

The image shows the logo for ASTM Committee D-7: Wood. It features a dark blue rectangular background. At the top, the text "ASTM COMMITTEE D-7: WOOD" is written in a bold, white, serif font. Below this, the phrase "Promoting Safety and Standardization for 100 Years" is written in a smaller, white, sans-serif font, centered on two lines. The entire logo is set against a light gray background that has a repeating pattern of the text "D-7" in a dark blue, serif font, arranged in a grid-like fashion.

By David W. Green, Robert L. Ethington,
Edward G. King, Bradley E. Shelley, and David S. Gromala

increasingly difficult to obtain, and products from them are often replaced by prefabricated wood I-joists and glued laminated (glulam) beams. Plywood once replaced solid-sawn wood for sheathing material, and oriented strandboard has now largely replaced plywood. Compared to 100 years ago, the use of forest resources in the United States includes a more diverse array of species and trees with smaller diameters.

All of these 20th century changes have been a challenge to the building industry and have the potential to cause confusion and distrust in consumers. But similar challenges have been faced before. Wood was a useful material long before Europeans set foot in North America. Three centuries later, commerce in wood products had developed, in both sophistication and geographic reach, to a degree where standardization promised better consumer satisfaction and buyer/seller understanding. Shelley (1992) notes that standards are developed in response to one or more of at least five factors: 1) expansion of marketing areas; 2) advances in technology, both within and without the wood products sector; 3) new code or regulatory requirements; 4) competition from other products; and 5) changes in consumer demand.

SEPTEMBER 2004

Officer	Term of Service	Length of Service (yr.)
Chair		
Hermann von Schrenk	1905 to 1948	44
L.J. Markwardt	1948 to 1964	16
Lyman W. Wood	1964 to 1966	2
W.A. Oliver	1966 to 1972	6
Wayne Lewis	1972 to 1974	2
F. Alan Tayelor	1974 to 1980	6
William L. Galligan	1980 to 1981	1
Al DeBonis	1981 to 1988	7
Ed Diekmann	1988 to 1992	4
Erwin Schaffer	1992 to 1994	2
Frank Beall	1994 to 1998	4
Robert Leichti	1998 to present	
Secretary		
William K. Hatt	1906 to 1915	10
John L. Newlin	1915 to 1943	28
L.J. Markwardt	1943 to 1948	5
L.W. Smith	1948 to 1958	10
W.A. Oliver	1958 to 1965	7
John Shope	1965 to 1972	7
L.L. Rappleyea	1972 to 1974	2
R.A. Hewett	1974 to 1979	5
Don Percival	1979 to 1984	5
R.E. Catchpole	1984 to 1988	4
Chris K.A. Stieda	1988 to 1992	4
Donald Onysko	1992 to 1999	7
David Kretschmann	1999 to present	

Table 1. — Officers of ASTM Committee D-7: Wood (complete records could not be found for other offices).

products to assure quality and reliability (Green and Hernandez 2000). Committee D-7 on Wood has played a vital role in this system.

The Beginning: 1905 to 1929

The development and expansion of the railroads in the middle to late 1800s spurred interest in standardization with respect to wood utilization. Prior to 1895, grading procedures, lumber testing procedures, and methods for calculation of allowable properties were proprietary procedures developed by consulting engineers, university professors, and a few government scientists active in the field of timber engineering. The expansion of the railroads brought a need to standardize these procedures for the design of railway structures.

In 1895, a committee of the American International Association of Railway Superintendents of Bridges and Buildings reported on the strength of bridge and trestle timbers (Berg et al. 1907). The report presented 15

recommendations for timber engineering, factors used for converting breaking strengths from laboratory tests to allowable properties, and average safe design stresses for the principal species used for bridge and trestle timbers. In response to increased marketing opportunities provided by rail transportation, the lumber industry had begun to develop standardized sizes of lumber surfaced on two sides, primarily to limit shipping costs.

Organized in 1898, ASTM provided an opportunity for further standardization. At the 1903 annual meeting, W.K. Hatt provided a "preliminary report" on the timber test program of the Bureau of Forestry. At the 1904 meeting, the Executive Committee adopted a motion by Hatt for the formation of a committee on specifications for the grading of structural timber.

