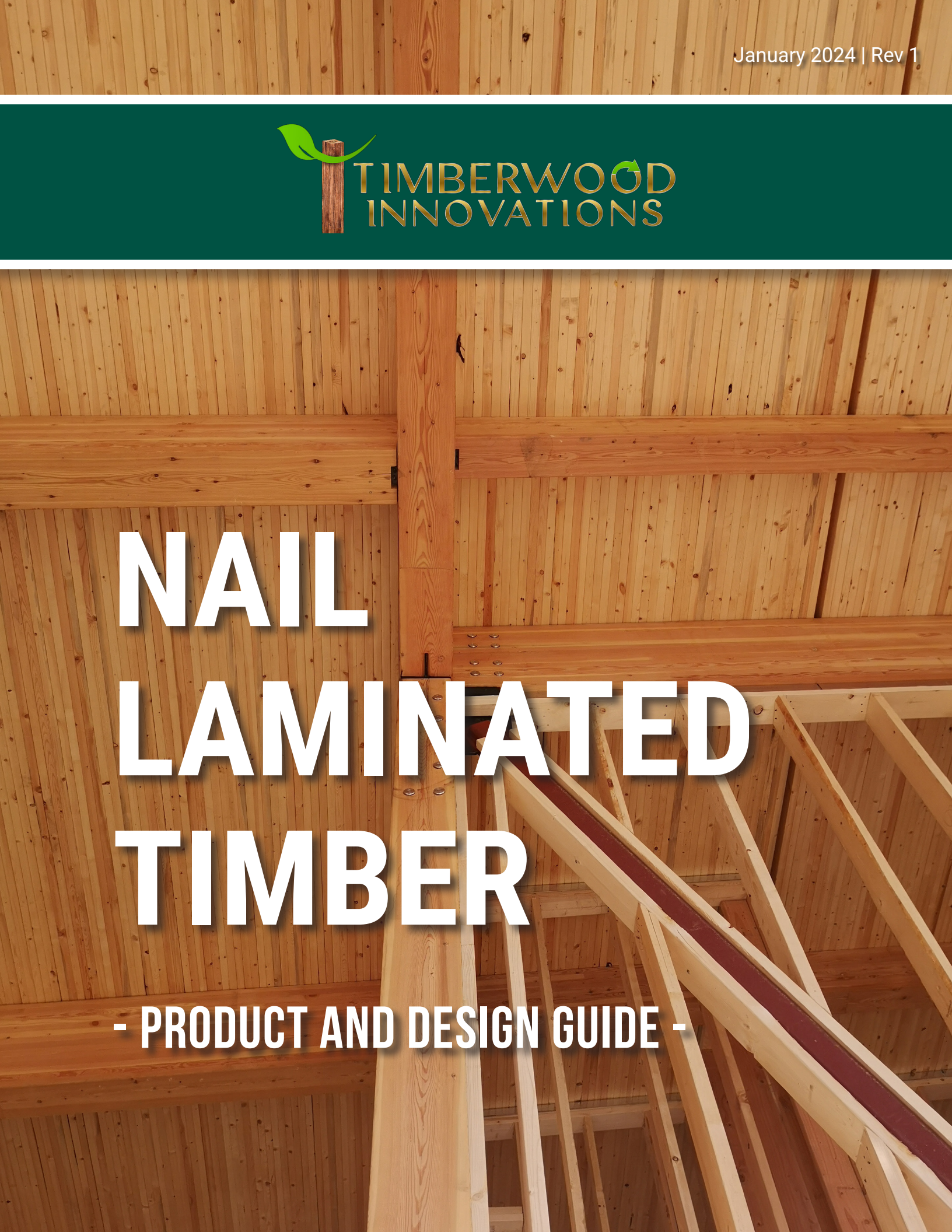
January 2024 | Rev 1

TIMBERWOOD INNOVATIONS



NAIL LAMINATED TIMBER

- PRODUCT AND DESIGN GUIDE -

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ABOUT

Nail Laminated Timber (NLT) has a long history of construction applications including buildings, bridge decks, and grain elevators. Elevators were a predominant landmark for prairie towns throughout the 19th and 20th centuries. They were once a hub for farmers and the community but are now being replaced by concrete silos with increased capacity and fire resistance. In the 1950's, there were over 3,000 timber grain elevators in Saskatchewan. This number has now dwindled to fewer than 500 as they are being demolished due to liability and cost of maintenance.

