CANADIAN MARKET

Reassessment of Design Values for Hem-Fir (N) Dimension Lumber

The design values for visually graded and mechanically graded Hem-Fir (N) dimension lumber have been updated in response to the routine assessment of strength and stiffness to ensure reliable performance in structural applications.

These updates take effect on April 1, 2025, and are published in the NLGA Standard Grading Rules for Canadian Lumber, CSA O86 – Engineering Design in Wood, and the National Design Specification® (NDS®) Supplement for Wood Construction, developed by the American Wood Council (AWC). Within the NDS® Supplement, these updates specifically apply to Tables 4A and 4C, with additional impacts on Table 4G.

The following Frequently Asked Questions provide detailed information about the updated design values, their implementation, and practical implications. This content is provided as general information only and is not intended to be relied upon for design decisions. For actual use and design implications, users of Hem-Fir (N) should consult the applicable design guides or specifications (e.g., CSA O86 - Engineering design in wood or the National Design Specifications® (NDS).

Minimal Practical Impact:

The design value updates should not result in significant changes to the practical use of Hem-Fir (N) in the majority of applications, maintaining continuity and confidence for builders and designers.

Consistent Performance:

Hem-Fir (N) remains a trusted and dependable choice for both residential and commercial construction, with updated design values that closely align with previous standards for the majority of applications.

NLGA NATIONAL LUMBER GRADES AUTHORITY

CANADIAN WOOD COUNCIL
CONSEIL CANADIEN DU BOIS

BACKGROUND

Q1: Why did the design values change?

The design values for Hem-Fir (N) have changed as part of the routine monitoring and assessment process conducted by the National Lumber Grades Authority (NLGA). This process ensures the integrity of structural performance and aligns design values with current data on lumber properties.

Q2: Who is responsible for the assessment, development and approval of design values?

The NLGA is responsible for the regular assessment of the major Canadian species groups and the subsequent development of the design values.

In Canada, approval of design values, including specified strengths, moduli of elasticity and other properties is the responsibility of the Technical Committee of CSA O86 – Engineering design in wood.

Q3: How are specified strengths and moduli of elasticity derived?

Specified strengths and moduli of elasticity properties like bending, tension, and compression parallel to grain are derived through testing of full-size samples[1] from commercially produced structural lumber.

The collected data from the samples is analyzed in accordance with approved standards, consistent with all major species used in Canada.

Q4: Do the updated design values for Hem-Fir (N) affect existing construction?

No, the updated design values for Hem-Fir (N) do not affect existing construction. Existing structures remain compliant if they followed the building codes that were in effect at the time they were built.

Q5: Should I continue to use Hem-Fir (N)?

Yes, Hem-Fir (N) remains a trusted and dependable choice for both residential and commercial construction, with updated design values that closely align with the previously published values for the majority of applications.

1 As defined in ASTM D1990.

GENERAL IMPACT

Q6: Which lumber properties have updated design values?

The updated design values apply to the following lumber properties. However, for the majority of applications these updates do not significantly impact the practical use of Hem-Fir (N).

For visually graded lumber, the following properties were updated:

- Specified strength in bending (f_b)
- Specified strength in tension parallel to grain (f_t)
- Specified strength in compression parallel to grain (f_c)
- Moduli of elasticity (E and E_{05})
- Relative density (G)

For mechanically graded lumber, only the following lumber property was updated:

- Relative density (G)

Q7: Which lumber properties have the same design values?

Two lumber properties remain unaffected by the updates:

- Specified strength in longitudinal shear (f_v)
- Specified strength in compression perpendicular to grain (f_{cp})

Q8: What visual grades are impacted?

The design value updates apply to all grades of visually graded Hem-Fir (N) dimension lumber with a thickness of 38-89 mm (nominal thickness of 2-4 inches), including the following:

- Select Structural (SS)
- No. 1 / No. 2
- No. 3 / Stud
- Construction
- Standard

Q9: Which lumber sizes are impacted by the updates?

The updated designs values apply to all Hem-Fir (N) dimension lumber products with a thickness of 38-89 mm (nominal thickness of 2-4 inches).

Q10: Have the design values for other Hem-Fir (N) lumber products changed?

The specified strengths and moduli of elasticity for other Hem-Fir (N) products such as beams, stringers, posts and timbers covered by the NLGA Standard Grading Rules remain unchanged. However, the change in relative density applies to all Hem-Fir (N) lumber products.

Design values for glulam and cross-laminated timber (CLT) are determined using other product standards.

Q11: How will the updated design values affect applications? Can the same sizes be used to span the same distances?

In most cases, the updated design values do not result in significant practical changes. Typically, the same sizes can be used to span the same distances without issue.

