City of Whitehorse Builders Permit and Code Education webinar series

Session 02
Excavation, Footings/Foundations, Radon and Drainage

January 22, 2025 (revised Jan 24)

Presenter – Ken Kunka AScT, BCQ

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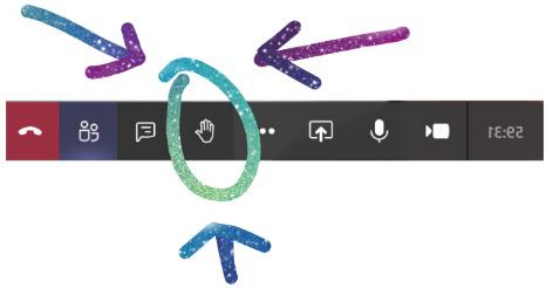
Session housekeeping

- Registration will be tracked
- Presentation is recorded for future access
- Please use raise hand icon if you have a question or comment
- Turn on your Chat and add comments (poll questions)
- Please mute your microphone
- You may need to turn off your camera
- Please follow up by email if you have specific question or example to share.
    - ken.flywheel@gmail.com



Workshop Series

As part of the City's commitment to improving the permit process and communication with building industry members, the city will be providing 5 online sessions to review local building regulations, the 2020 National Building Code and an overview on the building permit process.

This presentation is conceptual and for informal educational purposes only. Material presented must not be considered complete or exhaustive. Code provisions have been generally represented and may not reflect all provisions.

Workshop Series

2025 Education Webinar Sessions

1. ~~Jan 15 –~~ Part 9 overview & what makes up a complete permit submission
2. Jan 22 – Excavation, Footings/Foundations, Radon and Drainage,
3. Feb 5 – Framing including PWF S406-16,
4. Feb 19 - Fire Protection (Part 9.10),
5. March 5 – Building Envelopes & Mechanical Systems

These sessions will lead into the creation of building permit guide for Part 9 buildings – March 2025.

Workshop Series Content

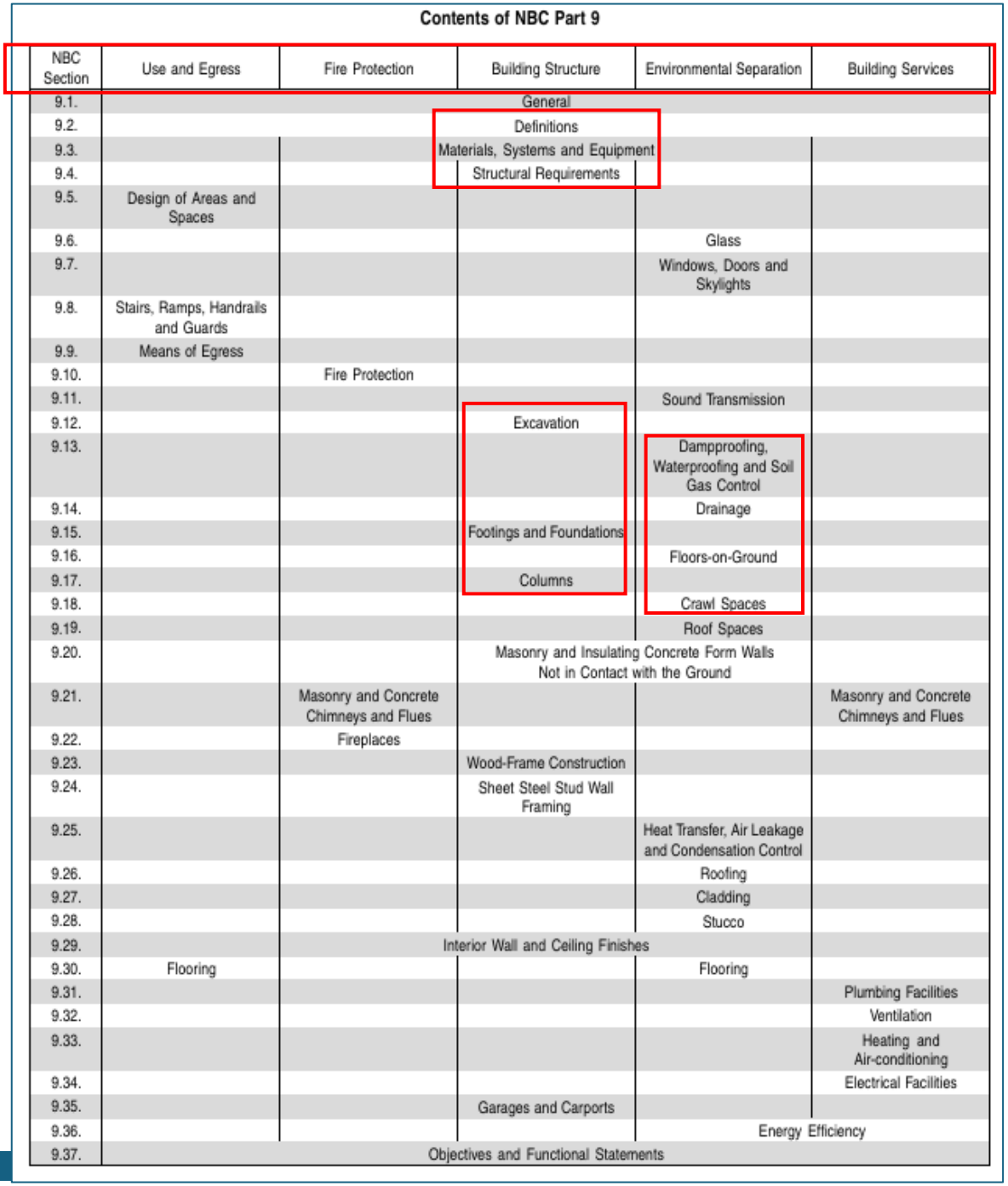
The NBC is broken into 5 main categories:

- Use and Egress
- Fire Protection
- Building Structure
- Environmental Separations
- Building Science

Session 02 will concentrate in the areas of

- Building Structure, and
- Environmental Separations.

Image from 2015 NBC Illustrated Guide



Contents of NBC Part 9

NBC Section	Use and Egress	Fire Protection	Building Structure	Environmental Separation	Building Services
9.1.			General		
9.2.			Definitions		
9.3.			Materials, Systems and Equipment		
9.4.			Structural Requirements		
9.5.	Design of Areas and Spaces				
9.6.				Glass	
9.7.				Windows, Doors and Skylights	
9.8.	Stairs, Ramps, Handrails and Guards				
9.9.	Means of Egress				
9.10.		Fire Protection			
9.11.				Sound Transmission	
9.12.			Excavation		
9.13.				Dampproofing, Waterproofing and Soil Gas Control	
9.14.				Drainage	
9.15.			Footings and Foundations		
9.16.				Floors-on-Ground	
9.17.			Columns		
9.18.				Crawl Spaces	
9.19.				Roof Spaces	
9.20.			Masonry and Insulating Concrete Form Walls Not in Contact with the Ground		
9.21.		Masonry and Concrete Chimneys and Flues			Masonry and Concrete Chimneys and Flues
9.22.		Fireplaces			
9.23.			Wood-Frame Construction		
9.24.			Sheet Steel Stud Wall Framing		
9.25.				Heat Transfer, Air Leakage and Condensation Control	
9.26.				Roofing	
9.27.				Cladding	
9.28.				Stucco	
9.29.		Interior Wall and Ceiling Finishes			
9.30.	Flooring			Flooring	
9.31.					Plumbing Facilities
9.32.					Ventilation
9.33.					Heating and Air-conditioning
9.34.					Electrical Facilities
9.35.			Garages and Carports		
9.36.				Energy Efficiency	
9.37.	Objectives and Functional Statements				

Workshop Series – reference material

Workshop sessions along with updated PowerPoint presentations will be available for review on the city's website.

Please note new Building Department Bulletins for 2025!

NEW Building Bulletins

The following **Building Bulletins** have been created by the Land and Building Services Department. These Building Bulletins are designed to provide clarity and up-to-date information to builders, contractors, suppliers, and others in the construction industry on changes to building requirements under the National Building Code and amendments to the City's Building and Plumbing Bylaw.

Check back often for updates. To sign up for email updates, please contact adminbuilding@whitehorse.ca.

- **Truss Design (Jan. 20, 2025)**
- **Permanent Wood Foundations (Jan. 20, 2025)**
- **Cast-in-Place and ICF Foundations (Jan. 20, 2025)**

https://www.whitehorse.ca/city-launches-building-bulletins

Learning Objectives – Session 02

This session has been developed to assist building industry partners to gain a better understanding of the following topics:

- Minimum drawing requirements – site and foundations
- Minimum inspection requirements – what to be ready for and documents provided
- Site Safety (excavations)
- Reducing negative impacts to neighbouring properties and city infrastructure
- When professional involvement may be required (Excavations, Bearing, Structural Design - Part 4)

Learning Objectives – Session 02

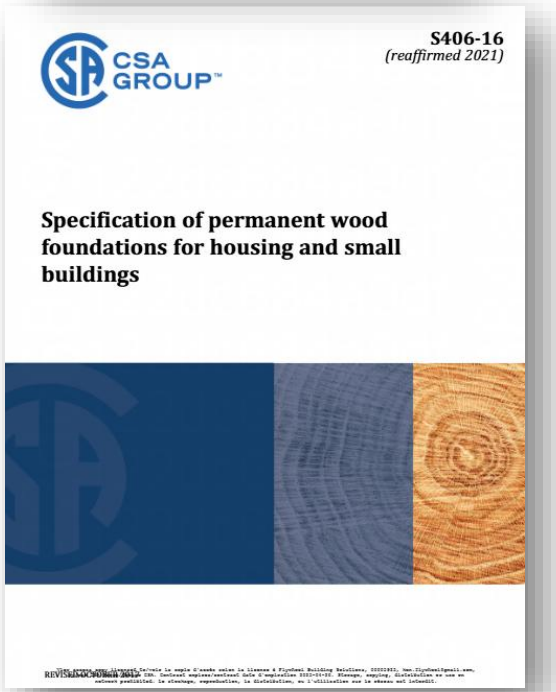
NBC Code Section focus

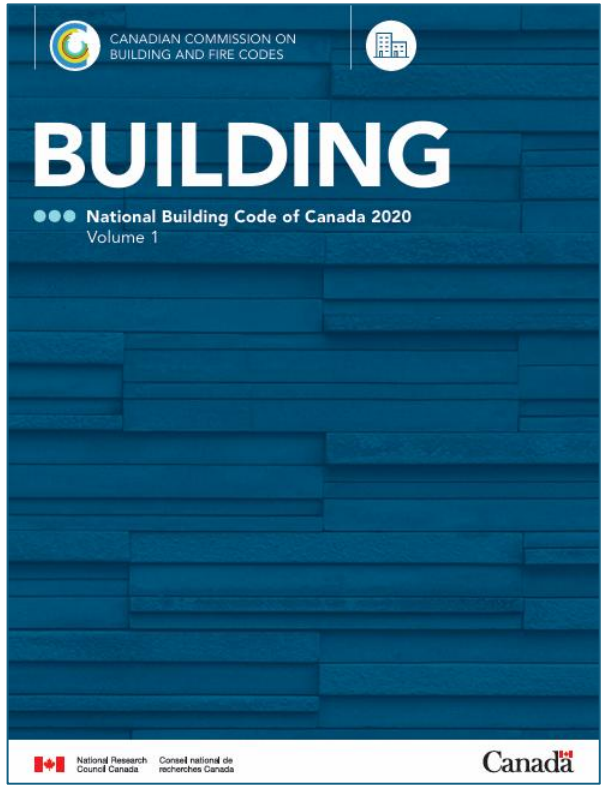
- 9.3. Materials, Systems and Equipment
- 9.4 Structural Requirements related to footing/foundations
- 9.12 Excavations
- 9.13 Dampproofing, Waterproofing and Soil Gas
- 9.14 Drainage
- 9.15 Footing and Foundations (9.17 Columns)