The crib walls of timber grain elevators were constructed of horizontally oriented NLT and heavy timber elements were used for beams and columns. Timberwood Innovations reclaims the NLT walls of grain elevators for use as floor, roof, and wall panels in new construction, giving new life to the timber structure.

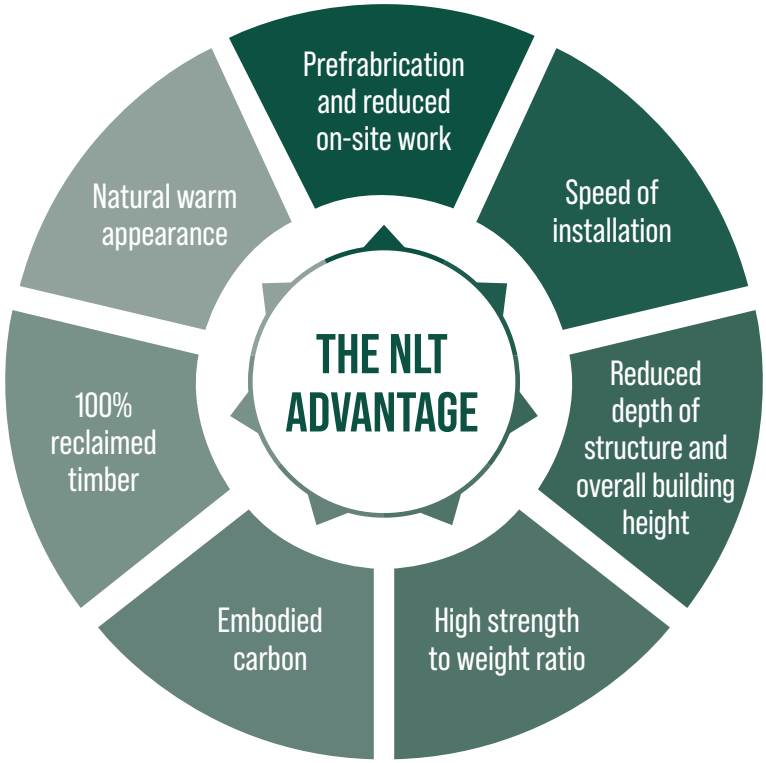
Nail Laminated Timber (NLT) consists of dimensional lumber laminations mechanically fastened to create a larger panel of mass timber. NLT panels can be used for creating roof, floor, and wall panels with structural efficiency as the laminations are oriented in a primary span direction and can distribute load through nail fasteners. There has been a recent resurgence of NLT, along with other mass timber products, as building code changes and technology have expanded use and understanding within the design community..

THE NLT ADVANTAGE

Timberwood NLT panels are processed within a controlled shop environment and fabricated to precise tolerances. This eliminates much of the on-site coordination, noise, and material waste common to site-built structural systems and drastically increases construction speed.

Since the NLT panels are constructed using 100% reclaimed material, the project carbon footprint is significantly reduced. Wood is the only fully renewable structural material and sequesters carbon from the atmosphere, whereas steel and concrete emit carbon during production. A structure that uses reclaimed material, that was otherwise slated for disposal, doubles its carbon sequestration compared to constructing with new material.