GENERAL IMPACT

Q12: How can more information be obtained about the specific changes to the Hem-Fir (N) design values?

Detailed tables outlining the updated Hem-Fir (N) design values (specified strengths, moduli of elasticity and relative density) are provided at the end of this document. Table 1 shows the updated values. Table 2 provides a comparison of the previous and updated values. Additional information and clarification can be found in CSA O86 - Engineering design in wood.

Q13: When will the updated design values come into effect?

The updated design values are effective as of April 1, 2025, and are published in the NLGA Standard Grading Rules for Canadian Lumber and in CSA O86 – Engineering design in wood.

Q14: How are design values implemented into building codes?

The National Building Code of Canada (NBC) is adopted or adapted by provinces and territories and relies on CSA O86 - Engineering design in wood to establish design values for the structural use of wood. Engineers and designers use these resources to ensure structural components meet building code requirements.

Q15: Will design value changes impact the maximum spans for joists, beams, lintels and rafters in the National Building Code – Part 9 Housing and Small Buildings?

Span tables in Part 9 will be adjusted to reflect the new design values.The impact is considered minimal in typical designs. See Table 3 and Table 4 at the end of this document for updated floor joists spans.

Q16: Have lumber grades or grade stamps changed?

No. Lumber grades and grade stamps have not changed.

HEM-FIR (N) DESIGN VALUE TABLES

The updated design values (specified strengths, moduli of elasticity and relative density) for Hem-Fir (N) dimension lumber are published in the NLGA Standard Grading Rules for Canadian Lumber and CSA O86 – Engineering design in wood per the following tables.

The updated design values are shown in **Table 1**. For most applications, however, these updates do not significantly impact the practical use of Hem-Fir (N). A comparison between the previous and updated design values is presented in **Table 2**.

Table 1: Updated Hem-Fir (N) Specified Strengths, Moduli of Elasticity and Relative Density

Grade	Design Values (in MPa)							G
	f_b	f_t	f_v	f_{cp}	f_c	E	E_{05}	
Select Structural	16.1	8.4	1.6	4.6	16.9	11000	8000	0.44
No. 1 / No. 2	12.0	5.0			14.9	10000	7000	
No. 3 / Stud	6.9	2.9			8.6	9000	5500	
Construction	15.6	5.7	2.7		15.4	9500	5500	
Standard	8.7	3.2			13.2	8500	5000	

f_b Specified strength in bending
f_t Specified strength in tension parallel to grain
f_v Specified strength in longitudinal shear
f_{cp} Specified strength in compression perpendicular to grain
f_c Specified strength in compression parallel to grain
E Specified modulus of elasticity
E_{05} Fifth percentile of specified modulus of elasticity
G Relative density

HEM-FIR (N) DESIGN VALUE TABLES

Table 2: Hem-Fir (N) Design Value Comparison

Design Value	Source	Select Structural	No. 1 / No. 2	No. 3 / Stud	Construction	Standard
f_b (MPa)	Previous	16.0	11.0	7.0	14.3	8.0
	New	16.1	12.0	6.9	15.6	8.7
	Variance	1%	9%	-1%	9%	9%
f_c (MPa)	Previous	17.6	14.8	9.2	16.9	13.9
	New	16.9	14.9	8.6	15.4	13.2
	Variance	-4%	1%	-6%	-9%	-5%
f_t (MPa)	Previous	9.7	6.2	3.2	7.0	3.9
	New	8.4	5.0	2.9	5.7	3.2
	Variance	-13%	-20%	-9%	-19%	-19%
E (MPa)	Previous	12000	11000	10000	10000	9000
	New	11000	10000	9000	9500	8500
	Variance	-8%	-9%	-10%	-5%	-6%
E_{05} (MPa)	Previous	8500	7500	6000	6000	5500
	New	8000	7000	5500	5500	5000
	Variance	-6%	-7%	-8%	-8%	-9%
G	Previous	0.46				
	New	0.44				
	Variance	-0.02				

f_b Specified strength in bending
f_t Specified strength in tension parallel to grain
f_v Specified strength in longitudinal shear
f_{cp} Specified strength in compression perpendicular to grain
f_c Specified strength in compression parallel to grain
E Specified modulus of elasticity
E_{05} Fifth percentile of specified modulus of elasticity
G Relative density