Committee Q

In the spring of 1905, a group of 12 men met to organize ASTM Committee Q on Standard Specifications for the Grading of Structural Lumber, the 7th technical committee to be formed (Fulweiler 1955). A report on the activities of Committee Q was presented by Herman von Schrenk at the 8th annual ASTM meeting in Atlantic City, New Jersey. In the report, von Schrenk listed himself as "Chairman pro tem," a post he held for 44 years (Table 1). The report proposed the following:

It is believed that the time has come for a comprehensive study and analysis of the grading of structural timbers, so as to arrive at a general understanding of the qualities of the various woods used for structural purposes, in order to standardize as far as possible, for the use of lumber manufacturers on the one hand, and architects and engineers on the other hand, the various grades and qualities of wood.

The subject was to be treated under three general headings:

1. Definition of structural timbers: define structural timber and indicate various uses for different species.
2. Standardization of trade names: establish a definitive list of common names of timbers used in this country.



Herman Von Schrenk, a pioneer of the science of forest pathology and Chair of ASTM Committee D-7 for 43 years. Photo courtesy of the Hunt Institute for Botanical Documentation, Carnegie Mellon University, Pittsburgh, Pennsylvania.

3. Grading: in establishing grading, define standard defects and their effect on strength and durability and establish specifications for both grading and grades.

The Proceedings of the 1906 meeting of ASTM stressed two distinct problems with respect to trade names. First, the rapid introduction of Pacific Coast species into the eastern states had brought about much confusion. For example, for over 50 years the term "white pine" had signified a soft white pine from Maine, Michigan, Wisconsin, and Minnesota. Now markets in the East were seeing "white pine" from Idaho and California. Similar problems were encountered with eastern and western hemlock, eastern and western larch, and the eastern and western spruces. The second problem was the use of "longleaf pine" for higher quality southern pine and "shortleaf pine" for lower quality southern pine rather than using these terms to indicate botanical species.

¹For ASTM standards cited in this paper, the year the standard was first approved is indicated after the number; e.g., D 9-07 was established in 1907. The letter "T" after the year indicates a "tentative" standard; this designation is no longer used.

In September of 1907 the first standard established by Committee Q, D 9-07,¹ the Standard Specification for Structural Timbers, was approved by a vote of the ASTM membership. The standard contained a definition of structural timber, definitions of standard defects, a list of standard names for structural timbers, and specifications for bridge and trestle timbers. Other topics proved more challenging and were to take several years to resolve. Among the problems to be addressed were the identification of longleaf and shortleaf southern pine, the effect of density and growth rings per inch on strength, and the variation in trade and botanical names.

Committee D-7

The year 1910 brought a name change for Committee Q to Committee D-7. A Standard Specification for the Grading of Yellow-Pine Bridge and Trestle Timbers was approved, and work on similar standards for Douglas-fir and western hemlock were in progress. Committee activities were changing to meet other challenges, especially with respect to preservative treatment of railroad ties and structural timbers. Some of the enduring standards approved over the next few years included D 25-15, which provided a standard specification on the physical characteristics of round timber piles; D 38-15, standard methods of sampling and analysis of creosote oil; D 52-18, wood paving blocks for exposed pavements; and D 93-21, determination of the flashpoint of hazardous liquids under laboratory conditions.

While the Committee had problems with some early specifications, they were more successful in methods of testing. For example, D 143-22 provided methods for sampling by species and procedures for mechanical testing of small clear specimens of wood, and D 198-24 addressed testing of lumber in structural sizes. These two standards were primarily developed at the USDA Forest Products Laboratory (FPL) in Madison, Wisconsin. Possible resolution of longstanding issues concerning lumber quality versus species and the development of allowable properties were suggested in USDA Circular 295, Basic Grading Rules and Working Stresses for Structural Timbers by Newlin and Johnson (1923). In 1926, these procedures were standardized with the adoption of D 245, Tentative Specifications for Structural Wood Joist and Planks, Beams and Stringers, and Posts and Timbers.