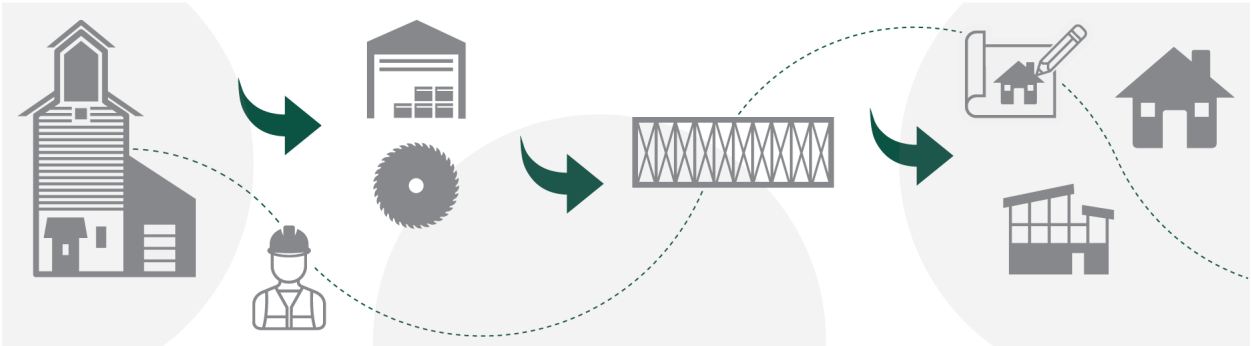
The natural beauty of wood allows it to be exposed which reduces cost and time spent installing finishes. NLT panels significantly reduce the depth of the structural system, relative to joists or trusses, which decreases building height and cost of the building envelope but maintains the design ceiling height.



A NEW PURPOSE

Grain elevators were constructed using a method called cribbed construction. The elevator consists of grain storage bins with the walls built using laminated timber planks to resist the lateral pressure of the stored grain. Often 2x6 planks were used at the lower part of the structure where loads were highest and 2x4 planks on the upper walls. Some elevators utilized 2x8, 2x10, and 2x12 planks in the walls. At wall intersections, the laminations overlapped each other, and diagonal bracing was used to stiffen the connection. Metal shiplap siding was used on the exterior to protect the structure from the elements. The timber is usually high quality due to it being harvested from old forests.

The grain elevators are deconstructed to reclaim panels in a variety of spans, depending on the wall layout. Panels are typically cut in 8' wide sections to maximize transportation efficiency and are taken to the fabrication shop in Battleford, SK. Engineered shop drawing and connection designs are created specific for each project and are issued for client approval prior to processing of the panels.



Quality control personnel confirm lumber grade and species and ensure the lamination joints and nailing patterns meet engineering requirements. A bridge saw is used to cut the panels to final dimensions and the panel can be planed and sealer or stain applied, depending on appearance requirements.

APPLICATIONS

Timberwood NLT panels can be used in a variety of building applications. Plywood or OSB sheathing is typically installed to provide in-plane shear capacity for diaphragms and shear walls. Bracing or strapping can also be used for light lateral loads.

Floor and Roof Panels	For residential and commercial buildings. Panels primarily span in one direction but can be reinforced to have capacity for cantilevers in the minor direction. Panels can be supported on wood stud walls, mass timber walls, concrete or steel beams, or concrete and masonry walls.
Wall Panels	Load bearing walls and stair shafts for residential and commercial buildings. Laminations typically span vertically but can be supported horizontally.
Beams and Lintels	NLT can act as horizontal bending members to support floors and roofs. Laminations may be reinforced with structural screws to increase capacity beyond what the existing nail patterns can provide.

INSTALLATION

NLT panels may be installed by telehandler or crane depending on site access. Lifting lugs can be provided for crane rigging. Plywood or OSB sheathing can be installed in the fabrication shop to protect the panels from the elements until the building is enclosed.

PANEL PROPERTIES

Timberwood NLT panels are primarily available in Douglas Fir species, although some grain elevators were constructed of Western Red Cedar that may be available.

Species

Douglas Fir, Spruce-Pine-Fir, Western Red Cedar may be available

Structural Grade

Existing wood is often better than No.2. Can be visually graded depending on loading requirements.

