



European Spruces - The Rest Of The Story

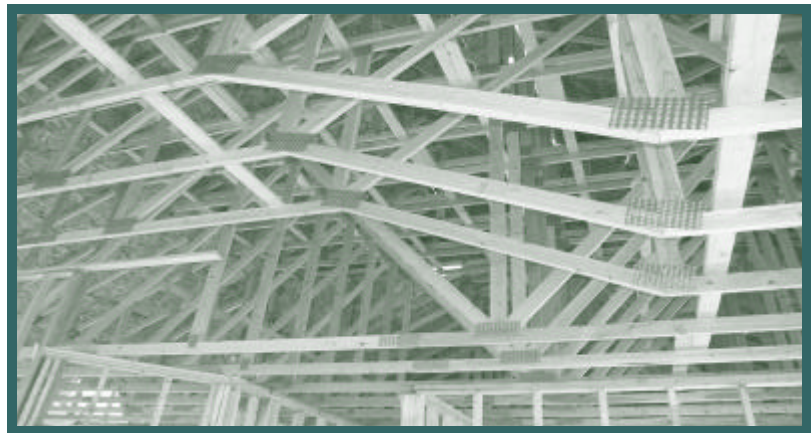
Introduction - Why All The Fuss?

Recently there have been a number of trade articles and other information circulating around the lumber industry alleging that Spruce-Pine-Fir from Canada is superior to European Spruce because allowable spans calculated for No. 2 grade S-P-F lumber are slightly greater than for the No. 2 grade spruces from Europe. While this is true, it does not tell the whole story. Several important facts have been omitted. The facts presented in this paper begin to set the record straight.

Fact No. 1

Select Structural spans for European Spruces equal or exceed S-P-F spans.

Because Select Structural grade has tighter grade specifications than other structural grades, the strength properties assigned to the grade are more reflective of the inherent strength of the wood. Table 1 provides a comparison of allowable spans for European spruces compared to Canadian S-P-F for several load conditions. It is clear from this comparison that European Spruce spans equal or exceed those for S-P-F. The table also includes a similar comparison for No. 1 grade. Many of these also equal or exceed S-P-F. More is explained below.



Fact No. 2

European Spruces are penalized for having too few near maximum knots.

The U.S. National Grading Rule for structural lumber uses the same limits for permitted characteristics or defects for each grade for all lumber species. As a result, lumber allowable properties can vary from species to species depending on the impact of these permitted characteristics on the species clear lumber strength and stiffness. Also, because the knot size and other characteristics are held constant for all species, species with few near maximum knots, create a problem when in-grade tested. In such cases, the test data must be “calibrated” to the grade description to cover the possibility that these near maximum knots could “possibly” occur.

When required, the grade “calibration” is accomplished by reducing the in-grade test data using what is called a grade quality index factor (GQI). The GQI factor attempts to lower the strength or stiffness value observed in the test data to ensure that if pieces with near maximum characteristics do occur in future lumber shipments, the assigned allowable properties are not non-conservative.

In the case of the North American species tested in the original in-grade testing program, no GQI adjustments were necessary. There were a sufficient number of lumber test specimens with near maximum characteristics that no adjustment was required. The European spruces, however, often did require adjustment. (continued next page)

Fact No. 2 (Cont.)

European Spruces are penalized for having too few near maximum knots.

Table 2 provides a listing of the typical GQI reductions applied to the European data sets No. 2 grade samples.

The values that are assigned to all grades of structural dimension lumber are based on just two grades, Select Structural and No. 2 grade. The test results for these two grades are critically important, especially No. 2 grade. No. 2 grade test data determines the values assigned to all other grades, except Select Structural and No. 1 grades. Select Structural grade is tested, and No. 1 grade is assigned properties based on both Select Structural and No. 2 grade test results.

Theoretically, the required GQI adjustment would be OK, except for two real problems. First, the relationship between the GQI estimate and the strength and stiffness of lumber, like many relationships, is not perfect. A fair amount of uncertainty can be assumed in the predictive equations. Secondly, the currently approved GQI adjustment procedures result in overly conservative values, at least for Modulus of Elasticity. The WCLIB has proposed alternate adjustment procedures to the American Lumber Standard Committee, and it anticipated that these will be approved shortly. To date, no one has disputed WCLIB's contention that the current procedures are overly conservative. Table 3 lists WCLIB's estimate of the likely impact of the present adjustment procedure on the test data.

Fact No. 3

European manufacturers do not typically identify and mark the higher grades which occur in their No. 2 and Better mix.

The WCLIB works with all member companies to ensure that all lumber grade marked by a WCLIB company is in full compliance with the minimum grade re-

Grading Rules No. 17. But, there is obviously no requirement to limit the amount of "better" lumber permitted in grades shipped by the mills. Many European manufacturers have chosen to grade stamp their No. 2 and Better lumber as straight No. 2. While this will yield a better appearing No. 2 grade product, it may also limit the ability of a consumer to fully utilize the values of the higher grade material included. WCLIB has begun encouraging its European members to grade and mark the higher grades occurring in their product mix. This will provide additional utilization options to their customers.