Wood products standardization in the early years of the 20th century was not the exclusive

domain of ASTM. Rather, there was close cooperation between Committee D-7 and other organizations promoting standardization. Many members of D-7 were also members of these other organizations. Cooperation and joint meetings with the American Railway Engineering and Maintenance of Way Association were an early part of D-7 activities. Cooperation and coordination of standards between Committee D-7 and the American Wood Preservers Association (AWPA), founded in 1904, was of great benefit. Hermann von Schrenk, the longstanding Chair of D-7, was also a founding member of AWPA. World War I brought a great deal of attention to the benefits of standardization.

In 1919, the American Lumber Congress called for development of lumber standards for grades, nomenclature, forms, and molding, and in 1922, the Central Committee on Lumber Standards was established by the U.S. Department of Commerce (USDC 1924). In 1924 and 1925, there were extensive discussions with the Central Committee to coordinate lumber specifications recommended by the two organizations. Input from the American Lumber Standard Committee (ALSC), the current incarnation of the Central Committee, has always been important to Committee D-7 activities, and ALSC continues to be a prominent user of D-7 standards.

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Great Depression and War: 1930 to 1954

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The ASTM procedures provide that standards are dynamic, and they should be subject to review and reaffirmation on a periodic basis. As time passed, some standards were modified and improved; others disappeared altogether. The decade of the 1930s is probably most recognized for the Great Depression and the prelude to World War II. As the decade opened, Committee D-7 had sired four standards related to wood preservation, which are still in print, and five standards related to solid wood. The preservative standards dealt largely with creosote measurement and quality. The other standards dealt with wood terminology, testing small clear specimens, testing timbers in structural sizes, visual stress grading, and specifications for round timber piles. Ten standards were focused on solid wood in 1924. Thus, in 5 years, fully half of the extant standards had been allowed to lapse.

The research that underpinned the standards continued, perhaps at a reduced level, during this



Glulam arches under test at the USDA Forest Service, Forest Products Laboratory in 1935.

quarter century, and some research programs were concluded and published during the 1930s (e.g., Markwardt and Wilson 1935, Wilson 1934). But the slow business climate probably kept the industry component of D-7 mostly on the sidelines, and with that minimal participation no new ASTM wood standards were promulgated until 1949, well after World War II. The focus for D-7 standards throughout the war period was on solid-sawn lumber and wood preservation.

However, the extant standards were used increasingly during that period. It was possible to classify structural timbers into grades that had "reasonable uniformity and fairly definite minimums of strength" (USDA 1935, p. 99). In turn, engineering principles could be used in design, although this prerogative was probably not practiced to any extent because most lumber was sold in "yard grades" for which no allowable property claims were made. Under the auspices of the Central Committee, the lumber industry had created an American Lumber Standard in the 1920s (Simplified Practice Recommendation 16-24 (SPR 16), not an ASTM standard), the first national lumber standard in the United States. This standard relied heavily on the existing standards of D-7 and in turn provided guiding principles for published trade association grad-

ing rules. The first edition of the *Wood Handbook* (USDA 1935) gives a fair synopsis of how research knowledge, D-7 standards, and the industry standard SPR 16 were melded.

It is clear from the literature of the first quarter of the 20th century that FPL played a major role in determining the content of D-7 standards. In D 245, for example, the standard follows FPL reports in both style and content to a great extent. Thus, in that standard, much of the procedure and text can be seen to mirror Miscellaneous Publication 185 (Wilson 1934) and related FPL publications. The *Wood Handbook* (USDA 1935) in turn cites D 245 as the authority for substantially the same procedures and text. As Shelley (1992) notes:

...from the time of publication of MP 185 in 1934 to 1949, the FPL moved from the position of a promulgator of lumber design stresses and grades to a more advisory role. At the same time the industry took on greater responsibility for the development of lumber grades and design values. By 1949 this shift of roles had progressed to the point that specific grade descriptions were removed from ASTM D 245 in favor of more generalized principles of stress grading.