Learning References

Reference material for this session :

- 2020 National Building Code
- CSA-S406-16 (reconfirmed 2021)
- 2015 Illustrated Users Guide





Design parameters – Session 02

Design references shall be related to:

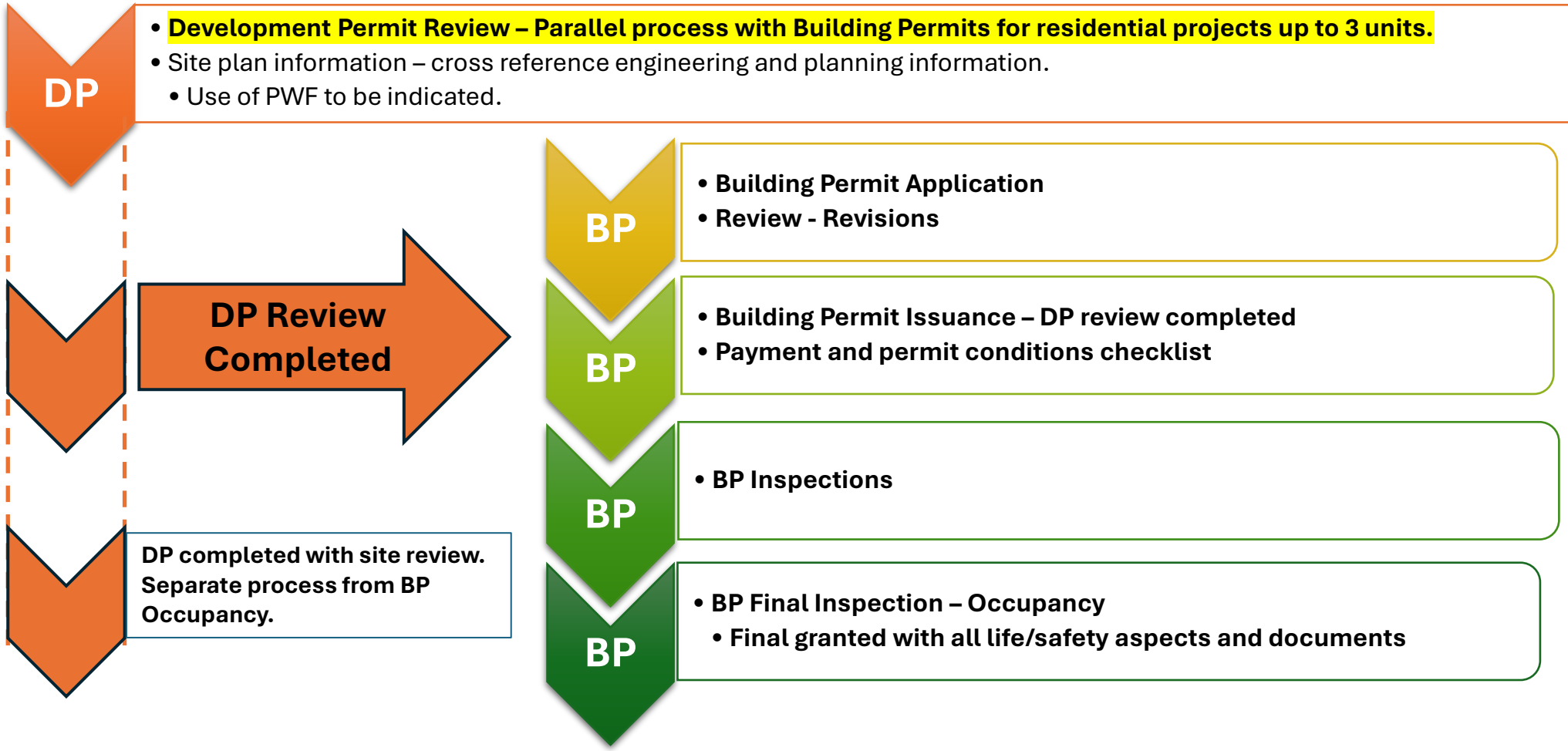
- 2 storey over basement single family home with decks,
- Climatic conditions of the city of Whitehorse,
- Soil bearing capacity is 75 kPa (1566 psf) or more,
- Standard load bearing for Single Family home – Part 9
- Dimensional lumber – preservative-treated wood as applicable
- Permanent Wood Foundations (CSA S406-16) with concrete footings over a drainage layer,
- PWF (basements) with concrete slab or suspended floor,
- Strip and Pad footings design to 9.15 of the NBC,
- 9.15.4 Flat Insulating Concrete Form Units – below grade.

Poll Question - Who is in the virtual room

- Registered Professionals
- Developers and General Contractors
- Part 9 Designers
- Trades
- Suppliers
- Other

Typical Building Permit Process – Part 9

Overview of typical Building permit flow for a new Residential projects – up to 3 units



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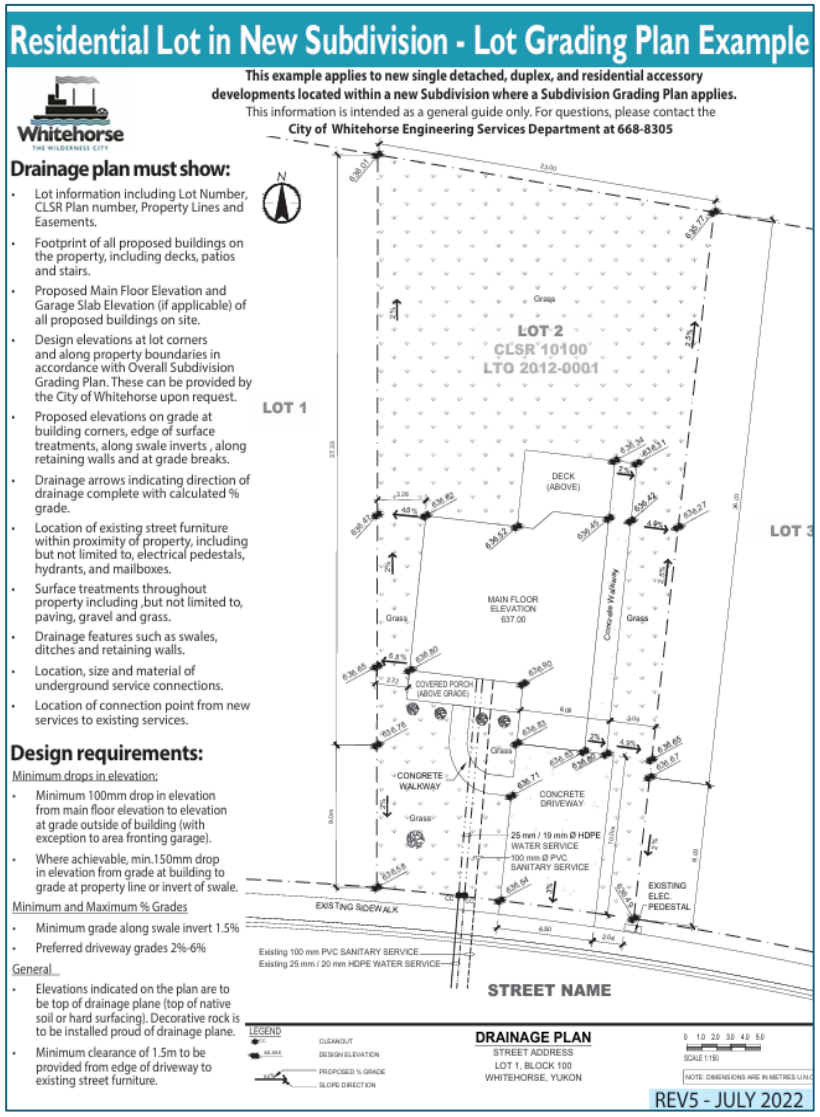
DP Process – New SFH

DP

- DP Review

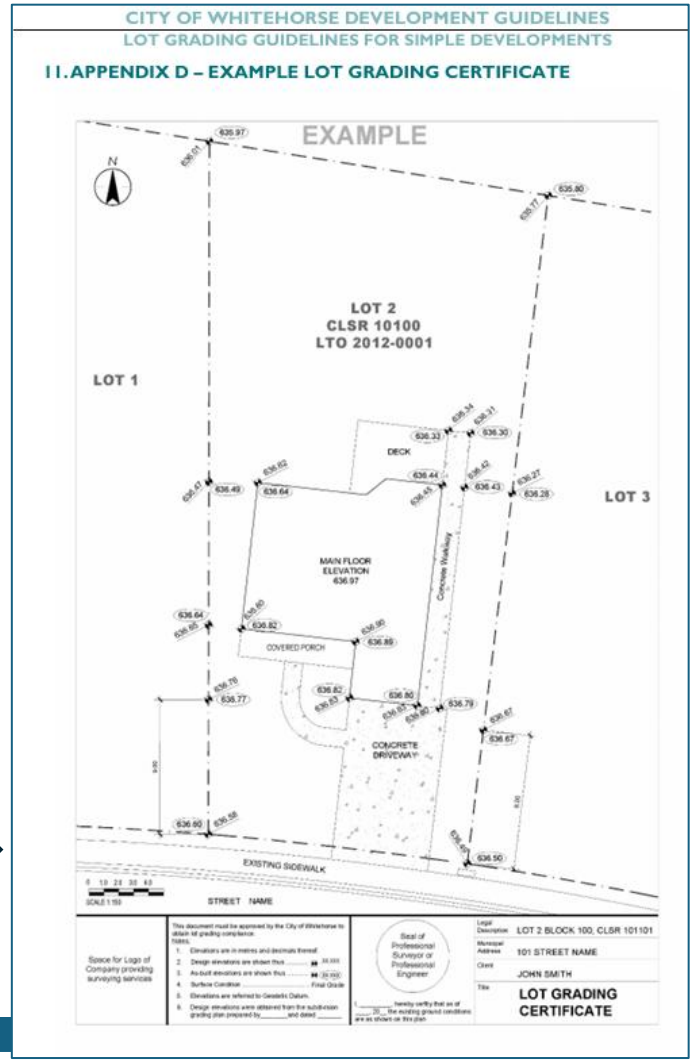


Site and Lot Grading plans

Ensure all required information is provided to allow for a timely review.