Fact No. 4

WCLIB is taking actions to revise current approved allowable Property development procedures to more accurately reflect the true performance of the European species.

As mentioned in Fact No. 2, the WCLIB has made a proposal to the ALSC to revise some of the present adjustment procedures to permit assignment of allowable properties which are more representative of the test performance of the European spruces. When these are approved, the European spruce allowable properties will likely be on a much more equitable basis relative to S-P-F. Also as mentioned in Fact No. 3, identifying and marking the higher grade material in the product mix will provide more structural use

Fact No. 5

Grandfather provisions in the ASTM Standard provide additional benefits to some species groups such as S-P-F.

The standard which is used to establish allowable properties for species and species combinations has procedures for combining two or more species into a single marketing group and assigning allowable properties which are appropriate for even the weakest species which is included in the grouping.

The procedures for forming a marketing group were used in the U.S. to establish the S-P-F South group from test data collected on the individual species. To obtain the currently approved allowable properties for S-P-F South, it was necessary to exclude Subalpine Fir from the group. The test results for Subalpine Fir would have required substantial reductions in assigned values for S-P-F South, if it were included. S-P-F from Canada does permit inclusion of Subalpine Fir in its mix. Its impact on the S-P-F values is not known because it was not tested separately. The ASTM standard permits exemption (or grandfathering) from the grouping requirements for species groups in existence at the time of original adoption of the standard (1991). S-P-F is one of these groups. While it is not possible to determine what effect, if any, such an analysis may have on assigned S-P-F values, the U.S. data may provide a reasonable estimate.

Conclusions:

There is a growing body of evidence that the European spruces are currently being under valued as a result of inequitable adjustment procedures, and grading procedures which do not fully reflect the higher lumber grades contained in No. 2 and Better grade shipments. The WCLIB is currently attempting to correct these identified inequities as ?

quickly as possible. Once changed, European spruces will be better positioned to fully market their proper structural performance.

Consumers and users of European spruces who have questions or comments regarding these issues may contact the West Coast Lumber Inspection Bureau at 503-639-0651; fax 503-684-8928; email bshelley@wclib.org.

TABLE 1

European Spruce Spans & Comparison to S-P-F

JOIST SPANS

SPANS ARE JOISTS OVER A SINGLE SPAN AND ARE FOR USE IN COVERED STRUCTURES.
 SPANS APPLY TO LUMBER SURFACED "GREEN" OR SURFACED "DRY" WHICH CONFORMS TO
 PS20-99 SIZES. APPLICABLE DESIGN CRITERIA ARE SHOWN IN THE HEADING FOR EACH TABLE

JOIST Size (in.)	Spac. (in.)	Aus. spr. - Austria/Czech Rep.	Norway spruce - Finland	Norway spruce - Germany	Norway spruce - Baltic States Estonia, Latvia, Lithuania	Norway spruce - Sweden	
		Select Structural					
		Span	Dif.	Span	Dif.	Span	Dif.

JOIST Size (in.)	Spac. (in.)	Aus. spr. - Austria/Czech Rep.	Norway spruce - Finland	Norway spruce - Germany	Norway spruce - Baltic States Estonia, Latvia, Lithuania	Norway spruce - Sweden	
		No. 1					
		Span	Dif.	Span	Dif.	Span	Dif.

FLOOR JOISTS - 10 PSF Dead Load/40 PSF Live Load

2x6	12	10 - 9	3	10 - 6	0	10 - 9	3	10 - 6	0	10 - 9	3
	16	9 - 9	3	9 - 6	0	9 - 9	3	9 - 6	0	9 - 9	3
	24	8 - 6	2	8 - 4	0	8 - 6	2	8 - 4	0	8 - 6	2
2x8	12	14 - 2	4	13 - 10	0	14 - 2	4	13 - 10	0	14 - 2	4
	16	12 - 10	3	12 - 7	0	12 - 10	3	12 - 7	0	12 - 10	3
	24	11 - 3	3	11 - 0	0	11 - 3	3	11 - 0	0	11 - 3	3
2x10	12	18 - 0	4	17 - 8	0	18 - 0	4	17 - 8	0	18 - 0	4
	16	16 - 5	5	16 - 0	0	16 - 5	5	16 - 0	0	16 - 5	5
	24	14 - 4	4	14 - 0	0	14 - 4	4	14 - 0	0	14 - 4	4
2x12	12	21 - 11	5	21 - 6	0	21 - 11	5	21 - 6	0	21 - 11	5
	16	19 - 11	5	19 - 6	0	19 - 11	5	19 - 6	0	19 - 11	5
	24	17 - 5	5	17 - 0	0	17 - 5	5	17 - 0	0	17 - 5	5