World War II was a powerful motivator for changes that eventually translated into modification of standards. Demand for lumber products skyrocketed, and the War Production Board mandated changes in the practice of describing and using lumber as a way of extending precious supplies. Two significant mandates were that the principles in ASTM D 245 be extended to lower grades of lumber not heretofore embraced in the standard and that basic stresses for some properties in that standard be arbitrarily increased by 10 percent. These key changes in practice were imposed on both civilian and military use, although there was probably little civilian use during the war. But experience gained with the imposed changes over a half-dozen years demonstrated that the changes were acceptable, and after the war there was probably no compelling reason to return to earlier practices. So, strength ratio and basic stress tables in D 245 were changed, and SPR 16 (by now SPR 16-53) and industry grading rules were brought in line with D 245.

At the end of World War II, there was a pent-up demand for housing, the major use for lumber. In about the same timeframe, the Federal Housing Administration (FHA) came into being and began to impose requirements for lumber used in new construction supported by FHA financing. One of those

requirements was that the wood must be American Standard Lumber. Thus, ipso facto, this immense quantity of lumber had to be graded by the principles set in D 245. Since homebuilders were likely to take advantage of FHA financing, in effect almost all new construction would require American Standard Lumber.

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Growth and Controversy: 1955 to 1979

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Standards on Mechanical Properties of Wood

Post-war demand fostered a rapid increase in lumber and plywood production, much of it from western forests. Coast Douglas-fir and larch had been the traditional western species of choice, but supply and demand dictated the use of many other species. The FHA required that products from these species have design properties consistent with D 245, which generally put them at a competitive disadvantage (i.e., lower design properties for similar grade descriptions). The industry unrest that followed included challenges that FPL-derived basic stresses might not be relevant to current production, were inconsistently assigned to various species groups, and did not treat all regions of the country equally, as well as a host of other issues.

As a result of these issues, in 1960 FPL announced that it would no longer recommend basic stresses for wood but would continue to provide clear wood mechanical property data for individual species. This announcement suggested that Committee D-7 provided the broad representation needed for establishing basic stresses that took into account all pertinent technical and marketing issues.

The foment about the way design properties for wood products were derived set in motion at least two decades of research and development, much of it focused on sampling methods. Snodgrass and Noskowiak (1968) investigated the collection of samples for testing small clear specimens from current lumber production, rather than the methods prescribed in D 143. In collaboration with the western softwood industry, FPL used a "double sampling" method to infer clear wood strength properties from extensive but less costly sampling of specific gravity (USDA 1965). Shortly thereafter, FPL investigated random sampling of small clear specimens from forests (Bendtsen et al. 1970).

Committee D-7 was the vector for codifying many of these advancements. In 1963, D-7 realigned subcommittee responsibilities to enable more effective handling of the controversial issues related to clear wood properties. A new subcommittee assumed responsibility for establishing and publishing clear wood strength properties for individual species or regions, and for establishing criteria for assigning clear wood strength properties to any combination of species. Under this restructuring, basic stresses were no longer to be published in D 245. Product standards on lumber, plywood, laminated timber, and round timber would be responsible for procedures for establishing stresses for product grades from information provided by the clear wood subcommittee, giving appropriate consideration to the technical and marketing factors particular to each product.

A new standard, Methods for Establishing Clear Wood Strength Properties (D 2555-66T), was developed during this period. This standard used historical clear wood property data from both the United

States and Canada and new information from double sampling for some species and from random sampling for others. Specific criteria were given for calculating properties to assign to any combination of species grouped for marketing purposes. By 1970, voluntary product standards for softwood lumber and plywood used or referred to D 2555 as a basis for establishing species groupings.

A particularly significant new standard was D 2915-70T, Standard Practice for Evaluating Allowable Properties for Grades of Structural Lumber. This new practice introduced statistical methodology for sampling test material from a mill, lumberyard, geographical area, or entire species group such that authoritative judgments could be made about the properties of the population being evaluated. Especially noteworthy was that the practice introduced to D-7 standards the concept of assigning confidence levels to tolerance (content) limits developed from test results using either parametric (defined distribution) or nonparametric (distribution free) statistics. These concepts have been incorporated in many other D-7 standards.

In a major international effort in the mid-1970s, the North American In-Grade Testing Program was initiated to establish the key mechanical properties of dimension lumber by testing full-size pieces sampled from production (the Snodgrass and Noskowiak sampling concept), rather than by using clear wood properties.