Note that infill lots require additional information in relation to neighbouring properties. Think 1.5m or 5 ft across the property line to ensure a good transition with neighbouring properties.

At time of final project closure a separate survey (lot grading certificate) maybe be required.



Building Permit Application

BP

- BP Application

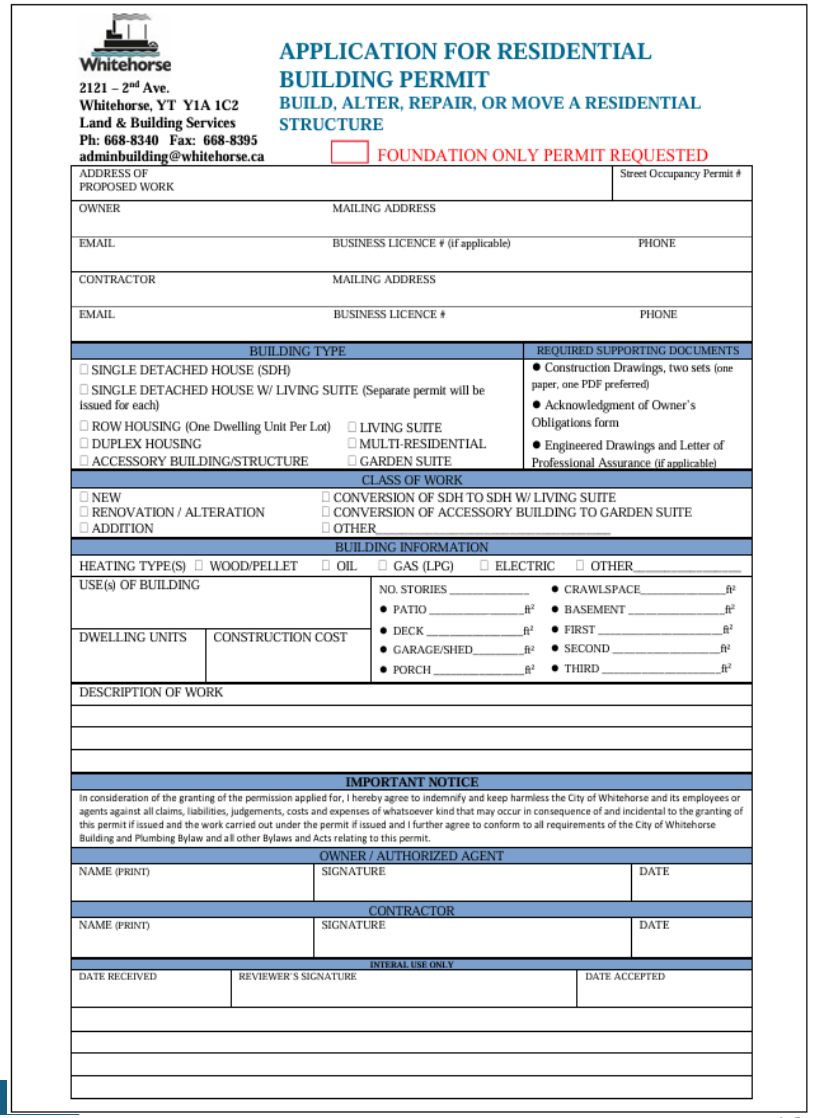
It is critical to ensure that the BP application is filled out and all required information has been provided. Please read the application package in full to ensure all the required information is provided.

In 2025, to improve the efficiency of the plan review process, incomplete building permit applications will not be accepted.

Please note that the DP site plan and lot grading information matches the BP drawings.

Separate projects such as a Garden Suites will require a separate BP application.

Link - 1Residential-Permit-Application-Form-V.3.1-July-2019.pdf



Whitehorse
2121 – 2nd Ave.
Whitehorse, YT Y1A 1C2
Land & Building Services
Ph: 668-8340 Fax: 668-8395
adminbuilding@whitehorse.ca

APPLICATION FOR RESIDENTIAL BUILDING PERMIT
BUILD, ALTER, REPAIR, OR MOVE A RESIDENTIAL STRUCTURE

☐ FOUNDATION ONLY PERMIT REQUESTED

ADDRESS OF PROPOSED WORK | Street Occupancy Permit #
OWNER | MAILING ADDRESS
EMAIL | BUSINESS LICENCE # (if applicable) | PHONE
CONTRACTOR | MAILING ADDRESS
EMAIL | BUSINESS LICENCE # | PHONE

BUILDING TYPE
☐ SINGLE DETACHED HOUSE (SDH)
☐ SINGLE DETACHED HOUSE W/ LIVING SUITE (Separate permit will be issued for each)
☐ ROW HOUSING (One Dwelling Unit Per Lot) ☐ LIVING SUITE
☐ DUPLEX HOUSING ☐ MULTI-RESIDENTIAL
☐ ACCESSORY BUILDING/STRUCTURE ☐ GARDEN SUITE

REQUIRED SUPPORTING DOCUMENTS
- Construction Drawings, two sets (one paper, one PDF preferred)
- Acknowledgment of Owner's Obligations form
- Engineered Drawings and Letter of Professional Assurance (if applicable)

CLASS OF WORK
☐ NEW
☐ RENOVATION / ALTERATION
☐ ADDITION
☐ CONVERSION OF SDH TO SDH W/ LIVING SUITE
☐ CONVERSION OF ACCESSORY BUILDING TO GARDEN SUITE
☐ OTHER_____

BUILDING INFORMATION
HEATING TYPE(S) ☐ WOOD/PELLET ☐ OIL ☐ GAS (LPG) ☐ ELECTRIC ☐ OTHER_____
USE(s) OF BUILDING
DWELLING UNITS | CONSTRUCTION COST
NO. STORIES _____
- PATIO _____ ft²
- DECK _____ ft²
- GARAGE/SHED _____ ft²
- PORCH _____ ft²
- CRAWLSPACE _____ ft²
- BASEMENT _____ ft²
- FIRST _____ ft²
- SECOND _____ ft²
- THIRD _____ ft²

DESCRIPTION OF WORK

IMPORTANT NOTICE
In consideration of the granting of the permission applied for, I hereby agree to indemnify and keep harmless the City of Whitehorse and its employees or agents against all claims, liabilities, judgements, costs and expenses of whatsoever kind that may occur in consequence of and incidental to the granting of this permit if issued and the work carried out under the permit if issued and I further agree to conform to all requirements of the City of Whitehorse Building and Plumbing Bylaw and all other Bylaws and Acts relating to this permit.

OWNER / AUTHORIZED AGENT
NAME (PRINT) | SIGNATURE | DATE

CONTRACTOR
NAME (PRINT) | SIGNATURE | DATE

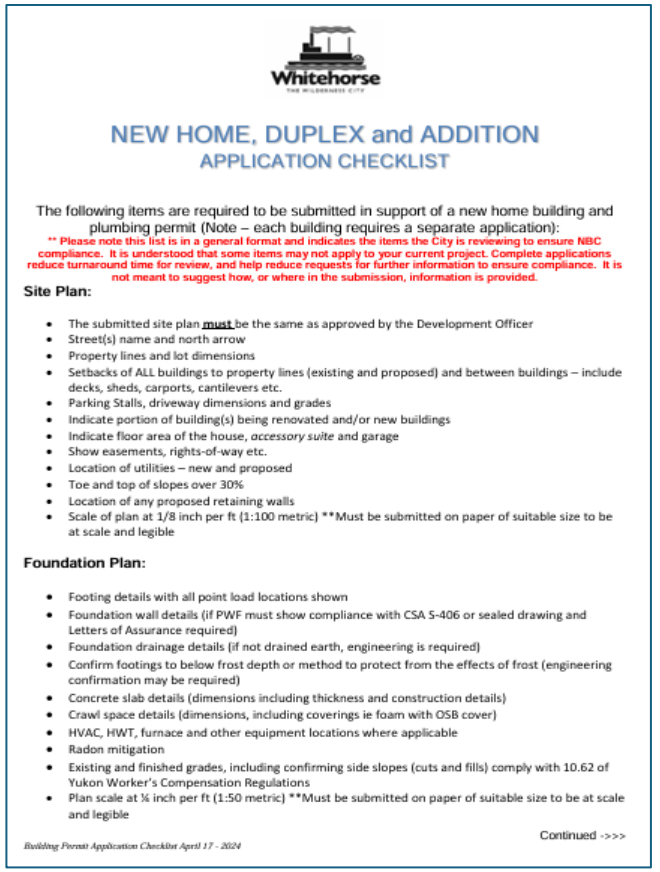
INTERAL USE ONLY
DATE RECEIVED | REVIEWER'S SIGNATURE | DATE ACCEPTED

Building Permit Application

BP

- BP Application

Refer to the Citys permit drawing checklist to ensure the minimum requirements to show substantial compliance with the National Building Code. It is understood that some items may not apply to your current project. Drawings should provide enough information to show substantial compliance to Code and city regulations, which will reduce turnaround time for review, and help reduce requests for further information to ensure compliance.



Whitehorse

NEW HOME, DUPLEX and ADDITION
APPLICATION CHECKLIST

The following items are required to be submitted in support of a new home building and plumbing permit (Note – each building requires a separate application):
** Please note this list is in a general format and indicates the items the City is reviewing to ensure NBC compliance. It is understood that some items may not apply to your current project. Complete applications reduce turnaround time for review, and help reduce requests for further information to ensure compliance. It is not meant to suggest how, or where in the submission, information is provided.

