

# The Preserved Wood Foundation Guide

*Prepared by MuniCode Services Ltd.*

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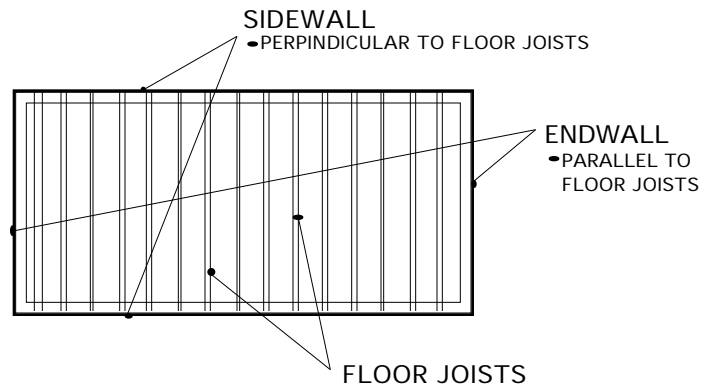
## **Outline and Restrictions of this Guide**

- The following information required for the construction of Preserved Wood Foundations (PWF's) is based on CAN/CSA S406-M92, "Construction of Preserved Wood Foundations".
- This standard is required by the 1995 National Building Code of Canada as adopted and amended by The Uniform Building and Accessibility Standards Regulations.
- The standard applies to all PWF's for dwellings which fall under Part 9 of the 1995 NBC.
- The standard as well as this guide is based on specific design assumptions. If any of the design conditions are different from these assumptions, or if the local authority specifically requires it, the PWF must be designed by a professional engineer.
- The foundation builder shall procure a copy of the standard and build in accordance to it. If there are any discrepancies between this guide and the Canadian Standard, the standard shall be considered correct.
- The CAN/CSA S406-M92 is available from Canadian Standards Association, 178 Rexdale Blvd., Rexdale, ON, M9W 1R3, Phone: 416-747-4000.
- This guide is based on requirements for basement concrete slabs and wood sleeper floors only. Additional and/or alternative codes are required for suspended wood floors in basements.

## Terms Used in this Guide

- End Wall - the exterior walls that are parallel to the floor joists, they do not support the floor joists.

- Side Wall - the exterior walls that are perpendicular to the floor joists.



- Framing Strap - a strip of 0.9mm (20 gauge) galvanized metal at least 38mm x 400mm (1 1/2" x 16") in size. Framing straps are generally used to transfer lateral loads into wall studs at floor joist locations or at openings in the exterior wall.

- Granular Drainage Layer - the continuous layer of crushed stone or rock used to drain moisture away from the bottom of the foundation. It may also distribute loads from the footing to undisturbed soil.

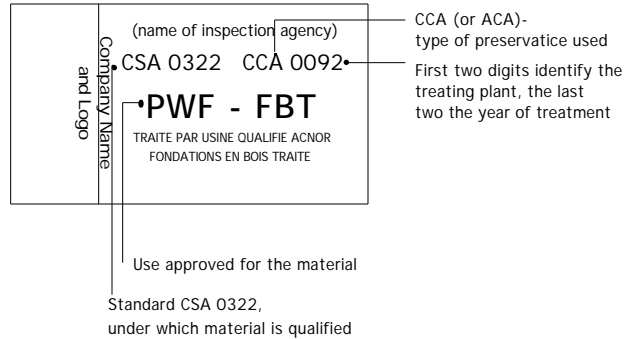
- Jack Stud - a stud that is less than full height and is fastened to a full height stud to support the ends of lintels or beams at foundation wall openings. It will transfer the vertical loads supported by the lintel or beam to the footing.

- Knee Wall - a less than full height foundation wall used adjacent to the main foundation wall to support additional loads from brick or stone siding or attached concrete slabs (garage).

## Materials

- All lumber and plywood used in a Preserved Wood Foundation must be treated with a preservative, except in limited locations outlined by the standard.

- Preserved wood will be identified as such by a certification mark stamped on the material, stating conformance with CSA 0322 Standard.



- Treated lumber shall not be...

- Cut lengthwise
- Notched

- Studs, blocking, and floor joists shall not be...

- Cut
- Notched
- Bored

...to accommodate electrical, mechanical utilities, or any other reason.

- Foundation wall studs may be cut to length and installed with treated (uncut) end down.

- Where necessary to field cut treated lumber, the cuts must be treated with two applications of a copper naphathane preservative solution containing a minimum of 2% copper metal and prepared with a solvent conforming to CSA Standard CAN/CSA-080.201.

