damage if properly built, not all contractors are fully conversant with the specification and best practices of installation. Omissions may occur, particularly if the system is site-built instead of prefabricated in a plant with good quality control. Deficiencies in proper treatment of cut ends and proper installation of membranes and moisture barriers can result in structural deterioration as well as air quality issues. All end connections that rest on grade or abut soil should be inspected and tested with a moisture meter. The sump pit should be inspected for proper free drainage on all sides and the water removal drain or pump checked for proper operation and good condition. From the outside, the integrity of moisture proofing and membranes should be verified, if possible.

The structural integrity of the system should be verified by inspecting for deviations from straight, plumb, and level. If any deficiencies are found; an attempt should be made to determine if they are a result of faulty construction or deterioration from moisture damage. Framing details that are necessary but not included in normal wood-frame construction should be verified by consulting a PWF construction guide.

It should be noted that some smaller sized lending corporations may request an engineers certificate for a PWF or may not provide a loan at all should a home be constructed with a wood foundation.

Summary:

- PWF moisture control systems differ from standard foundation systems
- PWF framing requires detailing not required in standard framing
- Inspection of PWF should be vigilant for signs of moisture ingress
- Correct detailing of framing should be verified

NBCC Reference: None specific to this type of construction. The **NBCC** refers users to CSA standard S406, “Permanent Wood Foundations for Housing and Small Buildings”. As of January 1st 2016, this standard has been replaced by CSA S406-14 “Specification of Permanent Wood Foundations for Housing and Small Buildings”. An illustrated construction guide compliant with this standard is available from the Canadian Wood Council online bookstore.