Site Plan:

- The submitted site plan must be the same as approved by the Development Officer
- Street(s) name and north arrow
- Property lines and lot dimensions
- Setbacks of ALL buildings to property lines (existing and proposed) and between buildings – include decks, sheds, carports, cantilevers etc.
- Parking Stalls, driveway dimensions and grades
- Indicate portion of building(s) being renovated and/or new buildings
- Indicate floor area of the house, *accessory suite* and garage
- Show easements, rights-of-way etc.
- Location of utilities – new and proposed
- Toe and top of slopes over 30%
- Location of any proposed retaining walls
- Scale of plan at 1/8 inch per ft (1:100 metric) **Must be submitted on paper of suitable size to be at scale and legible

Foundation Plan:

- Footing details with all point load locations shown
- Foundation wall details (if PWF must show compliance with CSA S-406 or sealed drawing and Letters of Assurance required)
- Foundation drainage details (if not drained earth, engineering is required)
- Confirm footings to below frost depth or method to protect from the effects of frost (engineering confirmation may be required)
- Concrete slab details (dimensions including thickness and construction details)
- Crawl space details (dimensions, including coverings ie foam with OSB cover)
- HVAC, HWT, furnace and other equipment locations where applicable
- Radon mitigation
- Existing and finished grades, including confirming side slopes (cuts and fills) comply with 10.62 of Yukon Worker's Compensation Regulations
- Plan scale at ¼ inch per ft (1:50 metric) **Must be submitted on paper of suitable size to be at scale and legible

Continued ->>>

Building Permit Application Checklist April 17 - 2024

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Building Permit Drawings

BP

- **BP Application**

Site Plan:

- The submitted site plan must match DP approved by the Development Officer
- Scale of plan at 1/8 inch per ft (1:100 metric)
- Street(s) name and north arrow
- Property lines and lot dimensions
- Setbacks of ALL buildings to property lines (existing and proposed) and between buildings – include decks, sheds, carports, cantilevers etc. (see Professional Involvement triggers)
- Parking Stalls, driveway dimensions and grades
- Indicate portion of building(s) being renovated and/or new buildings
- Indicate floor area of the house, accessory suite and garage
- Show easements, rights-of-way etc.
- Location of utilities – new and proposed
- Toe and top of slopes over 30% (see Professional Involvement triggers)
- Location of any proposed retaining walls

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Building Permit Drawings

BP

- BP Application

Foundation Plan:

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- Radon mitigation
- Existing and finished grades, including confirming side slopes (cuts and fills) comply with 10.62 of Yukon Worker's Compensation Regulations – See professional involvement triggers.

Building Permit Drawings

BP

- BP Application

Cross Section:

- Scale of plans at ¼ inch per ft (1:50 metric) or larger as required
- Footing design
- Foundation wall construction including wall height, backfill height, drained earth details,
- damproofing etc. (non-drained earth, surcharged, overheight and PWF walls that do not comply with CSA S-406 may required engineering and Letters of Assurance)
- Floor slab, ground cover, radon protection and subgrade details
- Crawlspace and ground cover details
- Existing grade and finished grade from property line to property line and indicate any surcharges
- (parking areas, retaining walls, steep slopes other building foundations etc.)
- Floor construction (beams, lintels, headers, joists, subfloor, blocking/bridging, materials etc.)
- Roof construction (beams, rafters, soffits, trusses, venting, materials etc.)
- Fully dimensioned stair section at min. ½” per ft (1:25 metric)
- Ceiling and roof heights

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BP Application - Professional Involvement

BP • Application

As outlined in Building Bylaw 99-50 and 9.4 of the Code, there will be more SFH projects requiring the involvement of an Engineer (geotechnical and or structural), which will require submission of sealed drawings and Letters of Design confirmation time of BP application.

NEW Building Bulletins

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- **Truss Design (Jan. 20, 2025)**
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- **Cast-in-Place and ICF Foundations (Jan. 20, 2025)**

Factors for the city requiring increased involvement of engineers are:

- New house designs are narrower open plan layouts with larger point loads outside the scope of Part 9,
- Increase in engineered building components and propriety products
- **Soil conditions that can create concerns related to site safety, bearing capacity, drainage and backfill.**

BP Application - Professional Involvement

BP

- BP Application

Site Plan Geotechnical Assessments – <u>Excavations greater than 1.2m or Steep excavation</u>

- Applications for permits, where excavation is required as part of the proposed works, will need to include site and building cross sectional details showing excavations depth, footing elevation(s), existing grade and finish grade as well as the existing and final elevations at the property lines.
- The sections noted above are required both across and lengthwise from property line to property line.
- If the projected slope from the grade at property line to the bottom of the excavation **exceed 30 percent and the excavation is greater than 1.2 m deep, geotechnical engineering design and oversight is required.**

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BP Application - Professional Involvement

Site Plans - Geotechnical Assessments (cont'd)

- If surcharges from or of the proposed building are expected, geotechnical oversight will be required. Similarly, if the proposed works will undermine or be undermined by a slope angle of greater than 30 percent, geotechnical oversight will be required.

- If oversight is required, the applicant must provide a signed LoA from a geotechnical engineer accompanied by a sealed report and design drawings detailing how the excavation works are to be conducted and supported or a sealed letter from geotechnical engineer referencing the plans submitted by the applicant specifically confirming the proposed excavations works will be safe of all on-site personnel and will not affect adjacent properties prior to issuance of any building permit or excavation permit.

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Climatic Data overview

Whitehorse is in Climatic Zone 7B
(6000 to 6999 HDD)

- Climatic data is found in

Illustrated Guide - Energy Efficient Houses - Zone 7B-8-North

Division B	Acceptable Solutions
Part 1	General
Part 2	Farm Buildings
Part 3	Fire Protection, Occupant Safety and Accessibility
Part 4	Structural Design
Part 5	Environmental Separation
Part 6	Heating, Ventilating and Air-conditioning
Part 7	Plumbing Services
Part 8	Safety Measures at Construction and Demolition Sites
Appendix C	Climatic and Seismic Information
Appendix D	Fire-Performance Ratings

Frost protection depths of 2.5m - Original Freezing index vs frost depth comparison.

Province and Location	Elev., m	Design Temperature				Degree-Days Below 18°C	15 Min. Rain, mm	One Day Rain, 1/50, mm	Ann. Rain, mm	Moist. Index	Ann. Tot. Ppn., mm	Driving Rain Wind Pressures, Pa, 1/5	Snow Load, kPa, 1/50		Hourly Wind Pressures, kPa	
		January		July 2.5%									S_s	S_r	1/10	1/50
		2.5% °C	1% °C	Dry °C	Wet °C											
Whitehorse	655	-41	-43	25	15	6580	8	43	170	0.5	275	40	2.0	0.1	0.29	0.38
Fort St. John	685	-35	-37	26	18	5750	15	72	320	0.5	475	100	2.8	0.1	0.29	0.39
Kelowna	350	-17	-20	33	20	3400	12	43	260	0.3	325	80	1.7	0.1	0.30	0.40

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Frost Depth and Climatic Change

Frost depths are determined soil conditions and drainage. An estimate of the depth of frost penetration can be made on the basis of the freezing index. The freezing index is the annual average cumulative total of the number of degree-days below freezing that occur during cold weather. See chart below.

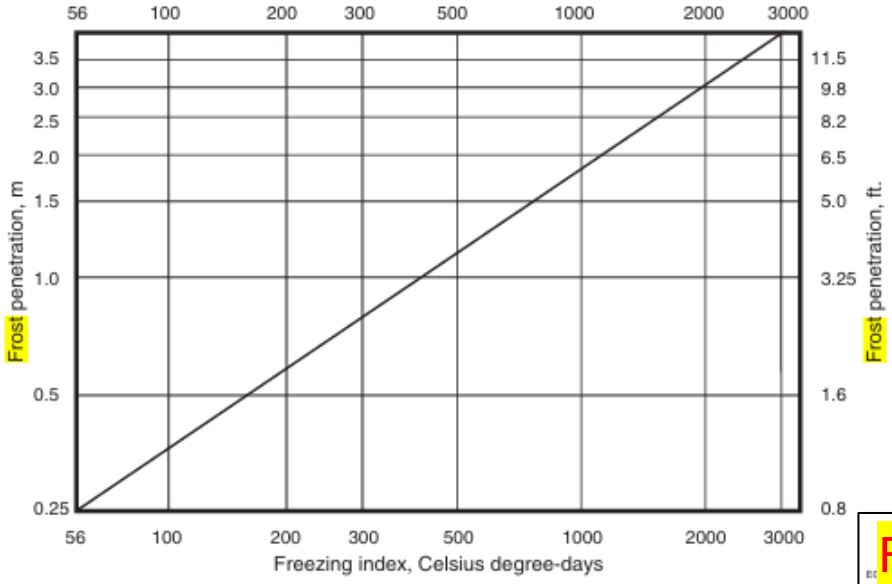


Figure 9.12.-3
Plot of frost penetration versus freezing index

Frost protection depths in WH are approximately 2.5m.

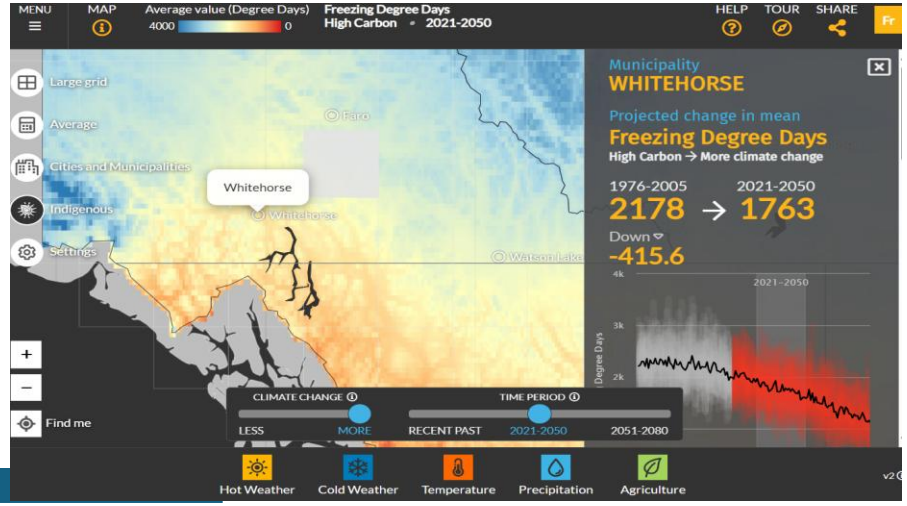
Changing climate adjustments

The National Research Council (NRC) is reviewing changes to Code based on climate change. Whitehorse may see changes in:

- Frost depth
- Increased snow loads (wetter snow)
- Increased wide fire threats.

https://nrc.canada.ca/en/stories/building-climate-resilience-construction

- Link - Freezing Degree Days | Canada | Climate Atlas of Canada



2020 NBC - Defined Terms – Excavation/Foundations

Dead load means the weight of all permanent structural and non-structural components of a building.

Deep foundation means a foundation unit that provides support for a building by transferring loads either by end-bearing to soil or rock at considerable depth below the building, or by adhesion or friction, or both, in the soil or rock in which it is placed. Piles are the most common type of deep foundation.

Excavation means the space created by the removal of soil, rock or fill for the purposes of construction.

Fill means soil, rock, rubble, industrial waste such as slag, organic material or a combination of these that is transported and placed on the natural surface of soil or rock or organic terrain. It may or may not be compacted.

Foundation means a system or arrangement of foundation units through which the loads from a building are transferred to supporting soil or rock.

Foundation unit means one of the structural members of the foundation of a building such as a footing, raft or pile.

Frost action means the phenomenon that occurs when water in soil is subjected to freezing which, because of the water/ice phase change or ice lens growth, results in a total volume increase or the build-up of expansive forces under confined conditions or both, and the subsequent thawing that leads to loss of soil strength and increased compressibility.