10 - 6	3	10 - 3	0	10 - 3	0	10 - 3	0	10 - 3	0
9 - 6	2	9 - 4	0	9 - 4	0	9 - 4	0	9 - 4	0
8 - 4	2	7 - 11	-3	7 - 9	-5	7 - 9	-5	7 - 11	-3
13 - 10	4	13 - 6	0	13 - 6	0	13 - 6	0	13 - 6	0
12 - 7	4	12 - 3	0	12 - 1	-2	12 - 1	-2	12 - 3	0
10 - 9	6	10 - 0	-3	9 - 10	-5	9 - 10	-5	10 - 0	-3
17 - 8	5	17 - 3	0	17 - 0	-3	17 - 0	-3	17 - 3	0
16 - 0	7	15 - 0	-5	14 - 9	-8	14 - 9	-8	15 - 0	-5
13 - 1	6	12 - 3	-4	12 - 0	-7	12 - 0	-7	12 - 3	-4
21 - 6	11	20 - 0	-7	19 - 8	-11	19 - 8	-11	20 - 0	-7
18 - 7	9	17 - 4	-6	17 - 1	-9	17 - 1	-9	17 - 4	-6
15 - 2	7	14 - 2	-5	13 - 11	-8	13 - 11	-8	14 - 2	-5

CEILING JOISTS - 10 PSF Dead Load/20 PSF Live Load/Drywall Ceiling/Limited Attic Storage

2x4	16	7 - 10	2	7 - 8	0	7 - 10	2	7 - 8	0	7 - 10	2
	24	6 - 10	2	6 - 8	0	6 - 10	2	6 - 8	0	6 - 10	2
2x6	16	12 - 3	3	12 - 0	0	12 - 3	3	12 - 0	0	12 - 3	3
	24	10 - 9	3	10 - 6	0	10 - 9	3	10 - 6	0	10 - 9	3
2x8	16	16 - 2	4	15 - 10	0	16 - 2	4	15 - 10	0	16 - 2	4
	24	14 - 2	4	13 - 10	0	14 - 2	4	13 - 10	0	14 - 2	4
2x10	16	20 - 8	6	20 - 2	0	20 - 8	6	20 - 2	0	20 - 8	6
	24	18 - 0	4	17 - 8	0	18 - 0	4	17 - 8	0	18 - 0	4
2x12	16	25 - 1	6	24 - 7	0	25 - 1	6	24 - 7	0	25 - 1	6
	24	21 - 11	5	21 - 6	0	21 - 11	5	21 - 6	0	21 - 11	5

7 - 8	2	7 - 6	0	7 - 6	0	7 - 6	0	7 - 6	0
6 - 8	2	6 - 6	0	6 - 6	0	6 - 6	0	6 - 6	0
12 - 0	3	11 - 9	0	11 - 9	0	11 - 9	0	11 - 9	0
10 - 6	3	10 - 2	-1	10 - 0	-3	10 - 0	-3	10 - 2	-1
15 - 10	4	15 - 6	0	15 - 6	0	15 - 6	0	15 - 6	0
13 - 10	7	12 - 11	-4	12 - 8	-7	12 - 8	-7	12 - 11	-4
20 - 2	5	19 - 4	-5	19 - 0	-9	19 - 0	-9	19 - 4	-5
16 - 11	8	15 - 9	-6	15 - 6	-9	15 - 6	-9	15 - 9	-6
24 - 0	12	22 - 4	-8	22 - 0	-12	22 - 0	-12	22 - 4	-8
19 - 7	9	18 - 3	-7	18 - 0	-10	18 - 0	-10	18 - 3	-7

CEILING JOISTS - 5 PSF Dead Load/10 PSF Live Load/Drywall Ceiling/No Attic Storage

2x4	16	9 - 10	2	9 - 8	0	9 - 10	2	9 - 8	0	9 - 10	2
	24	8 - 7	2	8 - 5	0	8 - 7	2	8 - 5	0	8 - 7	2
2x6	16	15 - 6	4	15 - 2	0	15 - 6	4	15 - 2	0	15 - 6	4
	24	13 - 6	3	13 - 3	0	13 - 6	3	13 - 3	0	13 - 6	3
2x8	16	20 - 5	6	19 - 11	0	20 - 5	6	19 - 11	0	20 - 5	6
	24	17 - 10	5	17 - 5	0	17 - 10	5	17 - 5	0	17 - 10	5
2x10	16	26 - 0	7	25 - 5	0	26 - 0	7	25 - 5	0	26 - 0	7
	24	22 - 9	6	22 - 3	0	22 - 9	6	22 - 3	0	22 - 9	6
2x12	16	31 - 8	9	30 - 11	0	31 - 8	9	30 - 11	0	31 - 8	9
	24	27 - 8	7	27 - 1	0	27 - 8	7	27 - 1	0	27 - 8	7

