Nordic X-Lam Slabs

CHECKLIST: **Nordic X-Lam Slabs**

To verify that the Slab Selection Tables are appropriate for the structure being designed, the following questions should be asked (the appropriate modification factor is given in brackets):

1. Is load duration "standard" (K_D)?
K_D is a load duration factor. The tables are based on a standard term load (K_D = 1.0), which includes the effects of dead loads plus live loads due to use and occupancy, and snow loads.

2. Is the service condition "dry" (K_S)?
K_S is a service condition factor. The tables are limited to dry service conditions (K_S = 1.0).

3. Is the material free of incising and/or strength-reducing chemicals (K_T)?
K_T is a treatment factor. The tables are based on untreated timber (K_T = 1.0).

4. Are the applicable total load and live load deflection limits based on L/240 and L/360, respectively?
The tables are based on deflection limits of span/240 under specified total load and span/360 under specified live load. For other deflection limits, multiply the values accordingly.

5. Should floor vibration be considered?
The designer is advised to check the maximum floor vibrations for CLT slab elements. The proposed design method[1] for controlling vibrations in CLT floors is based on a research project at the Technical University of Munich. See maximum floor spans on page 6.

6. Should creep effects be considered?
A 25% reduction in shear stiffness has been used when checking the elastic deflection limit due to total load in order to account for the deformations caused by shear perpendicular to grain (rolling shear) and creep.

7. Is the loading uniform?
The tables are based on uniform loads. In some applications, floor or roof slabs may have to be designed for a concentrated live load (as defined in article 4.1.5.9 of the 2010 NBCC) or other non-uniform loading. In these cases refer to CSA O86-09 and the CLT manual.

If the answer to any of those questions is no, consult Nordic. Otherwise, the Slab Selection Tables may be used directly. The selection tables provide the maximum uniform specified total or live load, $w_{\Delta R}$, that may be applied to a panel to ensure that the design criteria are met.

Note: The tables are based on standard depths for bending about the longitudinal (strong) axis of the panel. The slab self weight has not been considered in the calculation of maximum loads (i.e. it shall be included in the specified total load). Consult Nordic for other options.

[1] Hamm P., Richter A., Winter S. Floor vibrations - new results. WCTE 2010

Slab Selection Tables — Nordic X-Lam E1

$w_{\Delta R}$

Serviceability limit states - L/240, simple span
Maximum specified uniform total load $w_{\Delta R}$ (kPa)

Span	Layup Combinaison						
(m)	78-3s	105-3s	131-5s	175-5s	220-7s	244-7l	314-9l
3,0	4,69	10,1					
3,2	3,92	8,57					
3,4		7,30	11,7				
3,6		6,27	10,0				
3,8		5,41	8,66				
4,0		4,71	7,53				
4,2		4,12	6,59				
4,4		3,62	5,79				
4,6			5,12	11,3			
4,8			4,54	10,1			
5,0			4,05	9,06			
5,2			3,62	8,14			
5,4				7,35			
5,6				6,65			
5,8				6,03	11,3		
6,0				5,49	10,3		
6,2				5,01	9,40		
6,4				4,58	8,61		
6,6				4,20	7,91		
6,8				3,86	7,28		
7,0				3,55	6,71	10,9	
7,2					6,20	10,0	
7,4					5,75	9,31	
7,6					5,33	8,64	
7,8					4,95	8,03	
8,0					4,61	7,48	
8,2					4,30	6,98	
8,4					4,01	6,52	
8,6					3,75	6,10	11,5
8,8					3,51	5,71	10,8
9,0						5,36	10,2
9,2						5,03	9,56
9,4						4,73	9,01
9,6						4,46	8,50
9,8						4,20	8,02

Notes:
1. A complete design shall include the verification of the resistance, a consideration for floor vibration when applicable, and fire safety requirements.
2. A 25% reduction in shear stiffness has been used in order to account for the deformation caused by rolling shear and for creep.

Slab Selection Tables — Nordic X-Lam E1

$w_{\Delta R}$

Serviceability limit states - L/240, double span
Maximum specified uniform total load $w_{\Delta R}$ (kPa)