Dimensions

Panel width up to 8' wide. Panel length up to 36' to 48' length available as special order

Thicknesses available in 2x4, 2x6, 2x8, and 2x10 laminations

Fire Rating

Requires OSB or plywood sheathing to achieve heavy timber fire rating as per NBCC Part 3

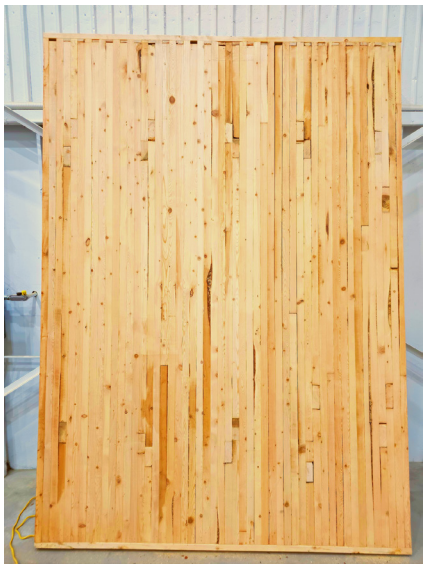

NON-STRUCTURAL FEATURE PANEL

APPEARANCE GRADES

Timberwood NLT panels are available in two primary appearance grades. A Feature grade of panel is available, upon request, that has unique properties, such as wear from grain erosion. These panels may be suitable for non-loadbearing applications due to their variable thickness.

Industrial

- End wall butt joints may be located anywhere, depending on structural capacity.
- Both faces are planed to uniform thickness.
- May contain visual defects.
- Appropriate when panel is non-aesthetic, industrial appearance is preferred, or the panel will be concealed with finishes.



Commercial

- End wall butt joints may be located strategically to be hidden.
- Both faces are planed to uniform thickness.
- Shop applied sealer or stain upon request.
- Panels with minimal visual defects are selected.

PANEL SPAN TABLES

ROOF

Panel Thickness	Superimposed Dead Load (kPa/psf)							
	0.5 / 10				1.0 / 20			
	Snow Load (kPa/psf)							
	1.0 / 20	1.5 / 30	2.0 / 40	2.5 / 50	1.0 / 20	1.5 / 30	2.0 / 40	2.5 / 50
2x4	3707	3415	3194	3019	3204	3194	3019	2875
	12' 2"	11' 2"	10' 6"	9' 11"	10' 6"	10' 6"	9' 11"	9' 5"
2x6	5357	5172	4867	4620	4739	4739	4620	4415
	17' 7"	16' 12"	15' 12"	15' 2"	15' 7"	15' 7"	15' 2"	14' 6"
2x8	6612	6598	6181	5694	5949	5949	5768	5360
	21' 8"	21' 8"	20' 3"	18' 8"	19' 6"	19' 6"	18' 11"	17' 7"
2x10	7992	7969	7290	6749	7296	7296	6831	6374
	26' 3"	26' 2"	23' 11"	22' 2"	23' 11"	23' 11"	22' 5"	20' 11"

FLOOR

Panel Thickness	Superimposed Dead Load (kPa/psf)							
	1.0 / 20				1.5 / 30			
	Live Load (kPa/psf)							
	1.9 / 40	2.4 / 50	3.6 / 75	4.8 / 100	1.9 / 40	2.4 / 50	3.6 / 75	4.8 / 100
2x4	2922	2684	2316	2086	2881	2684	2316	2086
	9' 7"	8' 10"	7' 7"	6' 10"	9' 5"	8' 10"	7' 7"	6' 10"
2x6	4597	4223	3644	3282	4325	4223	3644	3282
	15' 1"	13' 10"	11' 11"	10' 9"	14' 2"	13' 10"	11' 11"	10' 9"
2x8	5860	5435	4686	4167	5482	5140	4486	4020
	19' 3"	17' 10"	15' 4"	13' 8"	17' 12"	16' 10"	14' 9"	13' 2"
2x10	6934	6459	5608	5008	6532	6125	5378	4838
	22' 9"	21' 2"	18' 5"	16' 5"	21' 5"	20' 1"	17' 8"	15' 10"

Notes:

