SPECIAL REPORT

Euro Lumber Creates Grading Confusion

U.S. building codes do not formally recognize all the lumber currently circulating in the U.S. market

BY TED CUSHMAN

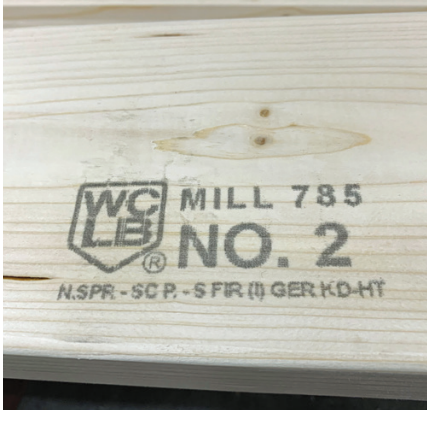
The COVID-19 pandemic has had a lot of ripple effects on the U.S. economy. Along with other factors, it has affected the supply of framing lumber in American lumberyards. Restricted supply of U.S. and Canadian lumber has led suppliers to look to Europe for wood to satisfy the high domestic demand. That means lumber produced in Europe has been showing up in U.S. lumberyards and home centers, and it may have different qualities than lumber from North America.

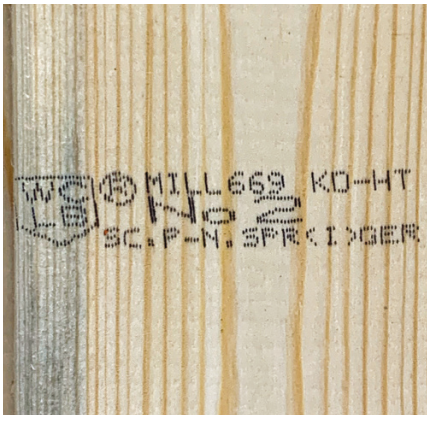
Background. Most lumber in the world market is visually graded. That is, a lumber grader at the sawmill looks at each piece and sorts the wood based on visual qualities—in particular, the size and number of knots in the wood. This characteristic is of aesthetic importance, but it also makes a difference in the structural performance of framing lumber in service.

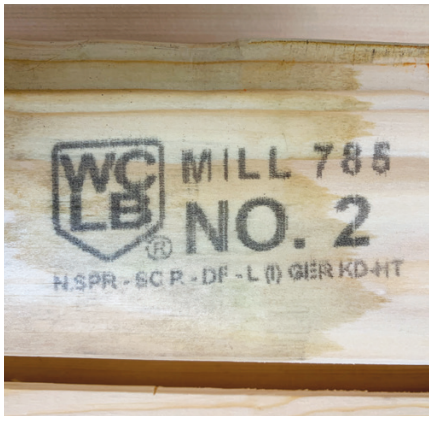
The structural strength of lumber also varies widely by species, and by the place where the wood was grown and harvested. That's why a grade stamp on a piece of framing lumber will specify the wood species and region of origin, not just the visual grade. Sometimes, species are grouped together based on their similarity in structural performance. So, you may see a piece of wood marked SYP, for southern yellow pine; this designation could refer to several different species of pine that grow in the southern U.S. "Hem fir," by the same token, might be hemlock or fir; the two species have comparable performance.

Each of the common species and species groupings in the U.S. market is routinely tested for structural characteristics under a lumber grading program developed by the American Lumber Standard Committee (ALSC), a voluntary standards group based in Washington, D.C. The ALSC publishes design values for the various species and grades of lumber, and engineers use those values to design wood structures.

European wrinkle. Mills in the U.S. usually process wood of a single species or species group, from a single region. But imported European lumber that's appearing in the market these days is coming from mills that process multiple species, grown in multiple regions. So, for example, wood may bear a grade stamp indicating that the lumber could be Scots pine from Germany, Norway spruce from Germany, Northeastern France, or Switzerland, or Douglas fir or European larch from Austria, the Czech Republic, or Bavaria. The mill just happens to process all those different kinds of logs. The







These lumber grade stamps were recently photographed on 2-by framing stock for sale at a large retail lumber chain. Design values published in March (see Table 4G excerpt, facing page) to cover the species identified on these stamps are different from the design values for the four North American categories currently recognized by U.S. building codes. Please note that the Pacific Lumber Inspection Bureau (or PLIB, as identified in Table 4G) merged operations with the West Coast Lumber Inspection Bureau, or WCLB (as identified on the grade stamps above).

Table 4G **Reference Design Values for Multi-Species and Country Grademarked Visually Graded Dimension Lumber (2" - 4" thick)**

(Tabulated design values are for normal load duration and dry service conditions. See NDS 4.3 for a comprehensive description of design value adjustment factors.)