- Nails for fastening treated material shall be hot-dipped galvanized or steel

- Staples shall be stainless steel with a minimum diameter or thickness of 1.6mm and a 9.5mm crown.

- Framing anchors and straps shall be galvanized.

- Moisture and vapour barriers must be a minimum 0.15mm (6mil) thick and conform to CAN/CGSB-51.34-M, "Vapour Barrier, Polyethylene Sheet for use in Building Construction".

Tip: Look for a maple leaf with a check mark through it stamped on your moisture or vapour barrier to ensure it has been tested and complies with CGSB standards.



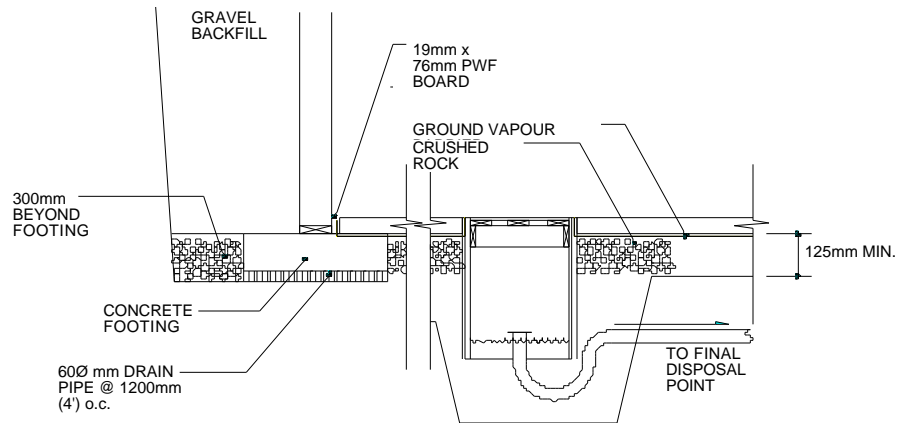
- Granular material for use in the granular drainage layer must be clean crushed stone or gravel that passes through a 40mm sieve with not more than 10% of fine material that will pass through a 4mm sieve.

## Site Preparation

- Excavation requirements shall conform to those of the appropriate building code.  
*See Section 9.12. of the 1995 National Building Code.*
- All top soil and vegetation matter that would be under the building must be removed.
- The bottom of the excavation must be free of all organic material and standing water.
- The excavation depth must be determined in accordance to Section 9.12. of the 1995 NBC.
- A continuous drainage layer shall be installed under floors of PWF's and be not less than 125mm (5").
- The excavation and drainage layer shall drain to a sump, which shall be provided with positive drainage, by gravity or pump, to a final disposal point outside the building.
- ***Perimeter drainage tile or pipe shall not be used with PWF's.***

## Footings

- Concrete footings shall be placed on undisturbed soil or on 125mm (5") granular drainage layer.
- When concrete footings are placed on undisturbed soil, drainage shall be provided by casting 60mm (2-1/4") dia. water passages (pipes) @ 1200mm (4') o.c. in the footing.



Remember: No drainage tile or pipe with a PWF.

## Foundation Columns

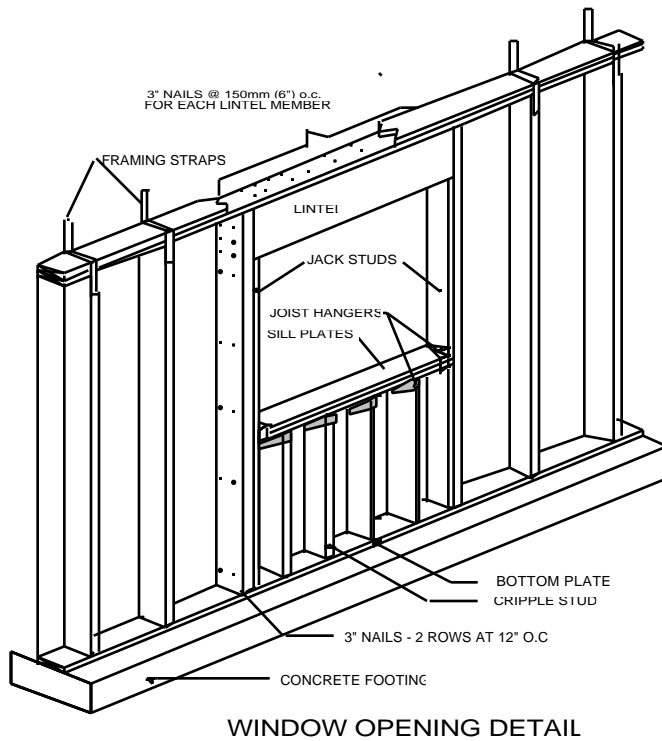
- Columns supporting floor beams shall be constructed in conformance with appropriate building code.