Defined Terms (2020 NBC)

Grade means the lowest of the average levels of finished ground adjoining each exterior wall of a building, except that localized depressions need not be considered in the determination of average levels of finished ground. (See First storey and Note A-1.4.1.2.(1).)

Groundwater means a free standing body of water in the ground.

Groundwater level (groundwater table) means the top surface of a free standing body of water in the ground.

Live load means a variable load due to the intended use and occupancy that is to be assumed in the design of the structural members of a building. It includes loads due to cranes and the pressure of liquids in containers.

Loadbearing (as applying to a building element) means subjected to or designed to carry loads in addition to its own dead load, excepting a wall element subjected only to wind or earthquake loads in addition to its own dead load.

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Defined Terms (2020 NBC)

Perched groundwater means a free standing body of water in the ground extending to a limited depth.

Pile means a slender deep foundation unit made of materials such as wood, steel or concrete or a combination thereof, that is either premanufactured and placed by driving, jacking, jetting or screwing, or cast-in-place in a hole formed by driving, excavating or boring. (Cast-in-place bored piles are often referred to as caissons in Canada.) Caisson (see Pile)

Rock means that portion of the earth's crust that is consolidated, coherent and relatively hard and is a naturally formed, solidly bonded, mass of mineral matter that cannot readily be broken by hand.

Shallow foundation means a foundation unit that derives its support from soil or rock located close to the lowest part of the building that it supports.

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Defined Terms (2020 NBC)

Soil means that portion of the earth's crust that is fragmentary, or such that some individual particles of a dried sample may be readily separated by agitation in water; it includes boulders, cobbles, gravel, sand, silt, clay and organic matter.

Subsurface investigation means the appraisal of the general subsurface conditions at a building site by analysis of information gained by such methods as geological surveys, in situ testing, sampling, visual inspection, laboratory testing of samples of the subsurface materials and groundwater observations and measurements.

Unsafe condition means any condition that could cause undue hazard to the life, limb or health of any person authorized or expected to be on or about the premises.

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NBC 9.3. Materials, Systems and Equipment

- 9.3.1.1. Concrete General
- 9.3.1.6. Compressive Strength
- 9.3.1.9. Cold Weather Requirements

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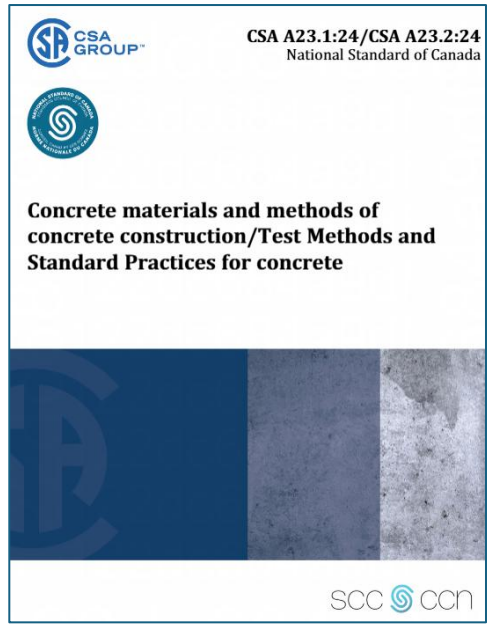
9.3. Materials, Systems and Equipment

9.3.1 Concrete

9.3.1.1. Concrete General

1) Except as provided in Sentence (2) and Articles 9.3.1.6. and 9.3.1.7., unreinforced and nominally reinforced concrete shall be designed, mixed, placed, cured and tested in accordance with the requirements for **“R” class concrete stated in Section 9 of CSA A23.1, “Concrete materials and methods of concrete construction.”**



A.3.4. Compliance and enforcement
Possibly the most significant cause of problems that arise in residential concrete construction is noncompliance with this standard.

FLYWHEEL
BUILDING SOLUTIONS

Section 9.3. Materials, Systems and Equipment

9.3.1 Concrete

9.3.1.1. Concrete General

“R” class concrete stated in Section 9 of CSA A23.1, “Concrete materials and methods of concrete construction.”

Ensuring strength and safety are primary considerations for developers working with concrete; the 12th edition of CSA A23.1 covers requirements for materials and methods of construction for cast-in-place concrete / concrete precast in the field, as well as concrete used in construction of **residential buildings that conform to Part 9 of the National Building Code of Canada.** A23.2 covers the principal test methods for hardened and freshly mixed concrete and for materials specified in A23.1 and A23.4.

New guidelines for residential concrete construction.

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BUILDING SOLUTIONS

Section 9.3. Materials, Systems and Equipment

9.3.1 Concrete

9.3.1.1. Concrete General

2) Unreinforced and nominally reinforced site-batched concrete shall be designed, mixed, placed and cured in accordance with Articles 9.3.1.2. to 9.3.1.9.

***NBC Part 9** does not have the necessary controls to ensure the adequate performance of reinforced concrete. Reinforced concrete is, therefore, regulated under NBC Part 4, which provides proper design and construction practices.

3) Except as provided in Sentence (4), reinforced concrete shall be designed to conform to the requirements of Part 4.

Although adding reinforcing to footings and foundations is commonly done – it is not a basic Code requirement and should be designed by a professional.
Non-code references to reinforcing is not reviewed by the city.

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BUILDING SOLUTIONS

Section 9.3. Materials, Systems and Equipment

9.3.1 Concrete

9.3.1.1. Concrete General

4) For flat insulating concrete form walls **not exceeding 2 storeys** in building height and having a maximum floor to floor height of 3 m, in buildings of light-frame construction, the concrete and reinforcing shall comply with Part 4 or

a) the concrete shall conform to **CSA A23.1, "Concrete materials and methods of concrete construction," with a maximum aggregate size of 19 mm,** and

b) the reinforcing shall

i) conform to CSA G30.18, "Carbon steel bars for concrete reinforcement,"

ii) have a minimum specified yield strength of 400 MPa, and

iii) be lapped a minimum of 450 mm for 10M bars and 650 mm for 15M bars (see also Articles 9.15.4.5. and 9.20.17.2. to 9.20.17.4.)

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BUILDING SOLUTIONS

Section 9.3. Materials, Systems and Equipment

Concrete cold weather requirements

- 9.3.1.6. Compressive Strength

- This Article sets minimum compressive strength values for concrete in certain applications. Compressive strength is used as a measure of concrete quality in terms of strength, durability, and resistance to the penetration of water, vapour and gas.

9.3.1.6. Compressive Strength

(See also Article 9.12.4.1., Sentence 9.15.4.2.(1) and Article 9.18.6.1.)

1) Except as provided elsewhere in this Part, the compressive strength of unreinforced concrete after 28 days shall be not less than

a) 15 MPa for walls, columns, fireplaces and *chimneys*, footings, *foundation* walls, grade beams and piers,

b) 20 MPa for floors other than those in garages and carports, and

c) for garage and carport floors, and the exterior steps,

i) 32 MPa, or

ii) 30 MPa where indigenous aggregates do not achieve 32 MPa with a 0.45 water to cementing material ratio.

2) Site-batched concrete used for garage and carport floors and exterior steps shall have air entrainment of 5 to 8%.

Typically “ready mix” concrete exceeds minimum requirements

FLYWHEEL BUILDING SOLUTIONS

Section 9.3. Materials, Systems and Equipment

Admixtures and Cold Weather Requirements

- This Article references two standards, which describe the acceptable properties for admixtures in a number of applications. The quality and suitability of chemicals added to concrete need to be controlled because the improper use of chemical admixtures can reduce the strength and durability of the concrete.

9.3.1.8. Admixtures

1) Admixtures shall conform to ASTM C260, "Standard Specification for Air-Entraining Admixtures for Concrete," or ASTM C494/C494M, "Standard Specification for Chemical Admixtures for Concrete," as applicable.

9.3.1.9. Cold Weather Requirements

1) When the air temperature is below 5°C, concrete shall be

a) kept at a temperature of not less than 10°C or more than 25°C while being mixed and placed, and

b) maintained at a temperature of not less than 10°C for 72 h after placing.

2) No frozen material or ice shall be used in concrete described in Sentence (1).

If freezing takes place before the initial hardening occurs, the strength of the concrete may be seriously reduced. For this reason, the temperature of the concrete must be maintained at not less than 10°C (50°F) for at least 72 h after placing when the air temperature is below 5°C (41°F).

The rational for using Permanent Wood Foundations (PWF).

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BUILDING SOLUTIONS

9.4 Structural Requirements

- 9.4.4.1 Allowable Bearing Pressure
- 9.4.4.2. Foundation Capacity of Weaker Soil and Rock
- 9.4.4.3. High Water Table
- 9.4.4.4. Soil Movement

Figure 33. *Exposure of deltaic sand overlying horizontally bedded glaciolacustrine silt on the upper slope of the Whitehorse escarpment above Main Street (18PL004). Note person at the top of the escarpment for scale.*

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BUILDING SOLUTIONS

9.4.4.1 Allowable Bearing Pressure

Section 9.4.4. Foundation Conditions outlines the limitations of Part 9 design and allowable bearing pressures for different soil conditions.

9.4.4. Foundation Conditions

9.4.4.1. Allowable Bearing Pressures

1) Footing sizes for *shallow foundations* shall be
a) determined in accordance with Section 9.15., or
b) designed in accordance with Section 4.2. using
i) the maximum allowable bearing pressures in Table 9.4.4.1., or
ii) allowable bearing pressures determined from *subsurface investigation*.

Table 9.4.4.1.
Allowable Bearing Pressure for Soil or Rock
Forming Part of Sentence 9.4.4.1.(1)

Type and Condition of *Soil* or *Rock*	Maximum Allowable Bearing Pressure, kPa
Dense or compact sand or gravel(1)	150
Loose sand or gravel(1)	50
Dense or compact silt(1)	100
Stiff clay(1)	150
Firm clay(1)	75
Soft clay(1)	40
Till	200
Clay shale	300
Sound *rock*	500

Notes to Table 9.4.4.1.:
(1) See Note A-Table 9.4.4.1.

A-Table 9.4.4.1. Classification of Soils. Sand or gravel may be classified by means of a picket test in which a 38 mm by 38 mm picket beveled at the end at 45° to a point is pushed into the soil. Such material is classified as "dense or compact" if a man of average weight cannot push the picket more than 200 mm into the soil and "loose" if the picket penetrates 200 mm or more.

Clay and silt may be classified as "stiff" if it is difficult to indent by thumb pressure, "firm" if it can be indented by moderate thumb pressure, "soft" if it can be easily penetrated by thumb pressure, where this test is carried out on undisturbed soil in the wall of a test pit.

Unless otherwise determined by a geotechnical engineer. Bearing capacity for foundations over a drainage layer may be best to be assumed at 75kPa (1566 psf) bearing pressure capacity.