Standards Development Takes Off

Standards D 2555 and D 2915 are just two of the 43 new standards developed by the committee after 1960, almost all of which continue to be published in updated form. This remarkable burst of activity occurred as regulatory agencies and user groups sought greater assurance that commodity wood products would provide satisfactory performance in service.

The 1970s saw the introduction of the first standards for deriving allowable properties for round timber piles (D 2899-70 and D 3200-74). In 1970, the glulam industry assumed responsibility for developing lamination grade and species combinations and related design values and so developed D 3737.

The ongoing need to assure regulatory agencies and users of the long-term decay and termite resistance of pressure-treated wood products continued to be reflected in the development of D-7 standards. Nineteen new specifications and test methods cover-



The Western Wood Density Survey provided information on nine species for formulating ASTM D 2555.

ing the content, analysis, evaluation, and treatment process for wood-preserving chemicals were introduced. Among these were the 1959 publication of specifications D 1624 and D 1625 and methods D 1627 and D 1628 for two waterborne salt treatments, ammoniacal copper arsenate (ACA) and chromated copper arsenate (CCA), marking a time of accelerating demand for these "clean" treatments in construction.

One of the most significant standards related to preservation issued in the history of Committee D-7 is D 1760-60, Standard Specification for Pressure Treatment of Timber Products. This standard is a virtual handbook of treating and penetration/retention information of importance to manufacturers and users of treated wood products. Included in each of seven tables is information on conditioning, the pressure treatment process, and results of treatment for each preservative solution (e.g., creosote, creosote-coal tar, pentachlorophenol, CCA, ACA) for each species or species group used for a particular timber product. The retention and penetration requirements provided for aboveground, ground contact, and coastal water uses are those required to assure long-term durability.

Two test methods related to the properties of fire-retardant chemicals were developed in the 1970s. One of these, D 2898-70T, provides a method for evaluating the durability of fire-retardant treatments of wood products under accelerated weathering. The impetus for this new method was the use of fire-retardant-treated wood shakes and shingles in the high-fire-risk brush areas of southern California. Standard D 2898 documents for regulatory agencies that the required flame spread rating of treated shakes and shingles as determined in the ASTM E 84 tunnel test is not changed by long-term exposure to the weather. The second fire treatment standard, D 3201-73T, was developed in response to chemical exudation and fastener corrosion problems associated with the use of interior fire-retardant-treated lumber in roof systems or other applications involving exposure to over 80 percent relative humidity.

Standard D 2017-62 involves evaluating the resistance of untreated wood to decay. It provides weight loss criteria for identifying decay-resistant species such as redwood and western redcedar for use in decks, sills, sleepers, and other aboveground applications.

The remaining 15 standards issued in this productive 25-year period deal with mechanical, physical, chemical analysis, and machining test methods; simulated service testing for flooring; and terminology. Seven standards involve test procedures for evaluating individual properties of plywood.

The strength of mechanical fasteners is a critical element in ensuring the satisfactory performance of wood structures. After World War II, university and industry research laboratories became increasingly involved in investigating the load-carrying capacity of different types of fasteners in both new and traditional wood products. Thus, the need for standard fastener test methods to assure reliable and comparable results was recognized. To meet this need, D 1761-60T was developed. This standard provides testing procedures for evaluating the withdrawal and lateral load resistance of nails, screws, bolts, and other types of connectors.

Since fastener design loads for mechanical connections are a function of species specific gravity and are classified on this basis, this overview of the third 25 years of Committee D-7 standardization activities concludes with reference to one of the Committee's most important fundamental test method standards, D 2395, Standard Test Methods for Specific Gravity of Wood and Wood-Based Materials, which was first issued in 1965. This method provides six different procedures for determining specific gravity, including volume by measurement, volume by water immersion, flotation, and increment core. Of particular significance are equations for converting specific gravity values to different moisture content bases, such as from a green volume basis as given in D 2555 to the oven-dry volume basis used for fasteners in the National Design Specification (AF&PA 1991).