Span	Layup Combinaison						
(m)	78-3s	105-3s	131-5s	175-5s	220-7s	244-7l	314-9l
3,0	6,57						
3,2	5,50	11,9					
3,4	4,65	10,2					
3,6	3,96	8,76					
3,8	3,40	7,57	12,1				
4,0		6,59	10,5				
4,2		5,77	9,23				
4,4		5,07	8,12				
4,6		4,49	7,18				
4,8		3,98	6,38				
5,0		3,55	5,69				
5,2			5,09	11,4			
5,4			4,58	10,3			
5,6			4,13	9,31			
5,8			3,74	8,46			
6,0				7,70			
6,2				7,03			
6,4				6,43			
6,6				5,90	11,1		
6,8				5,42	10,2		
7,0				5,00	9,42		
7,2				4,61	8,71		
7,4				4,27	8,07		
7,6				3,96	7,49		
7,8				3,67	6,96	11,3	
8,0					6,48	10,5	
8,2					6,04	9,80	
8,4					5,64	9,16	
8,6					5,28	8,57	
8,8					4,94	8,03	
9,0					4,63	7,54	
9,2					4,35	7,08	
9,4					4,09	6,66	
9,6					3,85	6,27	
9,8					3,63	5,91	11,3

Notes:
1. A complete design shall include the verification of the resistance, a consideration for floor vibration when applicable, and fire safety requirements.
2. A 25% reduction in shear stiffness has been used in order to account for the deformation caused by rolling shear and for creep.

Slab Selection Tables — Nordic X-Lam E1

$w_{\Delta R}$

Serviceability limit states - L/360, simple span
Maximum specified uniform live load $w_{\Delta R}$ (kPa)

Span	Layup Combinaison						
(m)	78-3s	105-3s	131-5s	175-5s	220-7s	244-7l	314-9l
3,0	3,23	7,13					
3,2	2,69	6,00					
3,4	2,26	5,08	8,14				
3,6	1,92	4,35	6,96				
3,8		3,74	5,99				
4,0		3,24	5,19				
4,2		2,83	4,53				
4,4		2,48	3,97				
4,6		2,19	3,50	7,89			
4,8		1,94	3,10	7,02			
5,0			2,76	6,27			
5,2			2,47	5,62			
5,4			2,21	5,06			
5,6			1,99	4,57			
5,8				4,14	7,79		
6,0				3,76	7,09		
6,2				3,42	6,47		
6,4				3,13	5,92		
6,6				2,86	5,43		
6,8				2,63	4,99		
7,0				2,42	4,59	7,46	
7,2				2,23	4,24	6,89	
7,4				2,06	3,92	6,38	
7,6					3,63	5,91	
7,8					3,37	5,49	
8,0					3,14	5,11	
8,2					2,92	4,76	
8,4					2,72	4,44	
8,6					2,55	4,15	
8,8					2,38	3,88	7,44
9,0					2,23	3,64	6,98
9,2					2,09	3,42	6,56
9,4					1,97	3,21	6,18
9,6						3,02	5,82
9,8						2,85	5,49

Note:
1. A complete design shall include the verification of the resistance, and a consideration for the effects of vibration when applicable.

Slab Selection Tables — Nordic X-Lam E1

$w_{\Delta R}$

Serviceability limit states - L/360, double span
Maximum specified uniform live load $w_{\Delta R}$ (kPa)

Span	Layup Combinaison						
(m)	78-3s	105-3s	131-5s	175-5s	220-7s	244-7l	314-9l
3,0	4,53						
3,2	3,78	8,38					
3,4	3,18	7,12					
3,6	2,71	6,09					
3,8	2,32	5,25					
4,0	2,00	4,55	7,29				
4,2		3,97	6,36				
4,4		3,48	5,58				
4,6		3,07	4,92				
4,8		2,72	4,36				
5,0		2,42	3,88				
5,2		2,17	3,47	7,89			
5,4		1,94	3,12	7,10			
5,6			2,81	6,41			
5,8			2,54	5,81			
6,0			2,30	5,28			
6,2			2,09	4,81			
6,4			1,91	4,40			
6,6				4,03	7,63		
6,8				3,70	7,01		
7,0				3,40	6,46		
7,2				3,14	5,96		
7,4				2,90	5,52		
7,6				2,69	5,11		
7,8				2,49	4,75	7,72	
8,0				2,32	4,42	7,18	
8,2				2,16	4,11	6,70	
8,4				2,01	3,84	6,25	
8,6					3,59	5,84	
8,8					3,36	5,47	
9,0					3,14	5,13	
9,2					2,95	4,81	
9,4					2,77	4,52	
9,6					2,61	4,26	
9,8					2,46	4,01	7,72

Note:
1. A complete design shall include the verification of the resistance, and a consideration for the effects of vibration when applicable.