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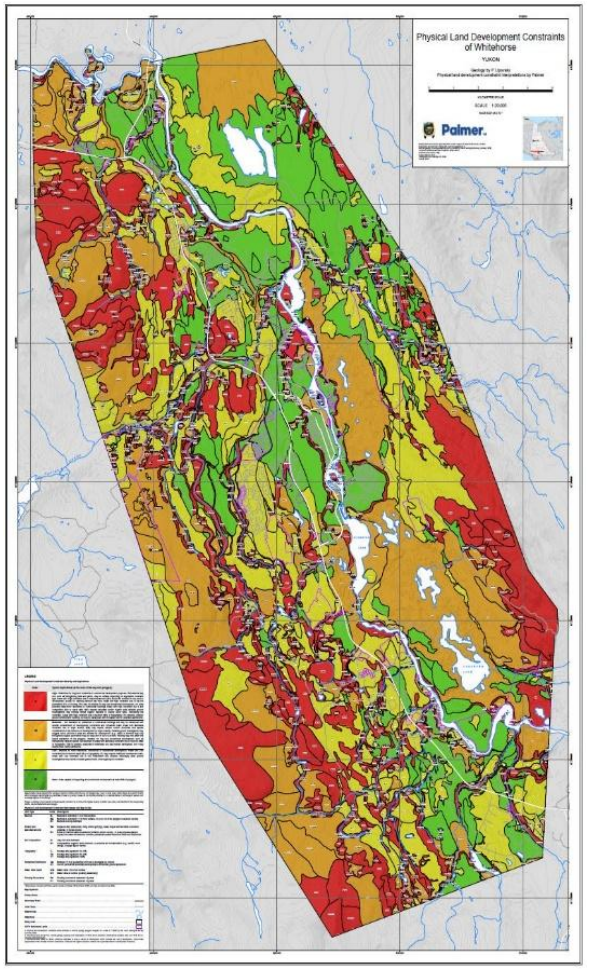
9.4.4.1. Allowable Bearing Pressure

Whitehorse has a wide variety of soil conditions which impact the soil bearing, backfilling and drainage. It is key to verify the soil conditions for your project to limit any negative affects to your build.

Newer sub-divisions such as Whistle Bend have soil conditions more prevalent to freezing and poor drainage, which requires involvement of a geotechnical engineer, and may change the typical foundation systems (PWF) that have been traditionally used in other areas of the city.

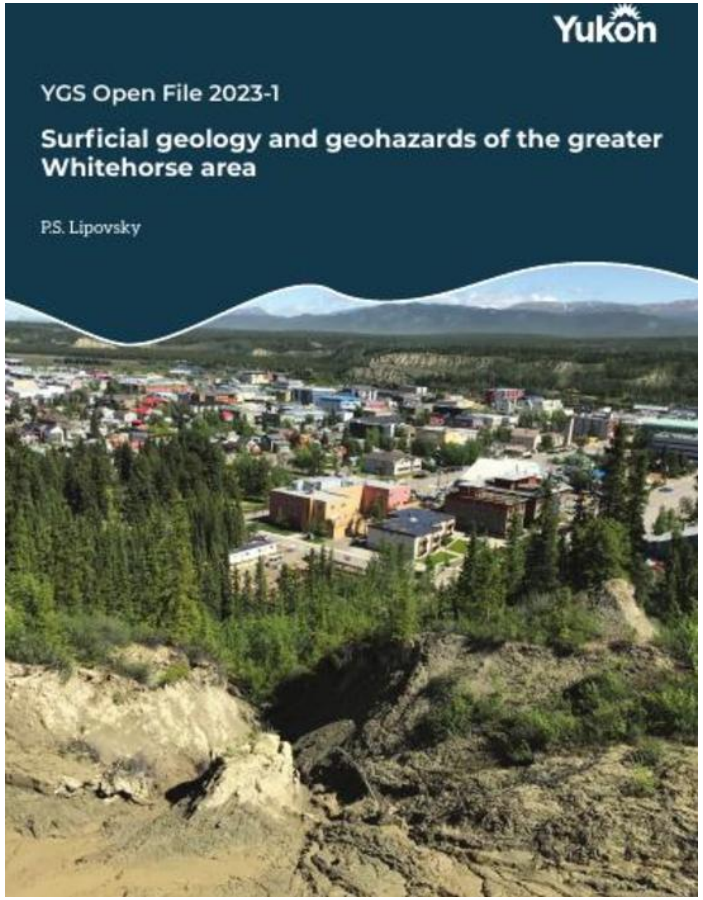


Most new homes and large additions will likely require the involvement of a Geotechnical Engineer.

FLYWHEEL
BUILDING SOLUTIONS

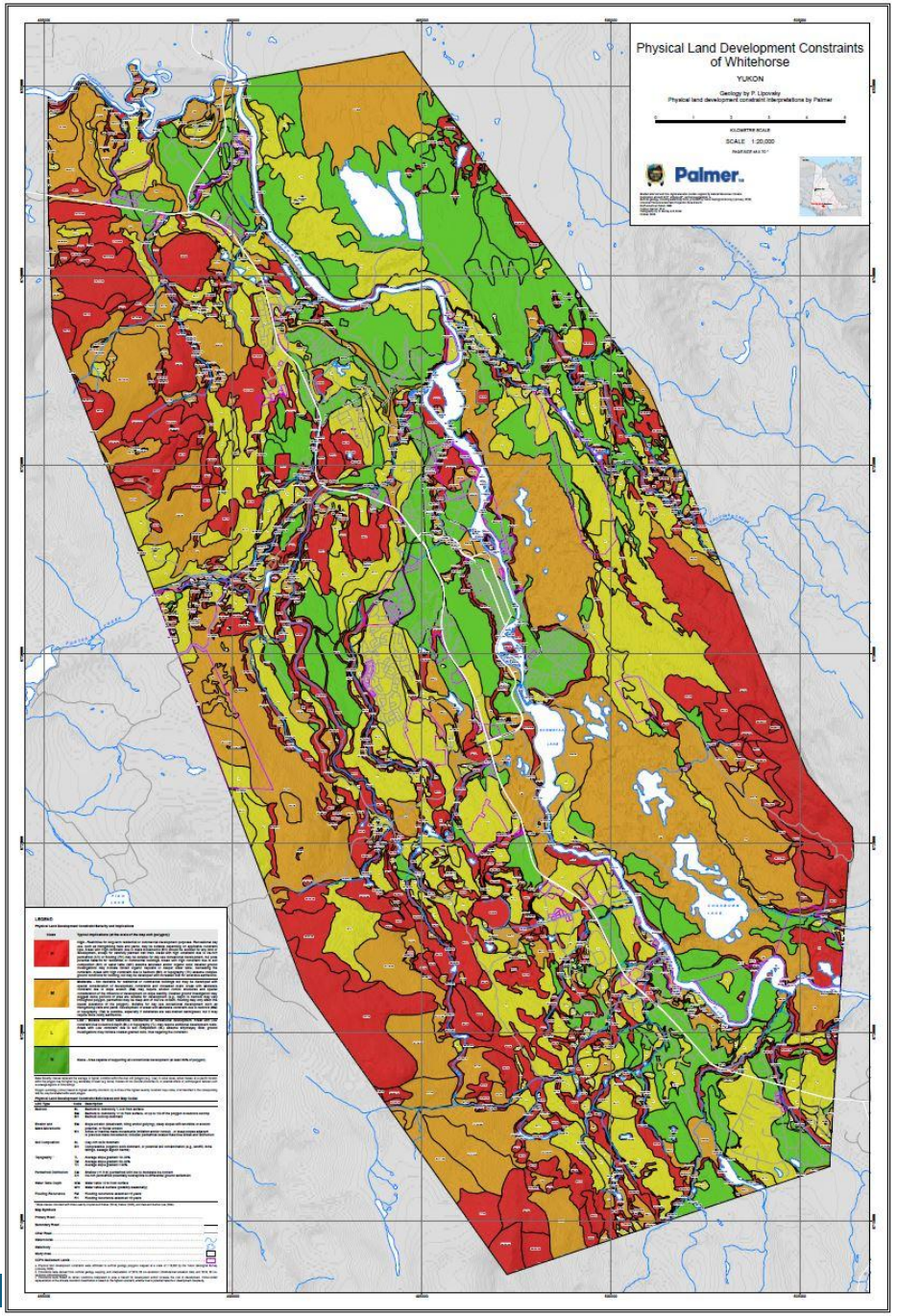
Soil Types

YGS publication "surficial geology and geohazards of the greater Whitehorse area“.



Geohazards that exist within the study area include landslides, radon gas, seismicity, permafrost and flooding. This report focusses on landslides as the primary geohazard, and includes a robust summary of the unprecedented landslide activity along the Whitehorse escarpment that occurred in early 2022. Recent and historical landslide features are also identified in the accompanying surficial geology map.

Palmer 2024- A report and map were prepared for Kwanlin Dün First Nation (KDFN) detailing the final results of a physical land development constraints (LDC) mapping project within the Whitehorse city limits portion of the Kwanlin Dün First Nation Traditional Territory.



Soil Types

Figure 10. *Fluvial terrace sand and gravel (gsFt) exposed in a bank of the Yukon River in Riverdale subdivision. Shrubby gravel bar on opposite side of the river is considered part of the active floodplain (gsFAp). Note undercutting of bank occurring on outside of river bend.*

150 kPa
But caution when excavating – sluffing.

Figure 11. *Fluvial sand and gravel exposed in infrastructure excavation near Wheeler St. and 6th Ave. This material underlies much of downtown Whitehorse, which is built on a terrace of the Yukon River (gsFt).*

Examples of YGS publication "surficial geology and geohazards of the greater Whitehorse area“.