## Exterior Walls

### *Studs*

- Stud sizes shall be dictated by backfill height conforming to the Stud Table (for 8' long studs only) in the Appendix.

### *Wall Openings*



- Where backfill height is 1200mm (4') or less, framing and fastening around wall openings may conform to the appropriate building code.

- Where the height of backfill is greater than 1200mm (4'), the framing and fastening shall conform to the following:

- 1) Lintels located below the wall top plate shall be nailed to adjacent studs with
  - 6 - 3" nails when the lintel is 140mm (2x6) deep and...
  - 8 - 3" nails where the lintel is 184mm (2x8) deep.

- 2) Each lintel member shall be fastened to the wall top plate with 3" nails spaced @ 150mm (6") o.c.

- 3) Jack studs and adjacent wall studs shall be fastened together with by 2 rows of 3" nails spaced @ 300mm (12") o.c.

- 4) Framing straps or framing anchors shall be provided at the connection between the sills, jack studs, and cripple studs.
- 5) Cripple studs shall be the same size and spacing as specified for all wall studs.
- 6) For openings of 1200mm (4") or less, there shall be at least 2 studs on each side of the opening when supporting a lintel and only one shall be a jack stud.
- 7) For openings between 1200mm (4') and 2400mm (8'), stud sizes and quantities shall conform to the Window Opening Framing Table in the Appendix. Only one stud on each side shall be a jack stud.
- 8) Nail laminated wood sills shall conform to the Window Opening Framing Table in the Appendix.

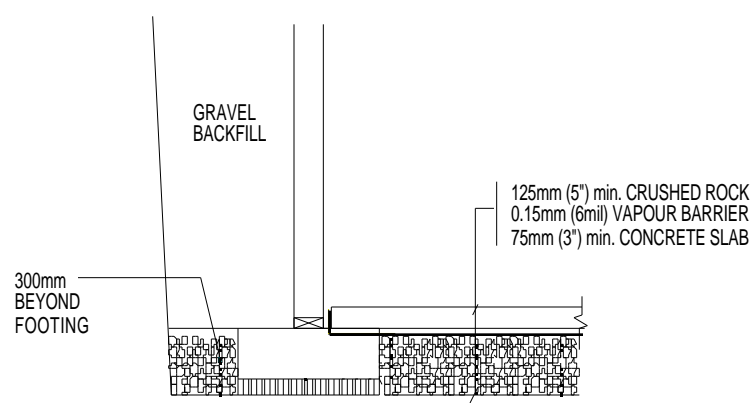
9) Openings greater than 2400mm (8') shall be designed in conformance with Part 4 of the 1995 NBC (Professional Engineer's design required).

***Sheathing***

- Wall sheathing thickness shall conform to the Plywood Sheathing Requirements Table in the Appendix.
- All below grade edges shall be supported by framing members (studs), 2x4 blocking, or by bottom wall plates.
- Edges shall be embedded in a sealant.
- A 2mm to 3mm separation shall be maintained between adjacent sheets of plywood.
- These gaps occurring below grade shall be sealed.
- Nailing shall conform to the minimum requirements of the “Minimum Fastening Requirements” table in the Appendix.
- If the backfill height is non-uniform, nailing shall conform to Tables B8 to B5 for the walls that are perpendicular to the opposing walls.
- Where backfill height is uniform, staples may be used in conformance to “Minimum Fastening Requirements” table.

**Concrete Slab Floors**

- Concrete slab floors shall be not less than 75mm (3") thick exclusive of concrete topping.
- Slabs shall extend at least 25mm (1") above the top of the bottom plate.
- A poly ground cover shall be placed between the floor slab and the granular drainage layer.
- All joints in the poly ground cover shall be overlapped a minimum of 300mm (12") and the sheet shall be sealed to the foundation wall footing around its perimeter.



