

PART I: GENERAL REQUIREMENTS FOR STRUCTURAL DESIGN

1.1-SCOPE

1.1.1-Practice Defined

1.1.1.1 The Specification defines a national standard of practice for the structural design of lumber, glued laminated timber, piles and wood mechanical connections based on working stress or deterministic design principals. Alternative design approaches based on reliability-based concepts may give different results than those obtained from the Specification. The choice of which design methodology to use should be based on the availability of code approved alternatives, knowledge of the bases of the alternative approaches, and experience with the performance of wood structures designed for different occupancies or other specific purposes.

1.1.1.2 The provisions of the Specification apply to lumber, glued laminated timber and timber piles that are subject to loads transferred from attached panel materials. The structural design of the panel products themselves shall be based on recognized design specifications for the materials involved, and/or in accordance with accepted engineering practice.

Where the structural performance of assemblies of panel products and lumber, glued laminated timber or piles is dependent upon the capacity of the connections between the materials, such as in shear diaphragms, the design provisions for mechanical connections in the Specification may be used for such assemblies when the panels are made of solid wood materials, or when such application is accepted engineering practice, or when experience has demonstrated such application provides for satisfactory performance in service.

1.1.1.4 The data and engineering judgments on which the Specification are founded are those related to working stress design. The general approaches contained in the provisions of the Specification have been successfully employed to design wood structures since 1944.

Components, assemblies or structures may be qualified for use employing criteria other than the working stress design requirements of the Specification, or, if available, the provisions of a reliability-based design standard. Such other criteria may involve use of full-scale test results, use of verified computer design models, application of generally recognized theoretical principles, and broad in-service experience. Examples are testing to establish adequate chord-web connections at the supports of top-hung parallel chord trusses, computer models for determining floor system performance, and computerized design packages for determining the load-carrying capacities of glued laminated timber beams.

An example of the use of a combination of criteria is the design procedure for metal-plate connected roof trusses. This procedure utilizes beam-column equations, sheathing contribution factors and duration of load adjustments from the Specification in combination with theoretical principles, computer modeling and test results to establish appropriate truss spans.

The other criteria for demonstrating satisfactory performance in use may be proprietary to a specific organization, or specialized design standards applicable to a particular component type. The appropriateness and acceptability of alternate criteria are determined by the designer and the code authorities in the jurisdiction in which the product is used or the structure is located.

1.1.2-Competent Supervision

The competent supervision requirement is particularly relevant to joint details and placement of fastenings. Design values for connections are dependent upon use of accurate end, edge, and spacing dimensions. Special attention also should be given to end details of columns and beam-columns to assure that design assumptions related to load eccentricity are meet in construction.

1.2-GENERAL REQUIREMENTS

1.2.2-Framing and Bracing

Adequate bracing and anchorage of trusses and truss members to assure appropriate resistance to lateral loads is particularly important. Good practice recommendations (179) for installation between trusses of vertical sway (cross) bracing, continuous horizontal bottom chord struts and bottom chord cross bracing are given in Appendix A.10. These recommendations have been part of the Specification since 1944.

In addition to providing adequate permanent bracing and bridging in the structure to resist wind and other racking forces, sufficient temporary bracing of load-carrying members should be used during construction to assure such members will withstand wind and temporary construction loads before adjacent members and cladding materials required by the design are installed.

1.4-DESIGN LOADS

1.4.1-Loading Assumptions

Accidental overload factors are not incorporated in any of the design procedures of the Specification. Should there be the possibility of overload on the structure, this should be directly taken into account in the loading assumptions.

Further, the design provisions in the Specification are not based on any quantified expectation that code specified design loads will generally exceed typical loads likely to be encountered in service. Where such differences in fact do occur, they are part of the successful experience record on which the Specification is based.

1.4.4-Load Combinations

The reduced probability of the simultaneous occurrence of combinations of various loads on a structure, such as dead, live, wind, snow and earthquake, is recognized in ASCE 7-88 (formerly ANSI A58.1) *Minimum Design Loads for Buildings and Other Structures* (10), in model codes, and in state and local codes. Some codes provide for a reduction in design load for wind or earthquake even when both are not considered to act simultaneously. This particular load reduction is accounted for in such codes by allowing all materials a 1/3 increase in allowable stress for these conditions. Because individual jurisdictions and code regions may account for load combinations differently, the building code governing the structural design should be consulted to determine the load combination factors that apply.

All modifications for load combinations are entirely separate from adjustments for duration of stress or load that are directly applicable to wood design values. Wood strength properties are related to the time period over which the induced stress is sustained: the shorter the duration, the greater the design stress applicable to the member.

Because the duration of stress or load adjustment previously applicable to wood design values for wind or earthquake loads for many years was 1.33, this adjustment was often confused with the 1/3 modification factor for wind or earthquake loads that is permitted in some codes for all materials. This confusion should be minimized in the future as new research has established that the duration of maximum ANSI wind and earthquake design loads is much shorter than previously assumed, thereby substantiating the establishment of a 1.6 duration of load adjustment of wood product design values for these particular loads (see Commentary for Section 2.3.2). It should be emphasized that reduction of design loads to account for the probability of simultaneous occurrence of load components, and the adjustment of wood resistances to account for the effect of the duration of the induced stress or applied load are independent of each other and both may be employed in the design calculation.

1.5-SPECIFICATIONS AND PLANS

1.5.1-Design Values

The recommendation for expressing design value requirements on working drawings and plans in terms of normal duration of load is to facilitate design review and implementation. Normal loading is defined as that loading which will fully stress a member, either cumulatively or continuously, for a period of ten years during the life of the structure in which the member is used. Design values for normal load duration are those tabulated for all wood structural materials in design specifications, material references and grading rules. Stating design value requirements in terms of normal loading in plans and drawings provides for ready identification of qualifying species and grades of material.

Identifying in plans and specifications the moisture conditions to which the design values apply also facilitates procurement and use of the proper material for the job.

1.5.2-Sizes

The use of nominal dimensions in the distribution and sale of lumber products has been a source of confusion to some designers, particularly those unfamiliar with wood structural design practices. To assure that the building is constructed of members with the capacity and stiffness intended by the designer, the basis of the sizes of wood products given in the plans and specifications should be clearly referenced in these documents. Alternate bases are the standard nominal or standard net sizes established for each product in national product standards (190); or special sizes applicable to proprietary or made-to-order products.

1.6-NOTATION

The many new symbols added to the Specification in the 1991 edition are a result of the conversion of design requirements to a consistent and comprehensive equation format. All adjustment factors and coefficients that may influence a member or connection design are identified by symbol to facilitate the designer's review and determination of their applicability.

The system of notation used in the Specification helps to identify the meaning of certain frequently used symbols. Factors, identified by the symbol "C", are those adjustments used to modify tabulated design values for conditions of use, geometry or stability. The subscripts "D", "F", "H", etc., are used to distinguish between different adjustment factors. In certain cases, upper and lower case subscripts of the same letter ("D" and "d") are used to denote two different adjustments (load duration factor and penetration depth factor, respectively). There is no particular significance to the use of the same letter with different cases for different adjustment factors. Coefficients, identified by the symbol "K", are characteristic values which, in most cases, are used to determine specific values of "C". The symbols "F" and "F'" denote tabulated and allowable strength values, respectively; where the latter values represent tabulated values multiplied by all applicable C factors. The symbol "f" indicates the actual or induced stress caused by the applied loads. The subscripts "b", "t", "c", "v", and "$c\perp$" indicate bending, tension parallel to grain, compression parallel to grain, shear and compression perpendicular to grain stress, respectively.