Fig. 1-17 Bowed PWF Wall
Image Source: CIHI

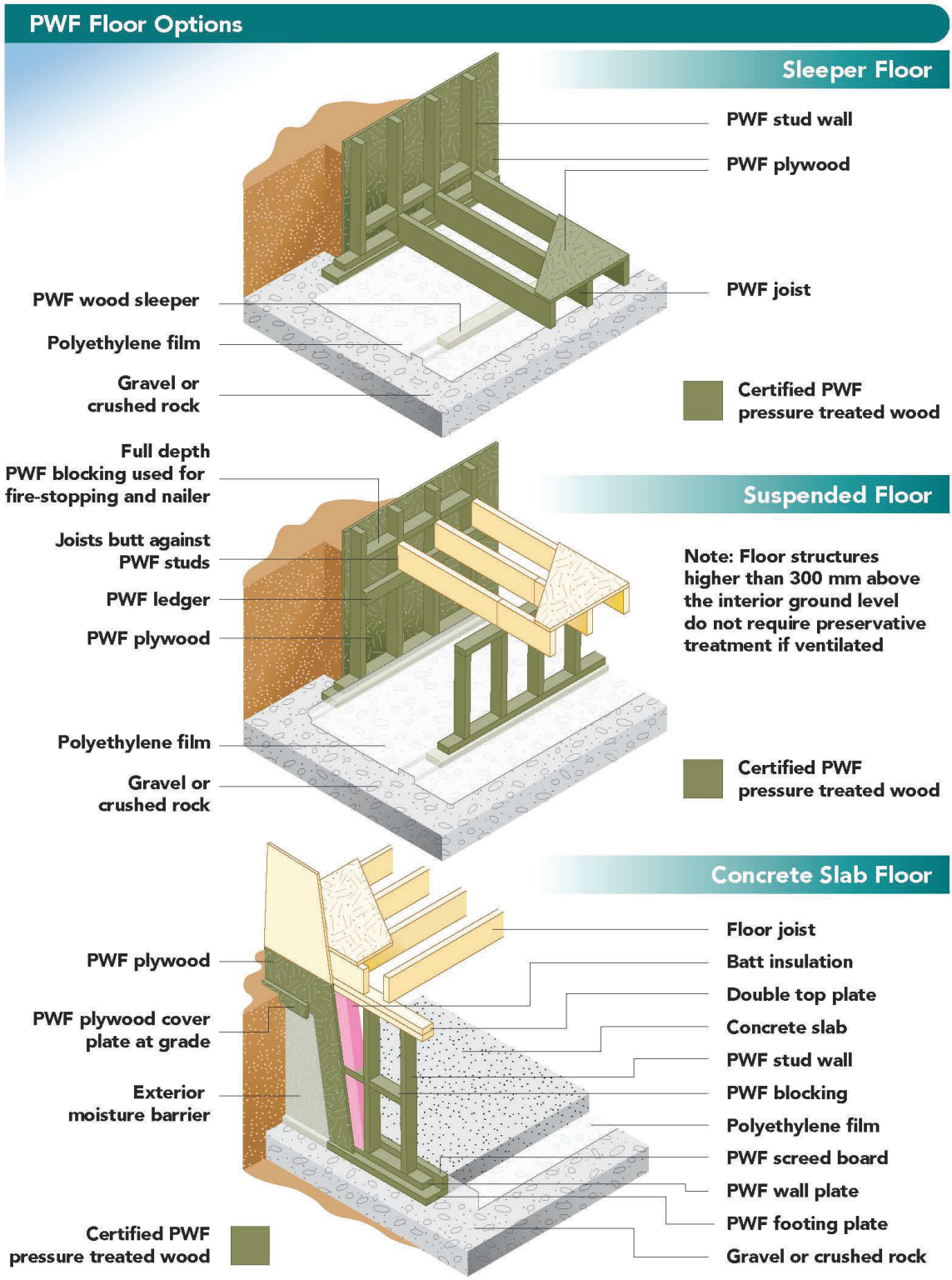


Fig. 1-15 PWF Floor Systems

Image Source: Canadian Wood Council and Wood Preservation Canada

1.7 Slab on Grade Foundations and Floors

Concrete slabs on grade are often used where there is no need or desire for an excavated basement or crawlspace, or where excavation is impractical. Foundations of this type may involve only shallow excavation to provide for a thickened edge where the slab supports walls.

In this type of construction, the slab and the thickened edge are typically cast as a single unit incorporating metal reinforcing throughout. Frost damage is prevented by heat transfer from the slab into the soil; the heat is retained by exterior perimeter insulation which may take the form of a frost shelf extending out from the slab as well as down.

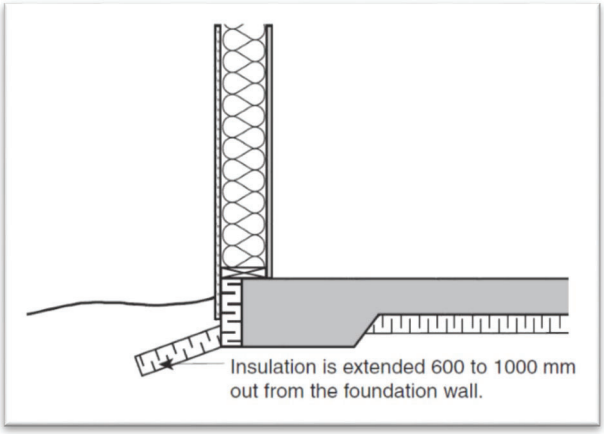


Fig. 1-18 Skirt Insulation - *Reproduced with the permission of Alberta Municipal Affairs and the National Research Council of Canada, copyright holder*

A variation of this method involves excavating to the frost line around the perimeter of the slab and casting a grade beam to frost line.

It may be desirable in slab on grade construction to separate the function of supporting exterior walls from the slab itself. This may be done to increase thermal efficiency, to accommodate in-floor heating, or for other reasons. If this construction method is adopted, the walls are supported on a foundation wall equipped with a footing at frost line, or on a reinforced grade beam supported on piers that extend to frost line.

Concrete slabs on grade are an acceptable foundation for buildings and generally avoid most of the potential problems associated with excavated foundations. There is no excavated space inside foundations of this type, thus there is no requirement for foundation drainage systems and minimal risk of damage from lateral pressure. On grade construction coupled with the use of a vapour barrier under the floor also avoids moisture migration and soil gas issues.

Older slab on grade installations may suffer from moisture migration around the perimeter if a moisture barrier is defective or missing. If the edge of the slab is not prevented from losing heat to the environment; moist indoor air can contribute to condensation where there is a thermal bridge. The result will damage the floor area closest to the perimeter. If wood framing is fastened directly to the edge of the slab without the use of a separate foundation or a block course to raise it away from grade; there may be moisture damage. Some older installations are deficient in this area particularly if the structure was converted from an unheated space to a heated one. Structural inspection should verify that no heaving or settling around the perimeter has occurred due to frost uplift or inadequate bearing.

In a heated space, slabs on grade that are not integrated in the support of exterior walls are not required by the **NBCC** to incorporate

reinforcing. This applies to basement floors as well as slabs on unexcavated grade.