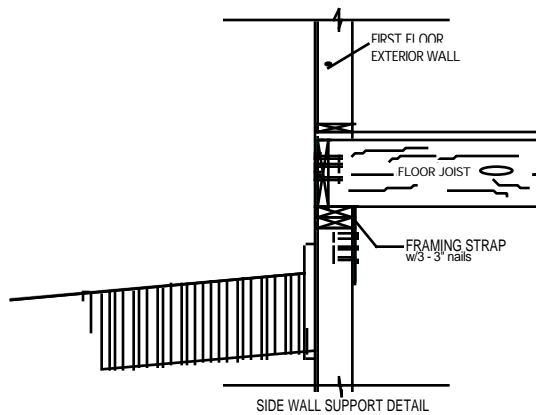
- All penetrations of the floor by pipes or other objects shall be sealed against water vapour and soil gas leakage.
- Note: Crawl spaces (no concrete slab) shall be backfilled and compacted to 2/5 of the exterior backfill height for lateral support and lined with a poly ground cover.

## First Floors

- The first floor system is an integral part of the entire foundation.
- Floors at the top of foundations shall be constructed to prevent the inward movement of exterior walls due to lateral pressure.

*\* A PWF shall never be backfilled before the entire first floor system (joists, subfloor, etc.) and basement floor are completely installed.*

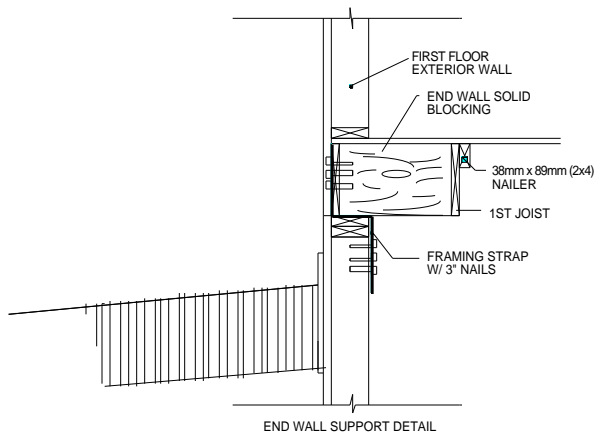
- Joists and blocking shall be nailed as required by the Minimum Fastening Requirements Table.



### ***Support for Side Walls***

- When the backfill height is greater than 1500mm (5'), framing straps shall be installed to each stud to attach the floor to the foundation wall in accordance with the requirements of the Minimum Fastening Requirements Table.

- Top chord bearing Trusses or I-joists shall be connected to the top of the wall to prevent inward movement of the wall by means of:
  - 1) framing straps nailed to the ends of the top chord and the inner face of the wall studs;
  - 2) steel hangers or a wood ledger located to provide positive bearing of the top chord against the wall stud ends or other means of providing support.



- Bottom chord bearing Trusses or I-joists shall be connected to the top of the wall to prevent inward movement of the wall by means of:
  - 1) steel hangers or a wood ledger located as to provide positive bearing of the chord end against the wall studs or other means of providing support.

### ***Support for End Walls***

- Full-depth blocking shall be installed, in line with foundation studs, between the rim joist or wall studs and the first joist from the wall.

• When backfill height is greater than 1500mm (5'), the first joist in from the end walls shall have a nailer joist (at least 2x4) fastened to it, mounted flush to the top of the joist.

- The subfloor shall be nailed to both the full joist and the nailer joist with one row of 2" nails at



100mm (4") o.c. Framing straps shall also be installed in accordance with the Minimum Fastening Requirements Table in the Appendix.

- When Trusses or I-joists top chords are located at the level of the foundation top plates, blocking shall be installed to ensure the direct transfer of lateral loads from studs to the top chord of the first joist and:

- 1) Increased nailing of the subfloor to the top chord is also required in accordance to the Minimum Fastening Requirements Table. If the top chord of the joist is a minimum 89mm (4") wide, the additional (2x4) nailer joist is not required.

- When Trusses or I-joists bottom chords are located at the level of the foundation top plates, lateral inward movement of the wall shall be resisted by means of:

- 1) blocking installed to ensure the direct transfer of lateral loads from the end wall studs upward into the floor sheathing at a top chord located at a distance from the wall at least twice the depth of the joist (may require blocking between the first two joists); or

- 2) If the backfill height is uniform on opposite end walls, install blocking in a continuous line between all the joists to transfer the lateral loads across the entire foundation.

### **Non-Uniform Backfill Heights**

- When the backfill heights are at different heights around the house, additional nailing requirements must be incorporated for the foundation wall sheathing. These requirements may be found in the “Perimeter Nailing Requirements for Differential Backfill Heights” table in the appendix at the back of this manual.