1. Panel Properties:
   - Species: D.Fir
   - Lamination Grade: No.1/2 Visually Graded
   - Nails: 4" lg x 0.173" dia. at 12" o.c.
2. Deflection limits:
   - Permanent load = L/360
   - Live load = L/360
   - Snow load = L/240
   - Total load = L/180
3. Floor vibration should be evaluated on a project specific basis.
4. Tabulated spans are based on simple span condition. Two-span continuous may achieve longer spans.
5. Tabulated spans are based on end wall butt joints being limited to L/4 from a support. Panels without end wall butt joints have increased capacities.
6. Span tables are for preliminary sizing. Project specific capacities confirmed by Timberwood Engineering.
7. Contact Timberwood Innovations for 2x8 and 2x10 panel availability.
8. Wall panel spans can be provided on a project specific basis.

REMANUFACTURED PANEL SPAN TABLES

For projects with the farthest span requirements, Timberwood Innovations can assemble new NLT panels using reclaimed wood laminations. Lamination joints are located in a manner that maximizes panel capacities for the furthest panel spans. These remanufactured panels have the environmental benefits of reclaimed wood but also the greatest capacities NLT can provide.

ROOF

Panel Thickness	Superimposed Dead Load (kPa/psf)							
	0.5 / 10				1.0 / 20			
	Snow Load (kPa/psf)							
	1.0 / 20	1.5 / 30	2.0 / 40	2.5 / 50	1.0 / 20	1.5 / 30	2.0 / 40	2.5 / 50
2x4	5120	5120	4778	4436	4460	4460	4460	4436
	16' 9"	16' 9"	15' 8"	14' 6"	14' 7"	14' 7"	14' 7"	14' 6"
2x6	7425	7425	7425	6983	6636	6636	6636	6636
	24' 4"	24' 4"	24' 4"	22' 11"	21' 9"	21' 9"	21' 9"	21' 9"
2x8	9207	9207	9207	9172	8357	8357	8357	8357
	30' 2"	30' 2"	30' 2"	30' 1"	27' 5"	27' 5"	27' 5"	27' 5"
2x10	11118	11118	11118	11118	10227	10227	10227	10227
	36' 6"	36' 6"	36' 6"	36' 6"	33' 7"	33' 7"	33' 7"	33' 7"

FLOOR

Panel Thickness	Superimposed Dead Load (kPa/psf)							
	1.0 / 20				1.5 / 30			
	Live Load (kPa/psf)							
	1.9 / 40	2.4 / 50	3.6 / 75	4.8 / 100	1.9 / 40	2.4 / 50	3.6 / 75	4.8 / 100
2x4	4100	3793	3313	3010	4047	3793	3313	3010
	13' 5"	12'5"	10' 10"	9' 11"	13' 3"	12' 5"	10' 10"	9' 11"
2x6	6454	5970	5215	4739	6102	5970	5215	4739
	21' 2"	19' 7"	17' 1"	15' 7"	20' 0"	19' 7"	17' 1"	15' 7"
2x8	8357	7842	6850	6224	7754	7754	6850	6224
	27' 5"	25' 9"	22' 6"	20' 5"	25' 5"	25' 5"	22' 6"	20' 5"
2x10	10227	10016	8750	7950	9566	9566	8750	7950
	33' 7"	32' 10"	28' 9"	26' 1"	31' 5"	31' 5"	28' 9"	26' 1"

Notes:

1. Panel Properties:
   - Species: D.Fir
   - Lamination Grade: No.1/2 Visually Graded
   - Nails: 4" lg x 0.173" dia. at 12" o.c.
2. Deflection limits:
   - Permanent load = L/360
   - Live load = L/360
   - Snow load = L/240
   - Total load = L/180
3. Floor vibration should be evaluated on a project specific basis.
4. Tabulated spans are based on simple span condition. Two-span continuous may achieve longer spans.
5. Span tables are for preliminary sizing. Project specific capacities confirmed by Timberwood Engineering.
6. Contact Timberwood Innovations for 2x8 and 2x10 panel availability.