Basement floors in residential construction generally are not provided with crack-control joints but are allowed to develop random cracks naturally as they cure. These cracks are normal, as is a degree of shrinkage away from the foundations wall. Cracks up to 3/32”/3mm should not be considered a problem unless there is evidence of heaving or displacement as well. The cause may be hydrostatic pressure caused by a high water table under the floor or a defective foundation drainage system.

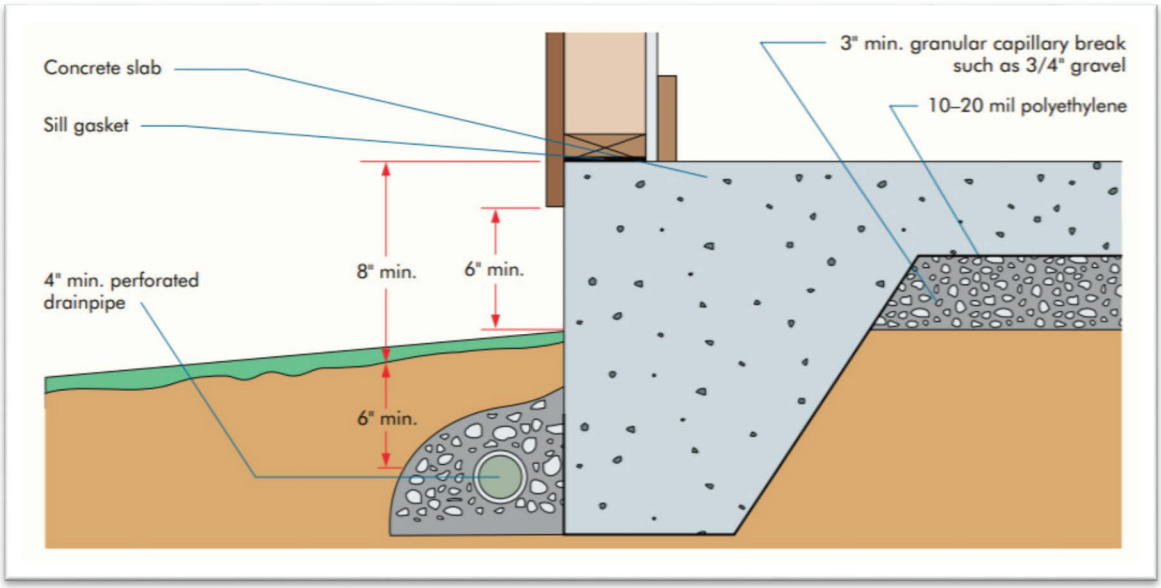
Larger interior floor slabs may incorporate reinforcing of glass, steel, or other fibres to reduce cracking and prevent edge displacement. These slabs may also be provided with crack controlling joints, called cold joints, at regular intervals, and around columns.

Summary:

- As per **CAN/CSA-A770-16, 5.3.3** Concrete slab on ground/grade inspection shall include, but not be limited to, an examination for damage, movement, and evidence of water issues
- Well-constructed slab on grade foundations avoid most moisture problems
- Heat loss around the perimeter can produce condensation issues
- Narrow random cracks in basement floor slabs are normal
- Floor slabs should not exhibit any sign of heaving

NBCC Reference: Section 9.16

Fig. 1-19 Slab on Grade Foundation
Image Source: APA



1.8 Pier (Pile) Foundations

The great majority of year-round homes are supported by full foundations whether continuous walls or slabs on grade. However, there exist homes that are fully or partially supported on piers usually of steel or concrete though wooden piers may be encountered. These structures are generally located where a conventional foundation is impractical; such as on a steep hillside or where it is necessary to elevate the structure above water. This type of structure may well have been designed with the services of an architect and engineer and exhibit unconventional construction methods and materials.

Recreational properties are often set on pier foundations for ease of construction and to minimize environmental impact on the building site. These piers will usually be of cast concrete or concrete block but may be of wood, either preservative-treated posts or site-cut timber. Structures of this type are usually conventional construction and are often owner-built. Outbuildings in rural areas or on recreational property may be supported on piers if not resting on a slab or directly on ground.

Recently, steel helical pier foundations have gained in popularity as they require little to no ground work.

Fig. 1-20 Green Helical Piers Supporting Deck
Image Source: Techno Metal Post

A helical pier is an oversized steel screw that is drilled into the ground, using hydraulic equipment, until it reaches the required bearing capacity. The size of the helix and the depth of the pier depends on the structure, the soil type, and on the required bearing capacity. Once installed, pier caps are used to attach the pier to the framing system. Pier caps come in many sizes and varieties, depending on the structure's frame.