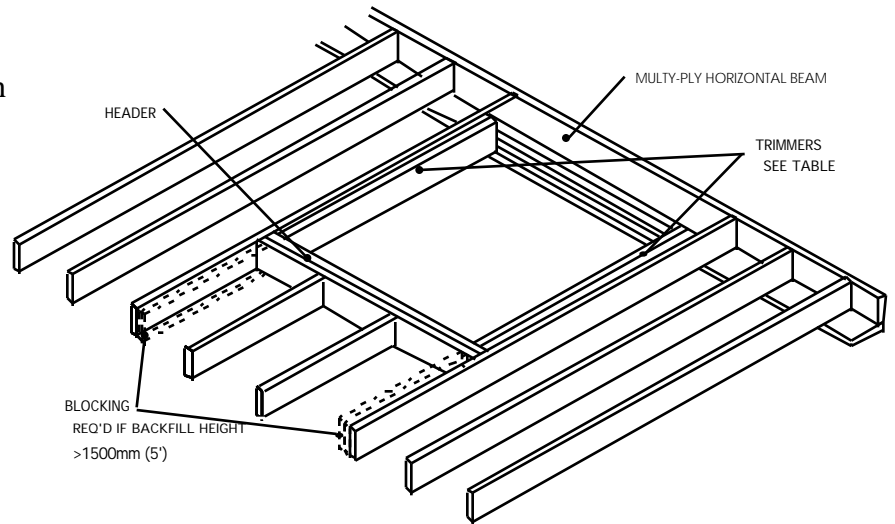
## Stairwell Openings

- When openings are greater than 1200mm (4') from a side wall and 1800mm (6') from an endwall, stairwell opening construction shall conform to the minimum requirements for wood frame construction in the appropriate building code.

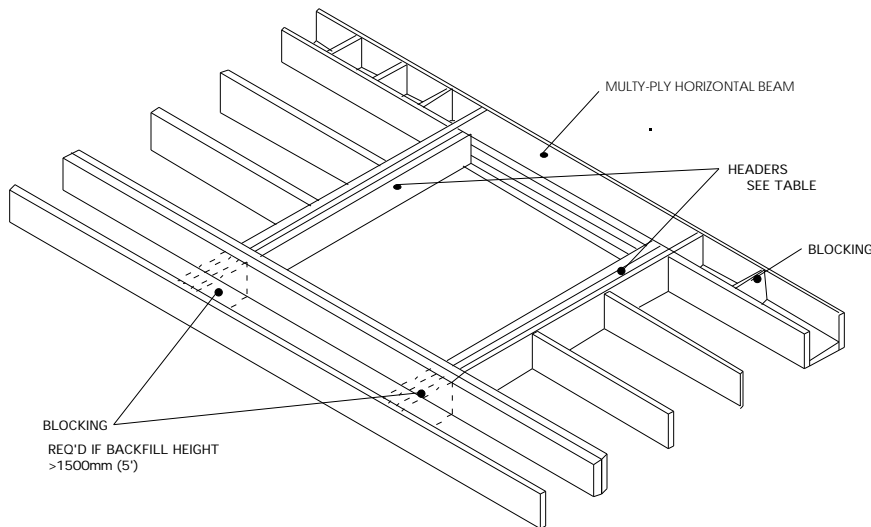
- When openings are closer to their adjacent walls than specified previously, they shall conform to the following:

1) The maximum dimension of a stairwell opening shall be 4300mm (14').

2) Openings less than 1200mm (4') from a side wall shall be framed with a multi-ply horizontal member.



STAIRWELL PERPENDICULAR TO SIDE WALL



STAIRWELL PARALLEL TO END WALL

3) Openings less than 1800mm (6') from an endwall shall be framed with a multi-ply horizontal member.

4) The size and nailing requirements of these multi-ply members for each circumstance shall conform to the "Stairwell Opening Framing" table in the appendix at the back of this manual.