UPDATED SPAN TABLES: NATIONAL BUILDING CODE – PART 9, HOUSING AND SMALL BUILDINGS

Table 3: Maximum Spans for Floor Joists – General Cases

Commercial Designation	Grade	Joist Size, mm	Maximum Span, m								
			With Strapping			With Bridging			With Strapping and Bridging		
			Joist Spacing, mm			Joist Spacing, mm			Joist Spacing, mm		
			300	400	600	300	400	600	300	400	600
Hem – Fir	Select Structural	38 x 89	2.00	1.85	1.66	2.09	1.90	1.66	2.09	1.90	1.66
		38 x 140	3.09	2.91	2.62	3.29	2.99	2.62	3.29	2.99	2.62
		38 x 184	3.71	3.53	3.36	3.98	3.75	3.44	4.19	3.90	3.44
		38 x 235	4.38	4.16	3.96	4.64	4.37	4.11	4.84	4.51	4.21
		38 x 286	4.99	4.75	4.52	5.24	4.93	4.64	5.43	5.07	4.72
	No. 1 / No. 2	38 x 89	1.90	1.77	1.61	2.03	1.84	1.61	2.03	1.84	1.61
		38 x 140	2.99	2.78	2.53	3.19	2.90	2.53	3.19	2.90	2.53
		38 x 184	3.60	3.42	3.26	3.86	3.63	3.33	4.06	3.78	3.33
		38 x 235	4.24	4.03	3.84	4.49	4.23	3.98	4.69	4.37	4.07
		38 x 286	4.84	4.60	4.37	5.07	4.78	4.50	5.26	4.91	4.58
	No. 3	38 x 89	1.81	1.68	1.55	1.96	1.78	1.55	1.96	1.78	1.55
		38 x 140	2.84	2.64	2.41	3.08	2.80	2.41	3.08	2.80	2.41
		38 x 184	3.47	3.30	2.93	3.73	3.51	2.93	3.92	3.59	2.93
		38 x 235	4.09	3.89	3.58	4.34	4.08	3.58	4.52	4.22	3.58
		38 x 286	4.67	4.44	4.16	4.90	4.61	4.16	5.08	4.74	4.16
	Construction	38 x 89	1.86	1.72	1.58	1.99	1.81	1.58	1.99	1.81	1.58
	Standard	38 x 89	1.76	1.63	1.45	1.92	1.75	1.45	1.92	1.75	1.45

For more information please refer to NBC 2020 Table 9.23.4.2.-A.

UPDATED SPAN TABLES: NATIONAL BUILDING CODE – PART 9, HOUSING AND SMALL BUILDINGS

Table 4: Maximum Spans for Floor Joists – Special Cases

Commercial Designation	Grade	Joist Size, mm	Maximum Span, m								
			Joists with Ceilings Attached to Wood Furring						Joists with Concrete Topping		
			Without Bridging			With Bridging			With or Without Bridging		
			Joist Spacing, mm			Joist Spacing, mm			Joist Spacing, mm		
			300	400	600	300	400	600	300	400	600
Hem – Fir	Select Structural	38 x 89	2.09	1.90	1.66	2.09	1.90	1.66	2.09	1.90	1.66
		38 x 140	3.29	2.99	2.62	3.29	2.99	2.62	3.29	2.99	2.62
		38 x 184	4.06	3.83	3.44	4.33	3.93	3.44	4.33	3.93	3.44
		38 x 235	4.78	4.50	4.11	5.24	4.98	4.39	5.53	5.03	4.39
		38 x 286	5.44	5.12	4.68	5.93	5.64	5.31	6.55	6.10	5.34
	No. 1 / No. 2	38 x 89	2.03	1.84	1.61	2.03	1.84	1.61	2.03	1.84	1.61
		38 x 140	3.19	2.90	2.53	3.19	2.90	2.53	3.19	2.90	2.53
		38 x 184	3.94	3.71	3.33	4.20	3.81	3.33	4.20	3.81	3.33
		38 x 235	4.63	4.36	3.98	5.08	4.83	4.25	5.36	4.87	4.16
		38 x 286	5.27	4.96	4.53	5.74	5.46	5.15	6.34	5.91	4.83
	No. 3	38 x 89	1.96	1.78	1.55	1.96	1.78	1.55	1.96	1.78	1.49
		38 x 140	3.08	2.80	2.41	3.08	2.80	2.41	3.00	2.60	2.12
		38 x 184	3.80	3.58	2.93	4.05	3.59	2.93	3.65	3.16	2.58
		38 x 235	4.47	4.21	3.58	4.90	4.39	3.58	4.46	3.87	3.16
		38 x 286	5.09	4.79	4.16	5.55	5.09	4.16	5.18	4.49	3.66
	Construction	38 x 89	1.99	1.81	1.58	1.99	1.81	1.58	1.99	1.81	1.58
	Standard	38 x 89	1.92	1.75	1.45	1.92	1.75	1.45	1.81	1.57	1.28

For more information please refer to NBC 2020 Table 9.23.4.2.-B