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Completing the Century

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The demand for standardization of wood and wood-based products that developed during the first 75 years of Committee D-7 continued to build as the Committee completed its first century. The standards developed during the last 25 years reflect the industry trend to define product sufficiency in terms of performance-based criteria. In some cases, these changes have resulted in new performance-based standards such as D 6570, Practice for Assigning Allowable Properties for Mechanically Graded Lumber. But even the new prescriptive standards such as D 1990, Practice for Establishing Allowable Properties for Visually-Graded Dimension Lumber From In-Grade Tests of Full-Size Specimens, reflect these trends by utilizing test results of full-size lumber specimens rather than relying on the traditional clear wood properties of D 2555.

D-7	D-7	D-7	D-7	D-7	D-7	D-7	D-7	D-7	D-7
D-7	D07.01 – Fundamental test methods and properties								D-7
D-7	D07.01.01 – Physical test methods and properties								D-7
D-7	D07.01.03 – Mechanical test methods and properties								D-7
D-7	D07.01.04 – Methods and evaluation of duration of load and creep effects								D-7
D-7	D07.02 – Lumber and engineered wood products								D-7
D-7	D07.02.01 – Solid sawn timber								D-7
D-7	D07.02.02 – Glulam								D-7
D-7	D07.02.03 – Structural composite lumber								D-7
D-7	D07.02.04 – Prefabricated wood I-joints								D-7
D-7	D07.02.06 – Reliability-based design								D-7
D-7	D07.02.07 – Wood plastic composites								D-7
D-7	D07.03 – Panel products								D-7
D-7	D07.03.01 – Structural use panels								D-7
D-7	D07.03.02 – Fiber and particle panel materials								D-7
D-7	D07.04 – Pole and pile products								D-7
D-7	D07.05 – Wood assemblies								D-7
D-7	D07.05.02 – Wood connections								D-7
D-7	D07.05.03 – Repetitive members assemblies								D-7
D-7	D07.05.04 – Floor system assemblies								D-7
D-7	D07.06 – Treatments for wood products								D-7
D-7	D07.06.01 – Specifications and chemical analysis of wood preservatives								D-7
D-7	D07.06.02 – Product standards and treatment methods								D-7
D-7	D07.06.03 – Evaluation of preservatives								D-7
D-7	D07.07 – Fire performance of wood								D-7
D-7	D-7	D-7	D-7	D-7	D-7	D-7	D-7	D-7	D-7

Table 2. — D-7 subcommittees and sections.

This shift from the more traditional clear wood basis used in standards such as D 245 to an approach based more on product test results or performance as reflected in standards such as D 1990 and D 6570 was fostered by events in the wood products industry that had originated in the 1970s. The advent of ready access to testing equipment that could easily test full-size specimens of products such as lumber and glued laminated beams facilitated many research studies on these and other wood products. The resulting data called into question components of some prescriptive models used to establish allowable properties for wood and wood-based products.

The North American In-Grade Testing Program was the first major industry-sponsored program that attempted to characterize the structural properties of commercial lumber used in the United States by systematically sampling and testing full-size lumber specimens of several grades and species. This program is probably the most visible example of the changes occurring in the industry that were subsequently reflected in standards under the jurisdiction of Committee D-7 (Green et al. 1989). Many sampling procedures developed for the program were incorporated into D 2915. Test methods were incorporated into a new standard, D 4761, adopted in 1988. The analytical methodology used to derive allowable properties from the thou-

sands of data collected in the program was formalized into standard D 1990, adopted in 1991. This standard has become the de facto basis for the allowable properties used for all visually graded lumber used in the United States.

By the completion of the In-Grade Program in the mid-1980s, more than 70,000 full-size specimens of production lumber had been tested. In some cases, new standards were promulgated, such as D 1990; in other cases, standards were revised or expanded to provide for criteria based on tests of full-size components, such as D 3737 (glued laminated timber). While these changes in "traditional" standards were under development in D-7, the wood products industry was also developing new "engineered" products, such as parallel laminated veneer lumber, oriented strandboard, and structural I-joists. These products did not fit easily into the old clear wood prescriptive models for assigning allowable properties; they could be more easily accommodated by standards that set minimum product or test performance criteria. Standards such as D 5055 (I-joists) and D 5456 (composite lumber) were developed for these products.