9 - 8	3	9 - 5	0	9 - 5	0	9 - 5	0	9 - 5	0
8 - 5	2	8 - 3	0	8 - 3	0	8 - 3	0	8 - 3	0
15 - 2	5	14 - 9	0	14 - 9	0	14 - 9	0	14 - 9	0
13 - 3	4	12 - 11	0	12 - 11	0	12 - 11	0	12 - 11	0
19 - 11	5	19 - 6	0	19 - 6	0	19 - 6	0	19 - 6	0
17 - 5	5	17 - 0	0	17 - 0	0	17 - 0	0	17 - 0	0
25 - 5	7	24 - 10	0	24 - 10	0	24 - 10	0	24 - 10	0
22 - 3	6	21 - 9	0	21 - 9	0	21 - 9	0	21 - 9	0
30 - 11	8	30 - 3	0	30 - 3	0	30 - 3	0	30 - 3	0
27 - 1	8	25 - 10	-7	25 - 5	-12	25 - 5	-12	25 - 10	-7

SPANS ARE CALCULATED USING REPETITIVE MEMBER VALUES INCREASED BY 15% FOR TWO MONTH DURATION OF LOADING AS FOR SNOW.

SPANS ARE SHOWN IN FEET - INCHES. DIFFERENCE COLUMN SHOWS SPAN DIFFERENCE RELATIVE TO S-P-F (negative numbers signify spans shorter than S-P-F).

- Spans greater than S-P-F
- Spans equal to S-P-F

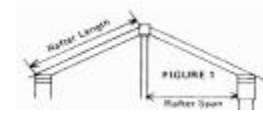


TABLE 1 (cont.)

European Spruce Spans & Comparison to S-P-F

RAFTER SPANS

SPANS ARE FOR RAFTERS USED IN COVERED STRUCTURES. SPANS APPLY TO LUMBER SURFACED "GREEN" OR SURFACED "DRY" WHICH CONFORMS TO PS20-99 SIZES. APPLICABLE DESIGN CRITERIA ARE SHOWN IN THE HEADING FOR EACH TABLE. RAFTER SPANS ARE MEASURED ALONG THE HORIZONTAL PROJECTION (SEE FIGURE 1).



JOIST Size (in.)	Spac. (in.)	Select Structural									
		Aus. spr. - Austria/Czech Rep.		Norway spruce - Finland		Norway spruce - Germany		Norway spruce - Baltic States Estonia, Latvia, Lithuania		Norway spruce - Sweden	
		Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.

No. 1											
Aus. spr. - Austria/Czech Rep.		Norway spruce - Finland		Norway spruce - Germany		Norway spruce - Baltic States Estonia, Latvia, Lithuania		Norway spruce - Sweden			
		Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.

RAFTER SPANS -- 15 PSF Dead Load/20 PSF Live Load/Drywall Ceiling/All Slopes

2x6	16	14 - 1	4	13 - 9	0	14 - 1	4	13 - 9	0	14 - 1	4
	24	12 - 3	3	12 - 0	0	12 - 3	3	12 - 0	0	12 - 3	3
2x8	16	18 - 6	4	18 - 2	0	18 - 6	4	18 - 2	0	18 - 6	4
	24	16 - 2	5	15 - 10	1	15 - 9	0	15 - 5	-4	15 - 9	0
2x10	16	23 - 8	6	23 - 2	0	23 - 7	5	23 - 1	-1	23 - 7	5
	24	20 - 8	17	20 - 0	9	19 - 3	0	18 - 10	-5	19 - 3	0
2x12	16	28 - 9	17	28 - 2	10	27 - 4	0	26 - 9	-7	27 - 4	0
	24	24 - 0	20	23 - 2	10	22 - 4	0	21 - 10	-6	22 - 4	0

13 - 3	6	12 - 5	-4	12 - 2	-7	12 - 2	-7	12 - 5	-4
10 - 10	5	10 - 1	-4	9 - 11	-6	9 - 11	-6	10 - 1	-4
16 - 10	8	15 - 8	-6	15 - 5	-9	15 - 5	-9	15 - 8	-6
13 - 9	7	12 - 10	-4	12 - 7	-7	12 - 7	-7	12 - 10	-4
20 - 7	10	19 - 2	-7	18 - 10	-11	18 - 10	-11	19 - 2	-7
16 - 9	8	15 - 8	-5	15 - 5	-8	15 - 5	-8	15 - 8	-5
23 - 10	12	22 - 2	-8	21 - 10	-12	21 - 10	-12	22 - 2	-8
19 - 5	9	18 - 2	-6	17 - 10	-10	17 - 10	-10	18 - 2	-6