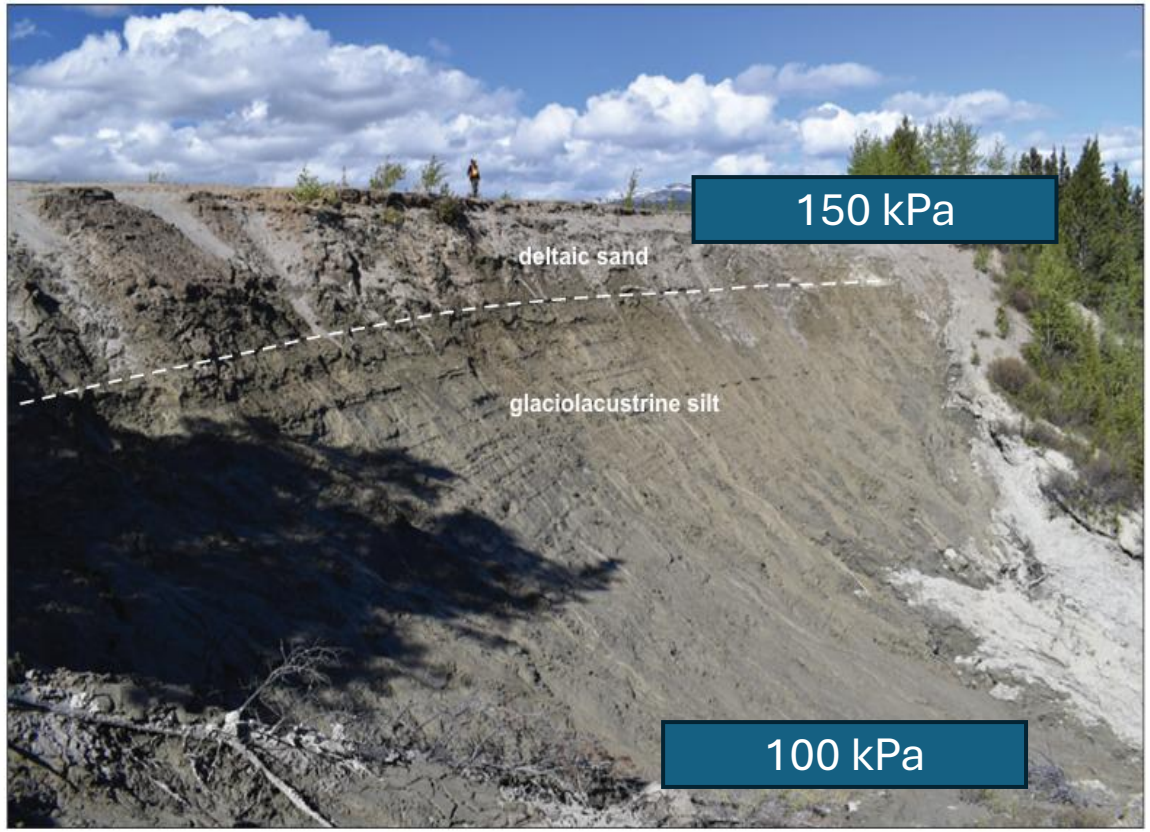


Figure 33. *Exposure of deltaic sand overlying horizontally bedded glaciolacustrine silt on the upper slope of the Whitehorse escarpment above Main Street (18PL004). Note person at the top of the escarpment for scale.*

Section 9.4. Structural Requirements

9.4.4.2. Foundation Capacity of Weaker Soil and Rock

1) Where a soil or rock within a distance equal to twice the footing width below the bearing surface has a lower allowable bearing pressure than that at the bearing surface as shown in Article 9.4.4.1., the design capacity of the foundation shall not be greater than would cause the weakest soil or rock to be stressed beyond its allowable bearing pressure.

2) In calculating subsurface pressures referred to in Sentence (1), the loads from the footings shall be assumed to be distributed uniformly over a horizontal plane within a frustum extending downward from the footing **at an angle of 60° to the horizontal**.

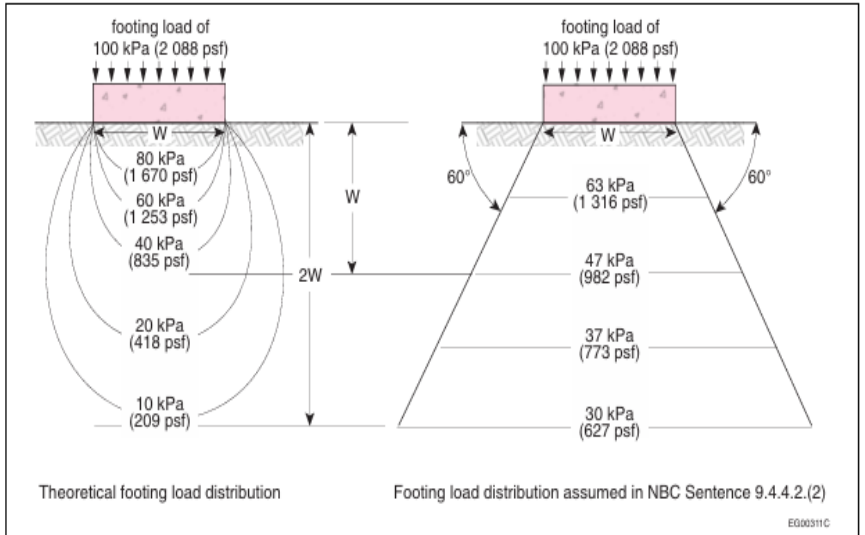


Figure 9.4.-2
Comparison of the theoretical footing load distribution and the footing load distribution assumed in NBC Sentence 9.4.4.2.(2)

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BUILDING SOLUTIONS

Section 9.4. Structural Requirements

9.4.4.3. High Water Table

This Article indicates that the allowable bearing pressures must be reduced for foundations over high water tables. If the soil at the bearing surface is granular (i.e., gravel, sand or silt), and if the ground water is close to the bottom of the footing (i.e., within a distance equal to the footing width below the bearing surface), then the allowable **bearing pressure is 50% of that listed in NBC Table 9.4.4.1.**

Table 9.4.4.1.
Allowable Bearing Pressure for Soil or Rock
Forming Part of Sentence 9.4.4.1.(1)

Type and Condition of *Soil* or *Rock*	Maximum Allowable Bearing Pressure, kPa
Dense or compact sand or gravel(1)	150
Loose sand or gravel(1)	50
Dense or compact silt(1)	100
Stiff clay(1)	150
Firm clay(1)	75
Soft clay(1)	40
Till	200
Clay shale	300
Sound *rock*	500

Is a condition to be reviewed in lower/central part of Whitehorse.

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BUILDING SOLUTIONS

Section 9.4. Structural Requirements

9.4.4.4. Soil Movement

This Article indicates that, where a foundation is located in an area where there is potential for soil movement due to changes in soil moisture content, freezing, or chemical-microbiological oxidation that could damage a building, measures must be taken to preclude the soil movement or to reduce its effect on the building so that the building will remain stable and its performance will not be adversely affected.

See NBC Note A-9.4.4.4.(1) for further information on soil movement.

- Expansion and Contraction due to Moisture
- Frost Heave
- Ice Lenses
- Adfreezing
- Pyrites

Ice lenses, two meters below ground April 11th 2024. clear looking lenses in the soil, most are lest than 1 mm thick. But if you get for than 25 of them in soild below a foundations, you will see a heave of over 25 mm (1 inch). This from an area where snow was undisturbed all winter long.

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BUILDING SOLUTIONS

9.12 Excavations

- Site Safety
- Reduced negative effects on neighbouring properties
- Bearing capacity
- Section 9.12.3.1 Backfill

9.12.2.Excavations - Safety

Part 10 - Construction and Building Safety

TRENCHING AND EXCAVATING

10.62

Engineering

(1) Excavating, shoring, trenching or shaft work shall be carried out according to the design, instruction and procedures developed and certified by a professional engineer, considering all the factors for safe operation, including the type of soil or material to be excavated, where

(a) the excavation or trench will be more than 6 m (20 ft.) deep,

(b) support structures will be used in an excavation or trench,

(c) an excavation or trench will be adjacent to an improvement or structure,

(d) the excavation or trench may be subject to hydraulic pressure or vibration which may result in ground movement,

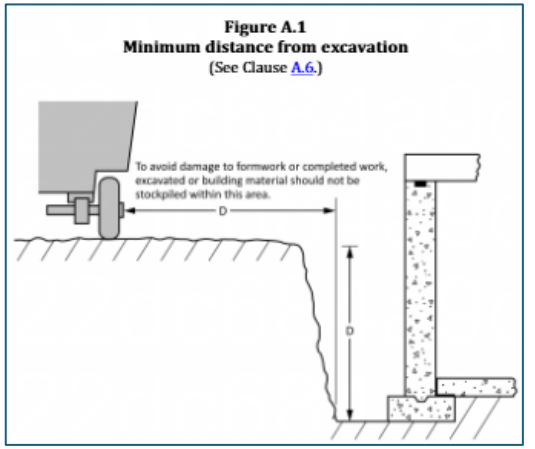
(e) the ground slopes away from or downhill toward the top edge of the excavation at an angle steeper than 3 horizontal to 1 vertical,

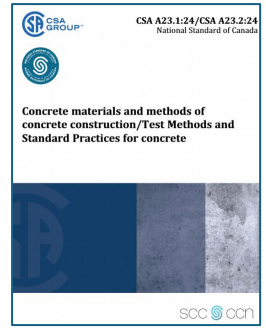
(f) in a trench or excavation of any depth there are any extraordinary conditions, or

(g) the trench or excavation will be in permafrost.

Geotechnical involvement required when excavating near neighbouring properties - +1.2m in depth or Steep Slopes

Example house
Safety and Infill challenge





FLYWHEEL BUILDING SOLUTIONS

Regulations

Part 10 - Construction and Building Safety

Trenching and Excavating

10.65

Protection from cave-in

(1) Before a worker enters any excavation or trench more than 1.2 m (4 ft.) in depth, or where a worker approaches the side or bank within a distance equal to the depth of the excavation, the excavation sidewalls shall be sloped or supported, as specified by a professional engineer, or the sidewalls of the excavation shall be, at a minimum

Sloped sidewalls

(a) sloped at an angle not steeper than 37 degrees from the vertical,

Slope tables

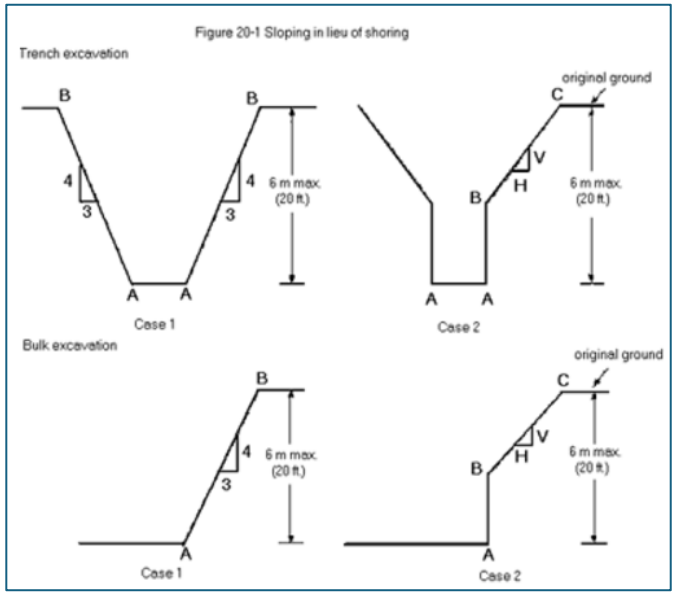
(b) sloped at an angle, dependent on soil conditions, which will ensure stable faces, but in no case may the slope or combination of vertical cut and sloping exceed that shown in Figure 10-1,

Benching

(c) benched as shown in Figure 10-2,

Shoring

(d) supported in accordance with the minimum requirements of Section 10.68, or



Case 1 (trench or bulk excavation) - maximum slope of excavated face, shown as line AB, in hard and solid soil is 3 horizontal to 4 vertical.