Slab Selection Tables — Nordic X-Lam E1

ℓ_{max}

Serviceability limit states - 1.5 kPa dead load
Maximum spans (m) - vibration criteria

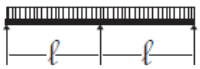
	Combination 78-3s	105-3s	131-5s	175-5s	220-7s	244-7l	314-9l
Standard criteria							
1:1 Ratio	2,92	3,89	5,15	6,20	7,11	7,94	9,09
1:2 Ratio	2,92	3,89	5,36	6,99	8,01	8,94	10,2
1:3 Ratio	2,92	3,89	5,36	7,13	8,20	9,15	10,5
Enhanced criteria							
1:1 Ratio	2,32	3,08	4,25	5,37	6,16	6,87	7,87
1:2 Ratio	2,32	3,08	4,25	5,66	6,94	7,56	8,87
1:3 Ratio	2,32	3,08	4,25	5,66	7,10	7,56	9,08

ℓ_{max}

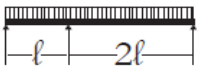
Serviceability limit states - 2.5 kPa dead load
Maximum spans (m) - vibration criteria

	Combination 78-3s	105-3s	131-5s	175-5s	220-7s	244-7l	314-9l
Standard criteria							
1:1 Ratio	2,92	3,89	4,58	5,57	6,45	7,24	8,38
1:2 Ratio	2,92	3,89	5,16	6,28	7,27	8,16	9,44
1:3 Ratio	2,92	3,89	5,28	6,43	7,44	8,35	9,66
Enhanced criteria							
1:1 Ratio	2,32	3,08	3,96	4,83	5,59	6,27	7,25
1:2 Ratio	2,32	3,08	4,25	5,44	6,30	7,06	8,18
1:3 Ratio	2,32	3,08	4,25	5,57	6,44	7,23	8,37

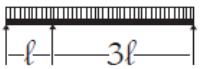
Notes:
1. The maximum spans are based on a dead load of 1.5 or 2.5 kPa in addition to the panel self weight.
2. The ratios represent the spans ratios (see figures below). For a simple span, use a ratio of 1:1.
3. The maximum spans are based on Hamm-Richter-Winter design method to control floor vibrations and take into account the following assumptions: live load neglected in the calculation of the mass, panels supported on both sides, damping factor of 1.0%.
4. It should be noted that floor vibrations evaluation is subjective, and that other floor compositions and bearing conditions may increase the floor performance.
5. The maximum spans only consider floor vibration criteria.



Ratio 1:1



Ratio 1:2



Ratio 1:3

Nordic X-Lam Slabs (continued)

EXAMPLE : **Roof Slab**

Roof slab

Given a slab of 105 mm (105-3s); self weight = 0.53 kPa — Technical note T-S21
Specified dead load = 2.0 kPa (including slab self weight)
Specified snow load for serviceability calculations = 2.0 kPa
Beam spacing (span) = 5.0 m
Dry service condition, untreated lumber, double span pattern
Deflection limits: L/240 based on live load, L/180 based on total load

Deflection criteria check

Specified live (snow) load w_L = 2.0 kPa

Specified total load w = 2.0 + 2.0 = 4.0 kPa

Using the appropriate deflection adjustments:

$w_{\Delta R}$ = (360/240) x 2.43 = 3.64 kPa > 2.0 kPa for L/240 deflection (live load)	√	Table $w_{\Delta R}$, L/360, double span
$w_{\Delta R}$ = (240/180) x 3.57 = 4.74 kPa > 4.0 kPa for L/180 deflection (total load)	√	Table $w_{\Delta R}$, L/240, double span

Use E1 105-3s, 105 mm thick slab.

Note: A complete design shall include the verification of bending and bearing resistances. Where slabs are used to support roof loads, the maximum spans for slabs may be limited by the NBCC roof point load requirements (refer to 2010 NBCC, article 4.1.5.9).

EXAMPLE : **Floor slab**

Floor slab

Given a slab of 175 mm (175-5s); self weight = 0.96 kPa ~ 1.0 kPa — Technical note T-S21
Specified dead load = 2.5 kPa (including slab self weight)
Specified live load = 1.9 kPa
Beam spacing (span) = 5.85 m
Dry service condition, untreated lumber, simple span pattern
Deflection limits: L/240 based on total load, L/360 based on live load; standard vibration criteria

Serviceability criteria check

Specified dead load excluding slab self weight w_D = 1.5 kPa

Specified live load w_L = 1.9 kPa

Specified total load w = 2.5 + 1.9 = 4.4 kPa

$w_{\Delta R}$ = 5.46 kPa ≥ 4.4 kPa for L/240 deflection (total load)	√	Table $w_{\Delta R}$, L/240, simple span
$w_{\Delta R}$ = 3.74 kPa ≥ 1.9 kPa for L/360 deflection (live load)	√	Table $w_{\Delta R}$, L/360, simple span
ℓ_{max} = 5.85 m ≥ 5.85 m for simple span (ratio 1:1)	√	Table ℓ_{max}, 1.5 kPa, standard cr.

Use E1 175-5s, 175 mm thick slab.

Note: A complete design shall include among other things the verification of a concentrated live load (if applicable), bending and bearing resistances, and fire safety requirements.