USE WITH TABLE 4F ADJUSTMENT FACTORS

Multi-Species and Country Label	Commercial Grade	Size Classification	Design values in pounds per square inch (psi)							Specific Gravity	Grade Stamping Agency
			Bending	Tension parallel to grain	Shear parallel to grain	Compression perpendicular to grain	Compression parallel to grain	Modulus of Elasticity			
			F_b	F_t	F_v	$F_{c\perp}$	F_c	E	E_{min}	G	
N Spr-Sc P(I) GER	NORWAY SPRUCE & SCOTS PINE from GERMANY										PLIB
Tabulated design values are the minumum values for the following species and commercial grades in Table 4F: NORWAY SPRUCE from GERMANY, NE FRANCE, & SWITZERLAND & SCOTS PINE from GERMANY	Select Structural	2" & wider	1200	550	160	355	1200	1.6	0.58	0.42	
	No. 1		800	375	160	355	1050	1.4	0.51		
	No. 2		700	325	160	355	950	1.1	0.40		
	No. 3		400	175	160	355	550	1	0.37		
	Stud	2" & wider	550	250	160	355	600	1	0.37		
	Construction		800	375	160	355	1150	1.1	0.40		
	Standard	2" - 4" wide	450	200	160	355	975	1	0.37		
	Utility		225	100	160	355	625	0.9	0.33		
N Spr-Sc P(I) ROM N SPr-Sc P(I) ROM-UKR	NORWAY SPRUCE & SCOTS PINE from ROMANIA NORWAY SPRUCE & SCOTS PINE from ROMANIA & UKRAINE										PLIB
Tabulated design values are the minumum values for the following species and commercial grades in Table 4F: NORWAY SPRUCE from ROMANIA & UKRAINE & SCOTS PINE from CZECH REPUBLIC, ROMANIA, & UKRAINE	Select Structural	2" & wider	1250	575	100	270	1200	1.5	0.55	0.38	
	No. 1		850	375	100	270	1050	1.4	0.51		
	No. 2		725	325	100	270	950	1.2	0.44		
	No. 3		425	200	100	270	550	1.1	0.40		
	Stud	2" & wider	575	250	100	270	600	1.1	0.40		
	Construction		850	375	100	270	1200	1.1	0.40		
	Standard	2" - 4" wide	475	200	100	270	1000	1	0.37		
	Utility		225	100	100	270	650	1	0.37		

Unless an engineer can determine that import lumber is adequate for a given design, there is a risk that the structure as built may not comply with code. Table 4G (excerpt shown above), an addendum to the 2018 Edition of the Design Values for Wood Construction, allows engineers to evaluate a project design built with European wood varieties. In many cases, the design values for the European lumber currently circulating in the U.S. are lower than for spruce-pine-fir, the weakest code-listed U.S. category.

wrinkle is this: The various kinds of wood that are coming out of European mills may have very different structural characteristics, even if their visual grading is very similar. While a piece of wood might bear a "Number 2" grade stamp based on its visual characteristics, engineering properties such as fiber stress in bending, modulus of elasticity, or density (specific gravity) could vary widely within lumber supplies that bear the same stamp. This complicates things for engineers and code officials who are trying to design or inspect structures built with this Euro lumber.

As of today, the ICC codes in the U.S. don't formally recognize all those European species and countries of origin. Tables in the IRC refer to four North American categories: southern yellow pine (SYP), Douglas fir, hem-fir, and spruce-pine-fir (SPF). Requirements in the code are based on those species and the properties that go with those species. SPF is the weakest species grouping among the eight design values that engineers use in wood design.

Design values have been published for the European species now appearing in the U.S. But the process of design is complicated by the mixing of species and countries of origin within one grade. To figure out the value for a given design problem, an engineer would have to look at each of the design values for each species of imported wood, and select the lowest value for any given property.

Table 4G. Some of this work has now been done for us. The American Wood Council has just released an addendum to the 2018 Edition of the Design Values for Wood Construction (a supplement to the National Design Specification for Wood Construction) that lists design values for European wood varieties (see excerpt, above). Engineers at the AWC have sifted through the design values for each of the wood species and countries of origin that have associated grade stamps, and have created combined tables that already select for the lowest value in each property.

Significance to design engineers. In many cases, the design values are lower for the Euro wood than for SPF, the weakest North American category listed in the IRC. In the case of shear wall and connector performance, the specific gravity ("G" in the table above) is a controlling factor because of its influence on fastener performance; the weaker Euro woods could result in a significant reduction in the capacity of a shear wall. Similarly, specific gravity influences the gripping strength of truss plates; weaker Euro wood could significantly compromise the strength of critical truss connections if the design software is not adjusted to take the wood variations into account. And in high-wind regions, bending strength of lumber is significant for the resistance of walls to the lateral pressure of wind.

Significance to builders. Up until now, this lumber strength issue may not have had a recognizable significance to builders. But the issue has been circulating in the code community and is starting to be on the radar screens of code officials. Going forward, inspectors in the field could be flagging critical structures, such as shear walls, constructed with lumber that bears an unfamiliar stamp.

Contributing editor Ted Cushman reports on the construction industry from Hartland, Vt.