RAFTER SPANS -- 15 PSF Dead Load/30 PSF Live Load/Drywall Ceiling/All Slopes

2x6	16	12 - 3	3	12 - 0	0	12 - 3	3	12 - 0	0	12 - 3	3
	24	10 - 9	3	10 - 6	0	10 - 9	3	10 - 6	0	10 - 9	3
2x8	16	16 - 2	4	15 - 10	0	16 - 2	4	15 - 10	0	16 - 2	4
	24	14 - 2	4	13 - 10	0	13 - 11	1	13 - 7	-3	13 - 11	1
2x10	16	20 - 8	6	20 - 2	0	20 - 8	6	20 - 2	0	20 - 8	6
	24	18 - 0	12	17 - 8	8	17 - 0	0	16 - 8	-4	17 - 0	0
2x12	16	25 - 1	12	24 - 7	6	24 - 1	0	23 - 7	-6	24 - 1	0
	24	21 - 2	18	20 - 5	9	19 - 8	0	19 - 3	-5	19 - 8	0

11 - 9	6	10 - 11	-4	10 - 9	-6	10 - 9	-6	10 - 11	-4
9 - 7	5	8 - 11	-3	8 - 9	-5	8 - 9	-5	8 - 11	-3
14 - 10	7	13 - 10	-5	13 - 7	-8	13 - 7	-8	13 - 10	-5
12 - 1	5	11 - 3	-5	11 - 1	-7	11 - 1	-7	11 - 3	-5
18 - 1	8	16 - 11	-6	16 - 8	-9	16 - 8	-9	16 - 11	-6
14 - 10	7	13 - 10	-5	13 - 7	-8	13 - 7	-8	13 - 10	-5
21 - 0	10	19 - 7	-7	19 - 3	-11	19 - 3	-11	19 - 7	-7
17 - 2	8	16 - 0	-6	15 - 9	-9	15 - 9	-9	16 - 0	-6

RAFTER SPANS -- 15 PSF Dead Load/40 PSF Live Load/Drywall Ceiling/All Slopes

2x6	16	11 - 2	3	10 - 11	0	11 - 2	3	10 - 11	0	11 - 2	3
	24	9 - 9	3	9 - 6	0	9 - 9	3	9 - 6	0	9 - 9	3
2x8	16	14 - 8	3	14 - 5	0	14 - 8	3	14 - 5	0	14 - 8	3
	24	12 - 10	3	12 - 7	0	12 - 7	0	12 - 4	-3	12 - 7	0
2x10	16	18 - 9	5	18 - 4	0	18 - 9	5	18 - 4	0	18 - 9	5
	24	16 - 5	13	15 - 11	7	15 - 4	0	15 - 1	-3	15 - 4	0
2x12	16	22 - 10	12	22 - 4	6	21 - 10	0	21 - 4	-6	21 - 10	0
	24	19 - 2	16	18 - 6	8	17 - 10	0	17 - 5	-5	17 - 10	0

10 - 7	5	9 - 11	-3	9 - 9	-5	9 - 9	-5	9 - 11	-3
8 - 8	4	8 - 1	-3	7 - 11	-5	7 - 11	-5	8 - 1	-3
13 - 5	6	12 - 6	-5	12 - 4	-7	12 - 4	-7	12 - 6	-5
10 - 11	5	10 - 3	-3	10 - 1	-5	10 - 1	-5	10 - 3	-3
16 - 5	8	15 - 4	-5	15 - 1	-8	15 - 1	-8	15 - 4	-5
13 - 5	7	12 - 6	-4	12 - 3	-7	12 - 3	-7	12 - 6	-4
19 - 0	9	17 - 9	-6	17 - 5	-10	17 - 5	-10	17 - 9	-6
15 - 6	7	14 - 6	-5	14 - 3	-8	14 - 3	-8	14 - 6	-5

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Spans greater than S-P-F
 Spans equal to S-P-F

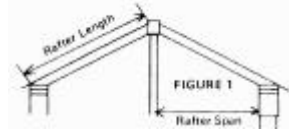


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JOIST Size (in.)	Spac. (in.)	Sel. Str.									
		Aus. spr. - Austria/Czech Rep.		Norway spruce - Finland		Norway spruce - Germany		Norway spruce - Baltic States Estonia, Latvia, Lithuania		Norway spruce - Sweden	
		Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.

No. 1											
Aus. spr. - Austria/Czech Rep.		Norway spruce - Finland		Norway spruce - Germany		Norway spruce - Baltic States Estonia, Latvia, Lithuania		Norway spruce - Sweden			
		Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.