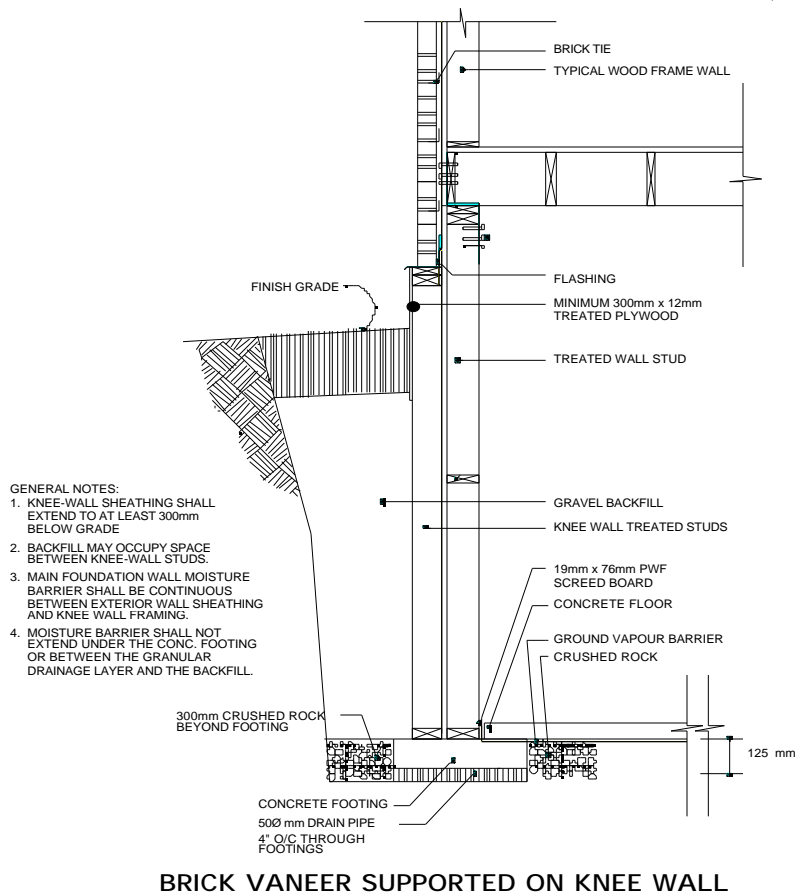
## Support of Masonry Veneer and Concrete Slabs

- Masonry veneer cladding shall be installed according to appropriate building code and shall be supported on either...
  - i) a knee wall attached to the exterior of the main foundation wall.

- ii) top of the main foundation wall.

### *Supported on Knee Wall*

- Footings supporting both a foundation wall and a knee wall shall conform to the appropriate building code to accommodate the additional width required by the knee wall.
- Knee wall studs shall be a minimum 2x4 @ 400mm (16") o.c. for supporting a single wythe of masonry to a maximum height of 550mm (18').



- The knee wall shall be installed outside the exterior moisture barrier and nailed at the top of each stud to the main foundation wall.

- If the knee wall exceeds 1500mm (5') in height, the studs shall also be toe-nailed at mid-height to the wall.

- Top plates of knee walls shall be doubled to support the masonry veneer.

- Joints in the top plates shall be placed a minimum of two stud spaces apart and shall occur directly above the centre of a stud.

- Knee wall sheathing shall extend a minimum of 300mm (12") below grade at any point.

- No exterior moisture barrier is required over the knee wall sheathing.

### *Supported on Main Foundation Wall*

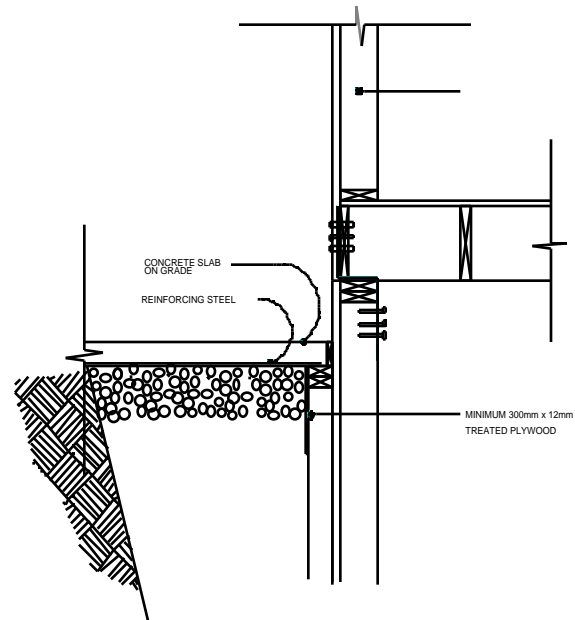
- Where masonry veneer is supported on the main foundation wall, the foundation framing shall have a width sufficient to provide required support for the masonry veneer as well as accommodating the floor framing.

- Top plates shall be doubled and pressure treated.

### ***Exterior Concrete Slabs***

- Where driveway or garage floor slabs are butted against foundation walls, one of the following two steps shall be taken to support additional load:

- i) Design the stud size and spacing as if the backfill height were 500mm (20") higher than the actual height.
- ii) Reinforce the slab and support it on a preserved wood knee wall (as described above).



