) More specific categories such as regulations for low- and high-rise buildings, long-span or space buildings, residential buildings, and factory buildings are needed.