RAFTER SPANS -- 10 PSF Dead Load/20 PSF Live Load/No Finish Ceiling/3:12 or Less Slope

2x6	16	14 - 1	4	13 - 9	0	14 - 1	4	13 - 9	0	14 - 1	4
	24	12 - 3	3	12 - 0	0	12 - 3	3	12 - 0	0	12 - 3	3
2x8	16	18 - 6	4	18 - 2	0	18 - 6	4	18 - 2	0	18 - 6	4
	24	16 - 2	4	15 - 10	0	16 - 2	4	15 - 10	0	16 - 2	4
2x10	16	23 - 8	6	23 - 2	0	23 - 8	6	23 - 2	0	23 - 8	6
	24	20 - 8	6	20 - 2	0	20 - 8	6	20 - 2	0	20 - 8	6
2x12	16	28 - 9	7	28 - 2	0	28 - 9	7	28 - 2	0	28 - 9	7
	24	25 - 1	12	24 - 7	6	24 - 1	0	23 - 7	-6	24 - 1	0

13 - 9	4	13 - 5	0	13 - 2	-3	13 - 2	-3	13 - 5	0
11 - 9	6	10 - 11	-4	10 - 9	-6	10 - 9	-6	10 - 11	-4
18 - 2	9	16 - 11	-6	16 - 8	-9	16 - 8	-9	16 - 11	-6
14 - 10	7	13 - 10	-5	13 - 7	-8	13 - 7	-8	13 - 10	-5
22 - 2	10	20 - 9	-7	20 - 4	-12	20 - 4	-12	20 - 9	-7
18 - 1	8	16 - 11	-6	16 - 8	-9	16 - 8	-9	16 - 11	-6
25 - 9	13	24 - 0	-8	23 - 7	-13	23 - 7	-13	24 - 0	-8
21 - 0	10	19 - 7	-7	19 - 3	-11	19 - 3	-11	19 - 7	-7

RAFTER SPANS -- 10 PSF Dead Load/30 PSF Live Load/No Finish Ceiling/3:12 or Less Slope

2x6	16	12 - 3	3	12 - 0	0	12 - 3	3	12 - 0	0	12 - 3	3
	24	10 - 9	3	10 - 6	0	10 - 9	3	10 - 6	0	10 - 9	3
2x8	16	16 - 2	4	15 - 10	0	16 - 2	4	15 - 10	0	16 - 2	4
	24	14 - 2	4	13 - 10	0	14 - 2	4	13 - 10	0	14 - 2	4
2x10	16	20 - 8	6	20 - 2	0	20 - 8	6	20 - 2	0	20 - 8	6
	24	18 - 0	4	17 - 8	0	18 - 0	4	17 - 8	0	18 - 0	4
2x12	16	25 - 1	6	24 - 7	0	25 - 1	6	24 - 7	0	25 - 1	6
	24	21 - 11	12	21 - 6	7	20 - 11	0	20 - 5	-6	20 - 11	0

12 - 0	3	11 - 7	-2	11 - 5	-4	11 - 5	-4	11 - 7	-2
10 - 2	5	9 - 6	-3	9 - 4	-5	9 - 4	-5	9 - 6	-3
15 - 9	8	14 - 8	-5	14 - 5	-8	14 - 5	-8	14 - 8	-5
12 - 10	6	12 - 0	-4	11 - 9	-7	11 - 9	-7	12 - 0	-4
19 - 3	9	17 - 11	-7	17 - 8	-10	17 - 8	-10	17 - 11	-7
15 - 8	7	14 - 8	-5	14 - 5	-8	14 - 5	-8	14 - 8	-5
22 - 3	10	20 - 9	-8	20 - 5	-12	20 - 5	-12	20 - 9	-8
18 - 2	8	17 - 0	-6	16 - 8	-10	16 - 8	-10	17 - 0	-6

RAFTER SPANS -- 10 PSF Dead Load/40 PSF Live Load/No Finish Ceiling/3:12 or Less Slope

2x6	16	11 - 2	3	10 - 11	0	11 - 2	3	10 - 11	0	11 - 2	3
	24	9 - 9	3	9 - 6	0	9 - 9	3	9 - 6	0	9 - 9	3
2x8	16	14 - 8	3	14 - 5	0	14 - 8	3	14 - 5	0	14 - 8	3
	24	12 - 10	3	12 - 7	0	12 - 10	3	12 - 7	0	12 - 10	3
2x10	16	18 - 9	5	18 - 4	0	18 - 9	5	18 - 4	0	18 - 9	5
	24	16 - 5	5	16 - 0	0	16 - 1	1	15 - 9	-3	16 - 1	1
2x12	16	22 - 10	6	22 - 4	0	22 - 10	6	22 - 4	0	22 - 10	6
	24	19 - 11	15	19 - 5	9	18 - 8	0	18 - 4	-4	18 - 8	0