As standards began to address these new products and data, it became clear that the structure of Committee D-7 did not provide adequate opportunity for review of the standards by representatives of other wood product lines. It also became clear that some needs for new standards did not fit well in the existing structure. The Committee was restructured in 1984 to address both of these concerns.

Historically, standards had been developed unique to specific products. D 2555 was the first standard to provide fundamental procedures that could be utilized by several product-specific standards. The new focus on product performance criteria resulting from new engineered products, and research on traditional products, also began to highlight other issues with broad product applicability. The reorganization of D-7 facilitated the Committee's ability to address these issues.

The Committee was divided into a number of subcommittees (Table 2). Fundamental test methods and properties were placed under the purview of subcommittee D07.01. All structural product standards that had been in separate product-specific subcommittees were consolidated into a single structural subcommittee (D07.02), with individual sections organized for each product line. This new structure ensured review of standards by all interested and affected committee members, and it also created a more streamlined and efficient process for standards development.



In-grade testing using portable equipment, 1980.

At times, Committee D-7 has been required to develop standards quickly in response to an urgent need. In the 1980s, some fire-retardant-treated lumber and panel products used in multi-family residential roof systems began to fail. Committee D-7 quickly began to develop standards to evaluate the effects of fire-retardant treatments on the structural properties of wood and wood-based products. In response to the urgency of the situation, standard ES 20-91 was first approved and published as an emergency standard. Emergency standards have been a seldom-used option in the long history of D-7, but were clearly appropriate in this circumstance. ES 20-91 was later balloted through the traditional committee process and approved as standard D 5516-94. A similar standard describing a test method for lumber, D 5664, was approved in 1995. Two additional standards, D 6305 and D 6513, were added in 1998 and 2000, respectively, to provide a standard practice for the development of appropriate fire-retardant-treatment adjustment factors.

The development of D 1990 is another example of the ability of Committee D-7 to quickly produce needed standards. This standard was written by a broad-based committee representing many segments of the wood products industry and other interested parties. And even though this standard broke new ground in many ways, it was completed in less than 4 years.

During the 1980s, the wood products industry also developed design methodologies that reflect the trend toward reliability based design concepts. The adopted protocol is referred to as Load Resistance Factor Design (LRFD) (AF&PA 1996) in the industry. In conjunction with the industry effort, Committee D-7

developed a new standard, D 5457, which provides a means for translating allowable properties developed according to the standards of D-7 to an appropriate value and format for use with LRFD.

Advances in testing and analysis of wood and wood-based products also prompted Committee D-7 to review existing standards in a new light, and some were revised in format to be more in line with the developing standards. Two examples of this effort were D 143 on the determination of clear wood properties and D 2016 on the determination of moisture content. In the case of D 143, the clear wood test methods were left intact in the standard, but the sampling procedures were removed and placed in a new standard, D 5536. In the case of D 2016, the revisions needed were such that D-7

felt it more appropriate to withdraw the standard and create two new standards, D 4442 and D 4444.

During this period, a number of new standards were also adopted relating to the performance of connectors used for wood, among these are D 5652 (bolted connections), D 5764 (metal shear plates), and D 5933 (dowel bearing). These standards were developed and adopted to reflect major changes in the design of fasteners and the determination of connector performance.

Meeting the Challenges of the Future

As Committee D-7 enters its second century, what are the prospects for the future? When asked this question, four trends were identified by people at the cutting edge of business, technology, and new product development: 1) a continuing trend toward globalization; 2) new products made of more than one type of material (composite materials); 3) an evolution from "standard products" to "product standards;" and 4) repercussions from advances in electronic technology.

Globalization

The direct implications of globalization for standards are fairly obvious. Multinational committees must assess the compatibility of standards from different countries. Differences in technical require-

ments, expressed in different terms and different languages, must be reconciled. The indirect implications of globalization are more profound. Manufacturers will continue to grow and consolidate. The needs of internationally focused companies will drive changes in U.S. standards development. These companies generally employ more sophisticated quality management systems than do smaller companies with a purely domestic focus.