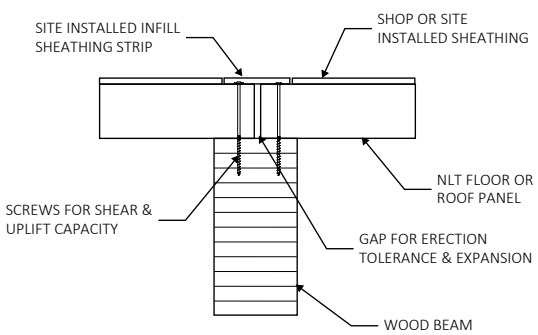
WALL PANELS

NLT EXTERIOR WALL AXIAL CAPACITIES (KN/M)				
Wall Height		Panel Thickness		
(mm)	(ft)	2x4	2x6	2x8
1829	6	790	1970	2850
2438	8	440	1500	2450
3048	10	245	1060	2040
3658	12	145	730	1600
4267	14	85	500	1225
4877	16	-	345	925
5486	18	-	245	695
6096	20	-	170	525
6706	22	-	120	395
7315	24	-	-	300
7925	26	-	-	230
8534	28	-	-	170
9144	30	-	-	130

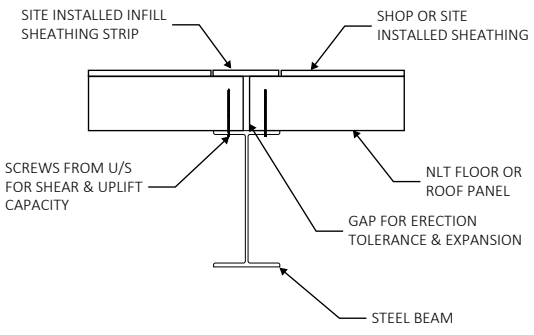
Notes:

1. Panel Properties:
   - Species: D.Fir
   - Lamination Grade: No.1/2 Visually Graded
   - Nails: 4" lg x 0.173" dia. at 12" o.c.
2. Table values are maximum factored axial load per 1m of wall length with a 1.4kPa applied factored wind load.
3. Tables are for preliminary sizing only.