10 - 11	3	10 - 4	-4	10 - 2	-6	10 - 2	-6	10 - 4	-4
9 - 1	4	8 - 6	-3	8 - 4	-5	8 - 4	-5	8 - 6	-3
14 - 1	7	13 - 1	-5	12 - 11	-7	12 - 11	-7	13 - 1	-5
11 - 6	6	10 - 9	-3	10 - 7	-5	10 - 7	-5	10 - 9	-3
17 - 2	8	16 - 1	-5	15 - 9	-9	15 - 9	-9	16 - 1	-5
14 - 0	6	13 - 1	-5	12 - 11	-7	12 - 11	-7	13 - 1	-5
19 - 11	9	18 - 7	-7	18 - 4	-10	18 - 4	-10	18 - 7	-7
16 - 3	8	15 - 2	-5	14 - 11	-8	14 - 11	-8	15 - 2	-5

SPANS ARE CALCULATED USING REPETITIVE MEMBER VALUES INCREASED BY 15% FOR TWO MONTH DURATION OF LOADING AS FOR SNOW.

SPANS ARE SHOWN IN FEET - INCHES. DIFFERENCE COLUMN SHOWS SPAN DIFFERENCE RELATIVE TO S-P-F (negative numbers signify spans shorter than S-P-F).

Spans greater than S-P-F
 Spans equal to S-P-F

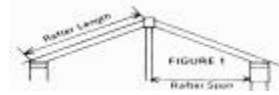


TABLE 1 (cont.)

European Spruce Spans & Comparison to S-P-F

RAFTER SPANS

SPANS ARE FOR RAFTERS USED IN COVERED STRUCTURES. SPANS APPLY TO LUMBER SURFACED "GREEN" OR OR SURFACED "DRY" WHICH CONFORMS TO PS20-99 SIZES. APPLICABLE DESIGN CRITERIA ARE SHOWN IN THE HEADING FOR EACH TABLE. RAFTER SPANS ARE MEASURED ALONG THE HORIZONTAL PROJECTION (SEE FIGURE 1).



RAFTER		Aus. spr. - Austria/Czech Rep.		Norway spruce - Finland		Norway spruce - Germany		Norway spruce - Baltic States Estonia, Latvia, Lithuania		Norway spruce - Sweden	
Size (in.)	Spac. (in.)	Select Structural									
Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.

RAFTER		Aus. spr. - Austria/Czech Rep.		Norway spruce - Finland		Norway spruce - Germany		Norway spruce - Baltic States Estonia, Latvia, Lithuania		Norway spruce - Sweden	
Size (in.)	Spac. (in.)	No. 1									
Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.	Span	Dif.

RAFTER SPANS -- 7 PSF Dead Load/20 PSF Live Load/Light Roof/Slope Over 3:12

2x4	16	9 - 10	2	9 - 8	0	9 - 10	2	9 - 8	0	9 - 10	2
	24	8 - 7	2	8 - 5	0	8 - 7	2	8 - 5	0	8 - 7	2
2x6	16	15 - 6	4	15 - 2	0	15 - 6	4	15 - 2	0	15 - 6	4
	24	13 - 6	3	13 - 3	0	13 - 6	3	13 - 3	0	13 - 6	3
2x8	16	20 - 5	6	19 - 11	0	20 - 5	6	19 - 11	0	20 - 5	6
	24	17 - 10	5	17 - 5	0	17 - 10	5	17 - 5	0	17 - 10	5
2x10	16	26 - 0	7	25 - 5	0	26 - 0	7	25 - 5	0	26 - 0	7
	24	22 - 9	10	22 - 3	4	21 - 11	0	21 - 6	-5	21 - 11	0

9 - 8	3	9 - 5	0	9 - 5	0	9 - 5	0	9 - 5	0	9 - 5	0
8 - 5	4	7 - 10	-3	7 - 9	-4	7 - 9	-4	7 - 10	-3		
15 - 1	7	14 - 1	-5	13 - 11	-7	13 - 11	-7	14 - 1	-5		
12 - 4	6	11 - 6	-4	11 - 4	-6	11 - 4	-6	11 - 6	-4		
19 - 2	9	17 - 10	-7	17 - 7	-10	17 - 7	-10	17 - 10	-7		
15 - 8	8	14 - 7	-5	14 - 4	-8	14 - 4	-8	14 - 7	-5		
23 - 5	11	21 - 10	-8	21 - 6	-12	21 - 6	-12	21 - 10	-8		
19 - 1	9	17 - 10	-6	17 - 6	-10	17 - 6	-10	17 - 10	-6		