GARAGE SLAB SUPPORTED ON KNEE WALL

### ***Garage Frost Walls***

- Frost walls used to support garage walls shall be placed in a trench and backfilled on both sides.

- Footings shall be placed below frost penetration level.

Note: Properly insulating the frost wall may reduce the required footing depth.

- Where the frost wall is subject to balanced soil loads, studs may be 2x4 with 1/2" plywood sheathing extending a minimum of 24" below grade.

### **Exterior Moisture Barrier**

- The below grade portion of the exterior face of the wall sheathing on a preserved wood foundation enclosing living space shall be protected by a moisture barrier.
- A polyethylene sheet moisture barrier shall be applied to the wall sheathing by embedding it into vertical beads of sealant, or into damproofing applied uniformly over the sheathing.
- Joints between poly sheets shall be vertical, lapped a minimum of 600mm (2') and sealed.
- When attached with vertical sealant beads, the poly shall not be sealed along the bottom of the wall.
- The upper edge of the poly ground sheet shall be looped a minimum of 150mm (6") and secured in place by the nailing of a cover plate.
- The cover plate shall be a pressure treated strip of plywood having a minimum thickness of 12.5mm and a minimum width of 300mm (12").

- The top edge of this continuous strip shall be embedded in sealant or damproofing along its full length.
- The plywood strip may follow the contour of the finished outside grade but shall extend a minimum of 75mm (3") above grade at all points.
- The moisture barrier shall be protected at interior and exterior corners from mechanical damage with treated plywood strips or other durable corner construction.
- The moisture barrier shall cover the entire surface below grade and extend to the bottom edge of a wood footing. For a concrete footing, it shall not obstruct the required drainage passages.

### **Backfilling**

- PWF's shall not be backfilled until the basement floor and the floor on top of the foundation are completely installed.
- Heavy equipment and loads shall be kept a safe distance from foundations.
- Backfill shall be placed in uniform lifts not exceeding 600mm (2') around the foundation.
- The site shall be graded according to appropriate building codes.
- Backfill material shall have good drainage characteristics. All backfill material placed within 600mm (2') of the foundation wall shall be free of deleterious debris, frozen clumps, and boulders larger than 150mm (6") in diameter.

# **Appendix**

## **Tables**

## Plywood Sheathing Requirements

Plywood Alignment on Wall	Stud Spacing mm (in)	Permissible Backfill Heights, mm (ft-in)		
		Plywood Thickness		
		12.5mm	15.5mm	18.5mm
Face grain perpendicular to studs	300 (12)	2900 (9'-6")	3500 (11'-6")	3600 (11'-10")
	400 (16)	2200 (7'-3")	2600 (8'-6")	3600 (11'-10")
Face grain parallel to studs	300 (12)	2100 (6'-11")	2700 (8'-10")	3000 (9'-10")
	400 (16)	1300 (4'-3")	2000 (6'-7")	2200 (7'-3")

Note: Plywood is required to have at least 4 plies (4 ply plywood shall be installed with grain perpendicular to studs)

### Minimum Fastening Requirements

	Construction Detail	Minimum Length of nails mm (in)	Minimum no. or max. spacing of fasteners	
Foundation wall framing (nails)	Bottom wall plate to wood footing plate	76 (3)	600mm (24) centres	
	Bottom wall plate to stud	(end nail)	76 (3)	2 each stud
		(toe nail)	63 (2 1/2)	3 each stud
	Top wall plate to stud (end nail)			
	-38x89mm (2x4) stud	89 (3 1/2)	2 each stud	
	-38x140mm (2x6) stud	89 (3 1/2)	3 each stud	
	-38x184mm (2x8) stud	89 (3 1/2)	4 each stud	
	Plate to plate nailing for doubled top plates			
	-38x89mm (2x4) stud	76 (3)	2 each stud space	
	-38x140mm (2x6) stud	76 (3)	2 each stud space	
-38x184mm (2x8) stud	76 (3)	3 each stud space		
	Horizontal wall blocking to wall stud	76 (3)	2 each end of block	
Floor framing (nails)	End wall blocking to floor joists	76 (3)	400mm (16") centres	
	Full depth end wall blocking to floor joists (end nail)	76 (3)	2 each end of block	
	Ledger strip to wall stud	89 (3 1/2)	3 each stud	
Floor attachment to foundation wall (nails and framing straps)	Floor joists and blocking at top of foundation wall to top plate (toe nail)			
	-38x89mm (2x4) wall plate	89 (3 1/2)	2 per joist or block	
	-38x140mm (2x6) wall plate	89 (3 1/2)	3 per joist or block	
	-38x184mm (2x8) wall plate	89 (3 1/2)	4 per joist or block	
	In addition, framing straps are required where backfill height exceeds	76 (3)	1 framing strap at every stud, with 3 nails into floor header and 3 nails into inner face of foundation wall stud	
	a) 1500mm (5') with sleeper or slab floor, or			
	b) 2000mm (6'-6") with suspended wood floor			