PANEL DETAILS

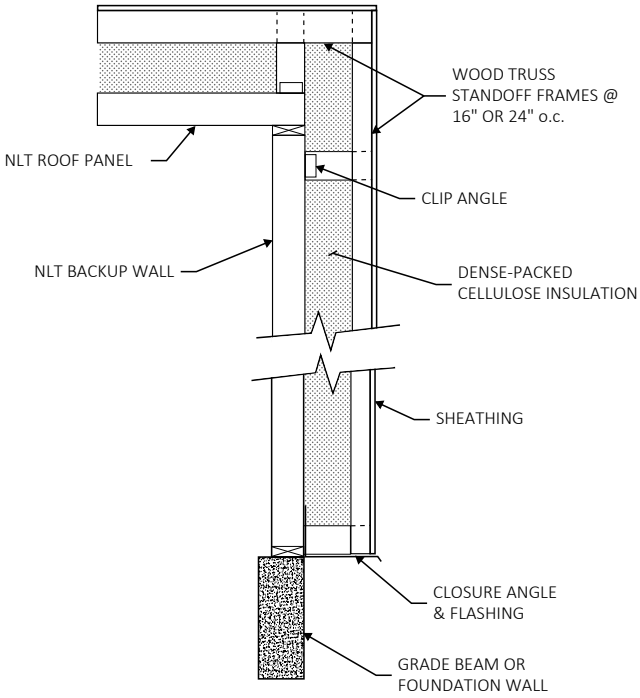


NLT PANEL ON WOOD BEAM

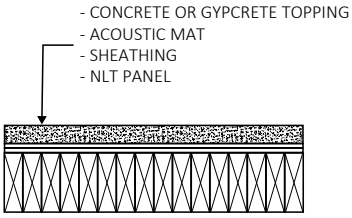


NLT PANEL ON WOOD BEAM

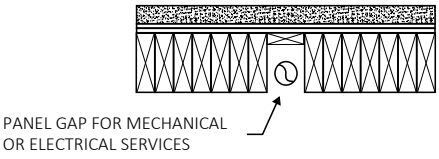
PANEL DETAILS



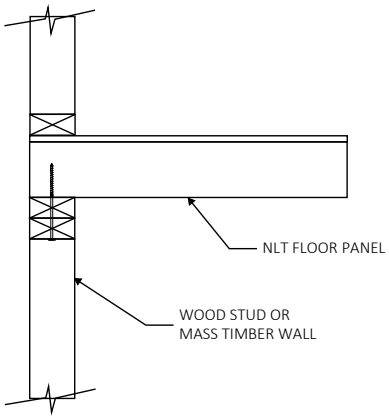
HIGH PERFORMANCE BUILDING ENVELOPE



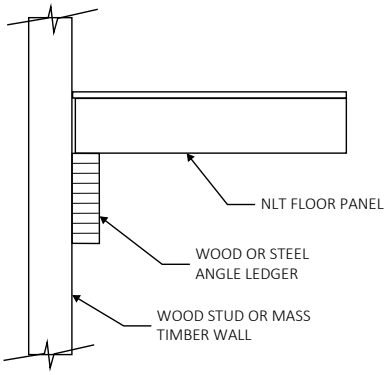
TYPICAL FLOOR CONSTRUCTION



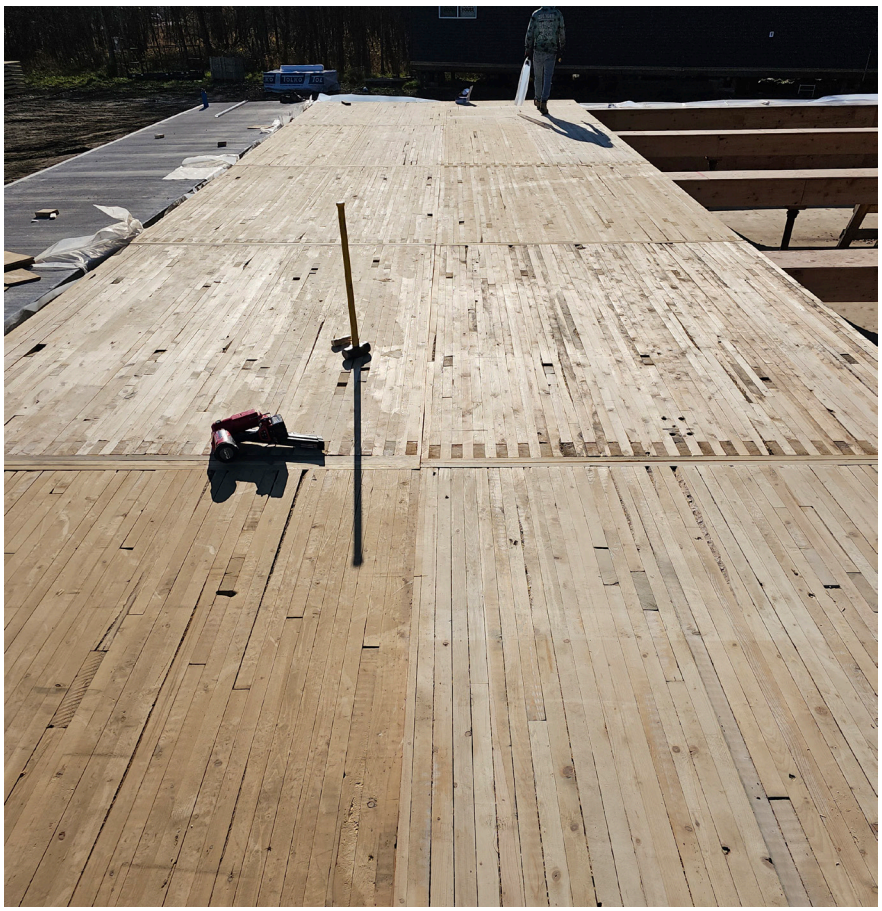
RECESSED SERVICES



NLT PANEL ON WOOD WALL - PLATFORM FRAMED



NLT PANEL ON WOOD WALL - BALLOON FRAMED



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