RAFTER SPANS -- 7 PSF Dead Load/30 PSF Live Load/Light Roof/Slope Over 3:12

2x4	16	8 - 7	2	8 - 5	0	8 - 7	2	8 - 5	0	8 - 7	2
	24	7 - 6	2	7 - 4	0	7 - 6	2	7 - 4	0	7 - 6	2
2x6	16	13 - 6	3	13 - 3	0	13 - 6	3	13 - 3	0	13 - 6	3
	24	11 - 10	3	11 - 7	0	11 - 10	3	11 - 7	0	11 - 10	3
2x8	16	17 - 10	5	17 - 5	0	17 - 10	5	17 - 5	0	17 - 10	5
	24	15 - 7	4	15 - 3	0	15 - 4	1	15 - 0	-3	15 - 4	1
2x10	16	22 - 9	6	22 - 3	0	22 - 9	6	22 - 3	0	22 - 9	6
	24	19 - 10	13	19 - 5	8	18 - 9	0	18 - 4	-5	18 - 9	0

8 - 5	2	8 - 3	0	8 - 1	-2	8 - 1	-2	8 - 3	0		
7 - 3	4	6 - 9	-2	6 - 7	-4	6 - 7	-4	6 - 9	-2		
12 - 11	6	12 - 1	-4	11 - 10	-7	11 - 10	-7	12 - 1	-4		
10 - 7	5	9 - 10	-4	9 - 8	-6	9 - 8	-6	9 - 10	-4		
16 - 4	8	15 - 3	-5	15 - 0	-8	15 - 0	-8	15 - 3	-5		
13 - 4	6	12 - 5	-5	12 - 3	-7	12 - 3	-7	12 - 5	-5		
20 - 0	10	18 - 8	-6	18 - 4	-10	18 - 4	-10	18 - 8	-6		
16 - 4	8	15 - 3	-5	15 - 0	-8	15 - 0	-8	15 - 3	-5		

RAFTER SPANS -- 7 PSF Dead Load/40 PSF Live Load/Light Roof/Slope Over 3:12

2x4	16	7 - 10	2	7 - 8	0	7 - 10	2	7 - 8	0	7 - 10	2
	24	6 - 10	2	6 - 8	0	6 - 10	2	6 - 8	0	6 - 10	2
2x6	16	12 - 3	3	12 - 0	0	12 - 3	3	12 - 0	0	12 - 3	3
	24	10 - 9	3	10 - 6	0	10 - 9	3	10 - 6	0	10 - 9	3
2x8	16	16 - 2	4	15 - 10	0	16 - 2	4	15 - 10	0	16 - 2	4
	24	14 - 2	7	13 - 10	3	13 - 7	0	13 - 4	-3	13 - 7	0
2x10	16	20 - 8	6	20 - 2	0	20 - 4	2	19 - 11	-3	20 - 4	2
	24	17 - 11	16	17 - 3	8	16 - 7	0	16 - 3	-4	16 - 7	0

7 - 8	2	7 - 4	-2	7 - 2	-4	7 - 2	-4	7 - 4	-2		
6 - 5	3	6 - 0	-2	5 - 10	-4	5 - 10	-4	6 - 0	-2		
11 - 6	6	10 - 8	-4	10 - 6	-6	10 - 6	-6	10 - 8	-4		
9 - 4	4	8 - 9	-3	8 - 7	-5	8 - 7	-5	8 - 9	-3		
14 - 6	7	13 - 6	-5	13 - 4	-7	13 - 4	-7	13 - 6	-5		
11 - 10	5	11 - 1	-4	10 - 11	-6	10 - 11	-6	11 - 1	-4		
17 - 9	9	16 - 7	-5	16 - 3	-9	16 - 3	-9	16 - 7	-5		
14 - 6	7	13 - 6	-5	13 - 3	-8	13 - 3	-8	13 - 6	-5		

SPANS ARE CALCULATED USING REPETITIVE MEMBER VALUES INCREASED BY 15% FOR TWO MONTH DURATION OF LOADING AS FOR SNOW.

SPANS ARE SHOWN IN FEET - INCHES. DIFFERENCE COLUMN SHOWS SPAN DIFFERENCE RELATIVE TO S-P-F (negative numbers signify spans shorter than S-P-F).

- Spans greater than S-P-F
- Spans equal to S-P-F



TABLE 2
Reduction of Test Data Due to Grade
Quality Index Adjustment

Country	Lumber Nominal Width (in.)	Reduction for GQI (%)
Austria/Czech Republic	4	15.1%
	6	10.4%
	8	24.7%
	Average adjustment	16.7%
Finland	4	0.0%
	6	0.0%
	8	15.1%
	Average adjustment	5.0%
Germany	4	26.7%
	6	15.1%
	8	15.1%
	Average adjustment	19.0%
Lithuania*	4	15.4%
	6	18.6%
	8	19.4%
	Average adjustment	17.8%
Estonia**	4	14.3%
	6	0.0%
	8	15.1%
	Average adjustment	9.8%
Sweden	4	19.2%
	6	17.0%
	8	22.3%
	Average adjustment	19.5%

* Data subsequently merged with Estonia and Latvia data

** Data subsequently merged with Lithuania and Latvia data

Latvian data not analyzed separate of other Baltic countries



The *Quality* Stamp

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