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Exterior Wall Construction in High Wind Zones

Code: 2018 NC Residential Code **Date:** May 5, 2021
Section: Chapter 4505

Question:

Can European species lumber be used for exterior wall construction and meet the requirements of Section R4505?

Answer:

Yes. Based on the allowable stud lengths from tables listed in *Technical Report #5* developed by Pacific Lumber Inspection Bureau (PLIB), here is the maximum exterior wall stud lengths for Austrian Spruce (Picea excelsa), Norway Spruce (Picea abies), Scots Pine (Pinus sylvestris), Douglas Fir, and Silver Fir (Abies alba) from various European countries:

(See Table Footnotes for assumptions and limitations applied in Table 1-3)

Table 1:

2x4 studs; #2 Grade; Exposure Category B									
	130 MPH			140 MPH			150 MPH		
	STUD SPACING			STUD SPACING			STUD SPACING		
SPECIES	12"	16"	24"	12"	16"	24"	12"	16"	24"
Austrian Spruce - Austria & The Czech Republic (Picea excelsa)	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"
Norway Spruce - Estonia, Latvia, & Lithuania	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10' - 0"	10'-0"	10'-0"	9' - 7"
Norway Spruce - Finland	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	9' - 9"	10'-0"	10'-0"	9' - 4"
Norway Spruce - Germany, NE France, & Switzerland	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	9' - 9"	10'-0"	10'-0"	9' - 4"
Norway Spruce - Norway	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10' - 0"	10'-0"	10'-0"	9' - 7"
Norway Spruce - Romania & Ukraine	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	9' - 9"	10'-0"	10'-0"	9' - 4"
Norway Spruce - Sweden	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	9' - 9"	10'-0"	10'-0"	9' - 4"
Scots Pine - Austria, The Czech Republic, Romania, & Ukraine	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	9' - 10"
Scots Pine - Estonia, Latvia, & Lithuania	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	9' - 9"	10'-0"	10'-0"	9' - 4"
Scots Pine - Finland	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10' - 0"	10'-0"	10'-0"	9' - 7"
Scots Pine - Germany	10'-0"	10'-0"	10' - 0"	10'-0"	10'-0"	9' - 6"	10'-0"	10'-0"	9' - 0"
Scots Pine - Sweden	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	9' - 9"	10'-0"	10'-0"	9' - 1"
Douglas Fir - France & Germany	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"
Douglas Fir / European Larch - Austria, The Czech Republic & Bavaria	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"
Silver Fir (Abies alba) - Germany, NE France, & Switzerland	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10' - 0"	10'-0"	10'-0"	9' - 7"

Table 2:

2x4 studs; #2 Grade; Exposure Category C									
	130 MPH			140 MPH			150 MPH		
	STUD SPACING			STUD SPACING			STUD SPACING		
SPECIES	12"	16"	24"	12"	16"	24"	12"	16"	24"
Austrian Spruce - Austria & The Czech Republic (Picea excelsa)	10'-0"	10'-0"	9' - 11"	10'-0"	10'-0"	9' - 5"	10'-0"	10'-0"	9' - 0"
Norway Spruce - Estonia, Latvia, & Lithuania	10'-0"	10'-0"	9' - 5"	10'-0"	10'-0"	8' - 11"	10'-0"	9' - 10"	8' - 6"
Norway Spruce - Finland	10'-0"	10'-0"	9' - 2"	10'-0"	10' - 0"	8' - 7"	10'-0"	9' - 7"	8' - 0"
Norway Spruce - Germany, NE France, & Switzerland	10'-0"	10'-0"	9' - 2"	10'-0"	10' - 0"	8' - 8"	10'-0"	9' - 7"	8' - 4"
Norway Spruce - Norway	10'-0"	10'-0"	9' - 5"	10'-0"	10'-0"	8' - 11"	10'-0"	9' - 10"	8' - 6"
Norway Spruce - Romania & Ukraine	10'-0"	10'-0"	9' - 2"	10'-0"	10' - 0"	8' - 8"	10'-0"	9' - 7"	8' - 4"
Norway Spruce - Sweden	10'-0"	10'-0"	9' - 2"	10'-0"	10' - 0"	8' - 8"	10'-0"	9' - 7"	8' - 4"
Scots Pine - Austria, The Czech Republic, Romania, & Ukraine	10'-0"	10'-0"	9' - 8"	10'-0"	10'-0"	9' - 2"	10'-0"	10'-0"	8' - 9"
Scots Pine - Estonia, Latvia, & Lithuania	10'-0"	10'-0"	9' - 2"	10'-0"	10' - 0"	8' - 8"	10'-0"	9' - 7"	8' - 4"
Scots Pine - Finland	10'-0"	10'-0"	9' - 5"	10'-0"	10'-0"	8' - 11"	10'-0"	9' - 10"	8' - 6"
Scots Pine - Germany	10'-0"	10'-0"	8' - 11"	10'-0"	9' - 9"	8' - 5"	10'-0"	9' - 3"	8' - 1"
Scots Pine - Sweden	10'-0"	10'-0"	8' - 11"	10'-0"	10' - 0"	8' - 3"	10'-0"	9' - 6"	Design
Douglas Fir - France & Germany	10'-0"	10'-0"	9' - 11"	10'-0"	10'-0"	9' - 5"	10'-0"	10'-0"	9' - 0"
Douglas Fir / European Larch - Austria, The CzechRepublic & Bavaria	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	9' - 7"	10'-0"	10'-0"	9' - 2"
Silver Fir (Abies alba) - Germany, NE France, & Switzerland	10'-0"	10'-0"	9' - 5"	10'-0"	10'-0"	8' - 11"	10'-0"	9' - 10"	8' - 6"