Wall sheathing and subfloor (nails or staples)	Sheathing to wall framing (uniform backfill) and subfloor to floor joists		
	-Nails	51 (2)	150mm (6") centres along edges and 300mm (12") centres along intermediate supports
	-Staples	51 (2)	100mm (4") centres along edges and 200mm (8") centres along intermediate supports
Framing around windows (framing anchors)	In addition to normal nailing requirements, framing anchors are required where backfill height exceeds a) 1200mm (4') with sleeper or slab floor; or b) 2000mm (6'-6") with suspended wood floor, at sill plate to -cripple studs -jack studs	51 (2)	1 framing anchor at each point, nailed as required by manufacturer

## Stud Table (8' Stud length)

Stud size, mm x mm - 2.4m (8') studs

Maximum building width (parallel to floor joists)		Lumber		Stud size, mm x mm - 2.4m (8') studs					
				38 x 89		38 x 140		38 x 184	
				Stud spacing - mm (in), o.c.					
With center support	No center support	Strength grouping	Grade	400 (16)	300 (12)	400 (16)	300 (12)	400 (16)	300 (12)

1 Storey				Maximum backfill when supporting 1 storey above foundation, no brick veneer, mm					
7m (23 ft)	5m (16 ft)	Species 1	SS	1200	1350	2075	2400	2400	2400
			No.2	1050	1250	1650	1925	2050	2400
		Species 2	SS	1025	1200	1700	1975	2125	2400
			No.2	875	1075	1450	1675	1800	2075
10m (33 ft)	8m (26 ft)	Species 1	SS	1200	1350	2025	2400	2400	2400
			No.2	925	1150	1600	1875	2025	2375
		Species 2	SS	925	150	1650	1925	2075	2400
			No.2	750	975	1400	1650	1750	2050

2 Storey				Maximum backfill when supporting two storeys above foundation, no brick veneer, mm					
7m (23 ft)	5m (16 ft)	Species 1	SS	1200	1350	2050	2400	2400	2400
			No.2	950	1175	1625	1900	2025	2375
		Species 2	SS	950	1175	1650	1950	2075	2400
			No.2	775	975	1400	1650	1750	2050
10m (33 ft)	8m (26 ft)	Species 1	SS	1075	1350	1950	2350	2400	2400
			No.2	800	1050	1550	1825	1975	2325
		Species 2	SS	775	1050	1575	1875	2025	2400
			No.2	575	850	1350	1575	1700	2000

1 Storey (w/ brick veneer)				Maximum backfill when supporting one storey above foundation, with brick veneer, mm					
10m (33 ft)	8m (26 ft)	Species 1	SS	n/a	n/a	1975	2375	2400	2400
			No.2	n/a	n/a	1575	1850	1975	2350
		Species 2	SS	n/a	n/a	1600	1900	2050	2400
			No.2	n/a	n/a	1350	1600	1725	2025

2 Storeys (w/ brick veneer on first storey)				Maximum backfill when supporting two storeys above foundation, with brick veneer on first storey, mm					
10m (33 ft)	8m (26 ft)	Species 1	SS	n/a	n/a	1900	2300	2400	2400
			No.2	n/a	n/a	1500	1800	1925	2300
		Species 2	SS	n/a	n/a	1525	1825	2000	2375
			No.2	n/a	n/a	1300	1550	1675	1975

2 Storeys (w/ brick veneer full height)				Maximum backfill when supporting two storeys above foundation, with brick veneer full height, mm					
10m (33 ft)	8m (26 ft)	Species 1	SS	n/a	n/a	1875	2250	2400	2400
			No.2	n/a	n/a	1450	1750	1900	2250
		Species 2	SS	n/a	n/a	1500	1800	1950	2325
			No.2	n/a	n/a	1250	1500	1625	1950

Note: When brick veneer supported on knee wall, the sections headed "no brick veneer" shall apply.