Composite Materials

When is a glulam beam no longer a glulam beam? ASTM D 3737 includes the embedded judgment of more than 100 years of collective technical knowledge and manufacturing experience in its provisions. However, even today, Committee D-7 is testing the boundaries of this knowledge and experience. Is a glulam beam still a glulam beam when the tension ply on the outer face shifts from sawn lumber to laminated veneer lumber? How about when the entire tension zone is replaced with fiber-reinforced laminations?

In a more general sense, are there hidden limitations within our basic testing standards that make them unsuitable for use with composite products? These questions are already in the pipeline for D-7. And, as the range of new products containing new combinations of materials continues to expand, we must be prepared to answer increasingly tough questions in this regard.

Standard Products vs. Product Standards

In the early days of Committee D-7, the development of standard designations for commercial grades of lumber was a key goal. In a time when lumber was produced by thousands of small mills, it was in the best interests of both manufacturers and consumers to have standard grades and sizes available to the marketplace. This concept was carried over into standards for glulam and wood structural panels. However, when the next generation of engineered wood products (EWPs) was presented to ASTM for standardization, companies were looking for something dramatically different. The companies introducing these products had invested heavily in their development. Patents typically covered many aspects of the products and their manufacturing techniques. Because of the many variables in manufacturing processes, it was generally accepted that each manufacturer should be responsible for evaluating the performance characteristics of its own production. This is in stark con-

trast to the approach used for visually graded lumber, in which fewer manufacturing variables impact structural performance.

The development of standards to cover EWPs presented D-7 with a unique challenge: achieving a balance in maintaining minimum safety levels and providing the manufacturer flexibility to optimize product performance. The difference between the old and new approaches is often contrasted as follows: the "old" system defines a standard product, while the "new" system establishes a product standard.

Electronic Technology

Why would advances in electronic technology affect Committee D-7? After all, our scope of products includes lumber, plywood, and EWPs – not satellite phones and digital cameras. Here's a list of possible areas in which electronic technology will change D-7 standards:

- *Laboratory testing and data acquisition.* — Test machines continue to evolve. Data acquisition systems are more sophisticated and cost less than ever before. Some current standards contain limitations related to limits in the technology available at the time the standards were developed. As the equipment evolves, standards must evolve to take advantage of the additional information available.

- *Advanced engineering analysis tools.* — Historically, some conservatism was embedded in traditional designs as a result of the limitations of hand-based engineering calculations. As software-based designs continue to become more sophisticated, many structures will be designed with less conservatism. What are the implications of this change relative to our standardized safety factors?

- *Electronic monitoring systems.* — As electronic devices shrink in size and cost while expanding their capabilities, embedded devices will be able to "report" about the condition of structures. "Smart materials" will know when they are over-stressed or exposed to conditions likely to cause degradation. When coupled with radio-frequency transmission capability, they will be able to "talk" to remote receiving equipment. These radio-frequency identification tags will also be able to track individual structural members to the underlying quality assurance data from their production run. What new standards can help us to leverage these advances?

Other Challenges

In addition to facing these long-term challenges, Committee D-7 will need to remain vigilant to subtle

"erosion" in the relevance of current and historical standards as products and their applications continue to evolve.

Products. — We will continue to support our traditional products while concurrently supporting "improved" versions of those products (e.g., machine-graded versus visually graded lumber).

Applications. — We must continue to match the requirements of the standard to the type of application. For example, while a purely statistical approach to developing design values is appropriate for sawn lumber, it is incomplete for engineered trusses, for which engineering stress analysis is a more important starting point.

Summary

Committee D-7 will continue to be challenged by new products, new materials, new technologies, and new regulations. Some future issues can be anticipated, and some will be thrust upon us. At stake in these issues will be public safety, economic vitality, and the competitive position of the U.S. economy. D-7 has successfully faced these types of challenges in the past, and it will successfully face them in the future.

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The authors are, Supervisory Research General Engineer, USDA Forest Serv., Forest Prod. Lab., Madison, WI 53705; Former Department Head and Professor (retired), Dept. of Wood Science and Engineering, Oregon State Univ., Corvallis, OR; President, Wood Construction Technologies, Inc., McLean, VA; Executive Vice President, West Coast Lumber Inspection Bureau, Portland, OR; and P.E., Director of Code and Product Acceptance, Weyerhaeuser Technology Center, Federal Way, WA.