Table 3:

2x6 studs; #2 Grade; Exposure Category B & C									
	130 MPH			140 MPH			150 MPH		
	STUD SPACING			STUD SPACING			STUD SPACING		
SPECIES	12"	16"	24"	12"	16"	24"	12"	16"	24"
Austrian Spruce - Austria & The Czech Republic (Picea excelsa)									
Norway Spruce - Estonia, Latvia, & Lithuania									
Norway Spruce - Finland									
Norway Spruce - Germany, NE France, & Switzerland									
Norway Spruce - Norway									
Norway Spruce - Romania & Ukraine									
Norway Spruce - Sweden									
Scots Pine - Austria, The Czech Republic, Romania, & Ukraine	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"	10'-0"
Scots Pine - Estonia, Latvia, & Lithuania									
Scots Pine - Finland									
Scots Pine - Germany									
Scots Pine - Sweden									
Douglas Fir - France & Germany									
Douglas Fir / European Larch - Austria, The Czech Republic & Bavaria									
Silver Fir (Abies alba) - Germany, NE France, & Switzerland									

Table Footnotes:

1. Table 1 -3 only covers two conditions:
   - Exterior walls supporting ONE floor, roof and ceiling.
   - Exterior Non-load bearing walls in two story structure (Maximum stud length = 10’-0”).

All other conditions not covered by the tables above shall be designed in accordance with accepted engineering practice.

2. Maximum mean roof height = 33 feet. (Per 2015 WFCM Section 2.1.3.1)
3. Total roof span shall not exceed 36 feet. (Per 2015 WFCM Section 3.1.3.4)
4. Exterior wall stud deflection limit = H/180

5. Design – Studs shall be designed in accordance with accepted engineering practice.
6. 3/8 inches thick wood structural sheathing shall be attached with 8d common nails (2.5" x 0.131") at 6 inches at perimeter and 12 inches at intermediate support.
7. Wind exposure category **D** is not covered by the tables and shall be designed in accordance with accepted engineering practice. (See 2018 NCRC Section R301.2.1.4 for definition of Exposure Category)
8. Load bearing wall shall not exceed 10 feet in height. (Per 2018 NCRC Table R602.3(5))
9. To address additional end zone loading requirements, end zone stud spacings shall be multiplied by 0.80 for framing located 4 feet of corners.
10. Grade Stamp Nomenclature: AS = Austrian Spruce, DF = Douglas Fir, DF-L = Douglas Fir/ European Larch, NSPR = Norway Spruce, SCOTP = Scots Pine, SFIR = Silver Fir, AUS = Austria, EST = Estonia, FIN = Finland, FRA = France, GER = Germany, LAT = Latvia, LTH = Lithuania, NOR = Norway, ROM = Romania, SW = Sweden, SWI = Switzerland, UKR = Ukraine

Question:

How to use the tables above for lumber grade-marked with multiple species/regions?

Answer:

The lowest of the allowable stud length among the mixed species/regions shall govern.

For example:
2x4 studs at 16 inches on center, #2 Grade, 150 mph, Exposure Category C

From Table 2:
NSPR(SW) = Norway Spruce from Sweden = 9'-7"
SCOTP(SW) = Scots Pine from Sweden = 9'-6"

In this specific comparison, the Scots Pine governs the stud length. The maximum allowable stud length = 9'-6"

Reference:

Technical Report No. 5 Maximum Allowable Stud Length Tables for European Species and Countries in High Wind Regions, Pacific Lumber Inspection Bureau (PLIB), Federal Way, WA, April 7th, 2021

Wood Frame Construction Manual for One-and Two-Family Dwellings-2015 (WFCM), American Wood Council, Leesburg, VA, 2015.