Case 2 (trench or bulk excavation), maximum height of vertical portion, shown as line AB is 1.2 metres (4 feet).

Safety – 2020 National Building Code

Refer to Part 8 – NBC - Safety Measures at Construction and Demolition Sites

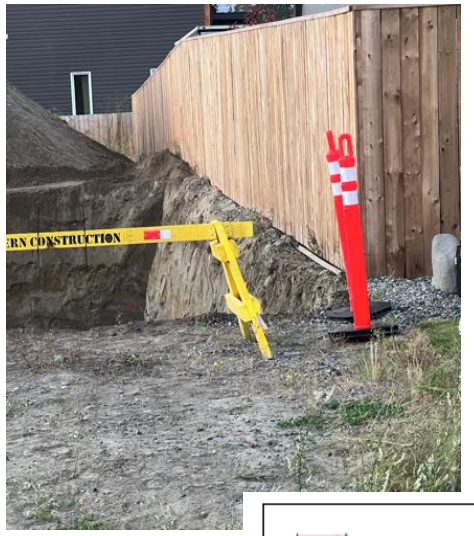
Section 8.2. Protection of the Public

8.2.2.2 - Protection of Adjoining Property

1) If the stability of adjoining buildings may be endangered by the work of excavating, adequate underpinning, shoring and bracing shall be provided to prevent

a) damage to, or movement of, any part of the adjoining building, and

b) the creation of a hazard to the public.



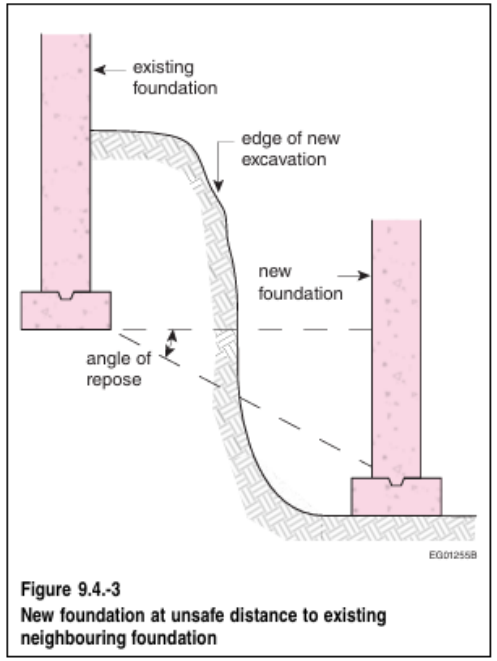


Figure 9.4.-3
New foundation at unsafe distance to existing neighbouring foundation

Infill lots can be challenging – additional information at time of application (lot cross sections) and engineering will be required.

9.12.2.Excavations and Frost Protection

9.12.1.2. Standing Water

1) *Excavations* shall be kept free of standing water.

9.12.1.3. Protection from Freezing

1) The bottom of *excavations* shall be kept from freezing throughout the entire construction period.

9.12.2. Depth

9.12.2.1. Excavation to Undisturbed Soil

1) *Excavations* for *foundations* shall extend to undisturbed *soil*.

Likely more reasonable to take precautions for an even soil movement during freezing conditions.

9.12.2.Excavations and Frost Depths

9.12.2. Depth

9.12.2.1. Excavation to Undisturbed Soil

1) *Excavations* for *foundations* shall extend to undisturbed *soil*.

9.12.2.2. Minimum Depth of Foundations

1) Except as provided in Sentences (4) to (7), the minimum depth of *foundations* below finished ground level shall conform to Table 9.12.2.2.

Table 9.12.2.2.
Minimum Depths of Foundations
Forming Part of Sentence 9.12.2.2.(1)

Type of *Soil*	Minimum Depth of *Foundation* Containing Heated *Basement* or Crawl Space[1]		Minimum Depth of *Foundation* Containing No Heated Space[2]	
	Good *Soil* Drainage	Poor *Soil* Drainage	Good *Soil* Drainage	Poor *Soil* Drainage
Rock	No limit	No limit	No limit	No limit
Coarse grained *soils*	No limit	No limit	No limit	Below the depth of frost penetration
Silt	No limit	No limit	Below the depth of frost penetration[3]	Below the depth of frost penetration
Clay or *soils* not clearly defined[4]	1.2 m[3]	1.2 m	1.2 m but not less than the depth of frost penetration[3]	1.2 m but not less than the depth of frost penetration

Notes to Table 9.12.2.2.:
(1) *Foundation* not insulated to reduce heat loss through the footings.
(2) Including *foundations* insulated to reduce heat loss through the footings.
(3) Good *soil* drainage to not less than the depth of frost penetration.
(4) See Note A-Table 9.12.2.2.

Frost protection depths of 2.5m - Original Freezing index vs frost depth comparison – see Slide 25.

9.4.4. Foundation Conditions

9.4.4.1. Allowable Bearing Pressures

1) Footing sizes for *shallow foundations* shall be
a) determined in accordance with Section 9.15., or
b) designed in accordance with Section 4.2. using
i) the maximum allowable bearing pressures in Table 9.4.4.1., or
ii) allowable bearing pressures determined from *subsurface investigation*.

Table 9.4.4.1.
Allowable Bearing Pressure for Soil or Rock
Forming Part of Sentence 9.4.4.1.(1)

Type and Condition of *Soil* or *Rock*	Maximum Allowable Bearing Pressure, kPa
Dense or compact sand or gravel[1]	150
Loose sand or gravel[1]	50
Dense or compact silt[1]	100
Stiff clay[1]	150
Firm clay[1]	75
Soft clay[1]	40
Till	200
Clay shale	300
Sound *rock*	500

Notes to Table 9.4.4.1.:
(1) See Note A-Table 9.4.4.1.

Best to assume minimum soil bearing is 75kPa (1566 psf)

FLYWHEEL BUILDING SOLUTIONS

9.12.2. Frost Protection – depth of frost

A-Table 9.12.2.2. ***Division B***

A-Table 9.12.2.2. Minimum Depths of Foundations. The requirements for clay soils or soils not clearly defined are intended to apply to those soils that are subject to significant volume changes with changes in moisture content.

A-9.12.2.2.(2) Depth and Insulation of Foundations.

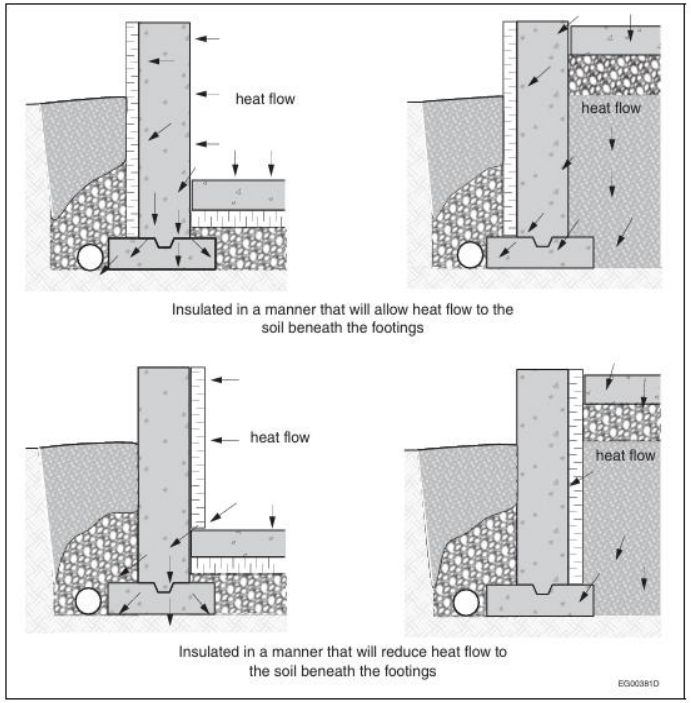


Figure A-9.12.2.2.(2)
Foundation insulation and heat flow to the soil beneath the footings

A-9.36.2.8.(4) Unheated Floors-on-ground Above the Frost Line. Figure A-9.36.2.8.(4) illustrates the insulation options for unheated floors-on-ground that are above the frost line.

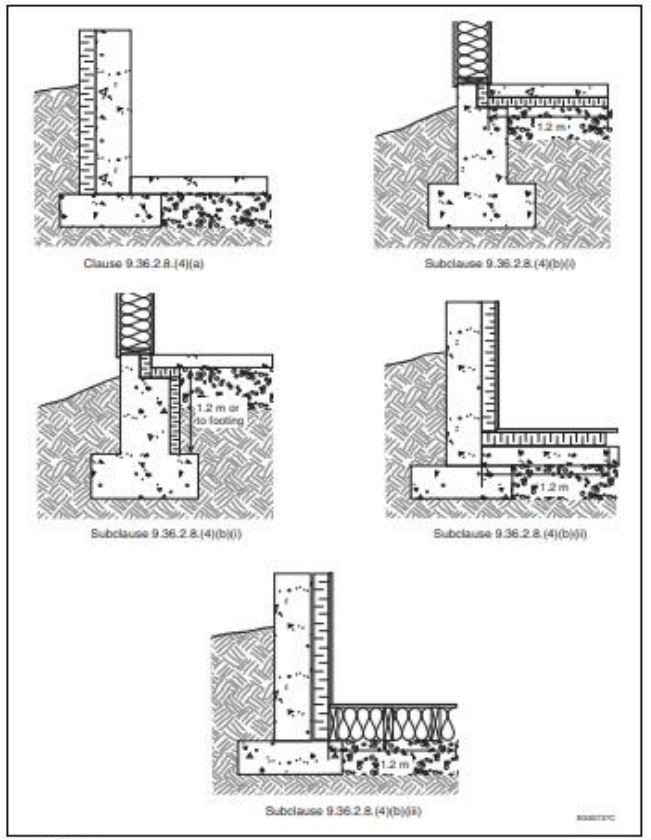


Figure A-9.36.2.8.(4)
Options for insulating unheated floors-on-ground

A-9.36.2.8.(9) Skirt Insulation. "Skirt insulation" refers to insulation installed on the exterior perimeter of the foundation and extended outward horizontally or at a slope away from the foundation. In cold climates, skirt insulation is typically extended 600 to 1 000 mm out from the vertical foundation wall over the footings to reduce heat loss from the house into the ground and to reduce the chance of frost forming under the footings.

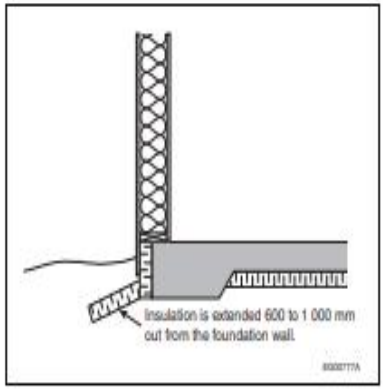
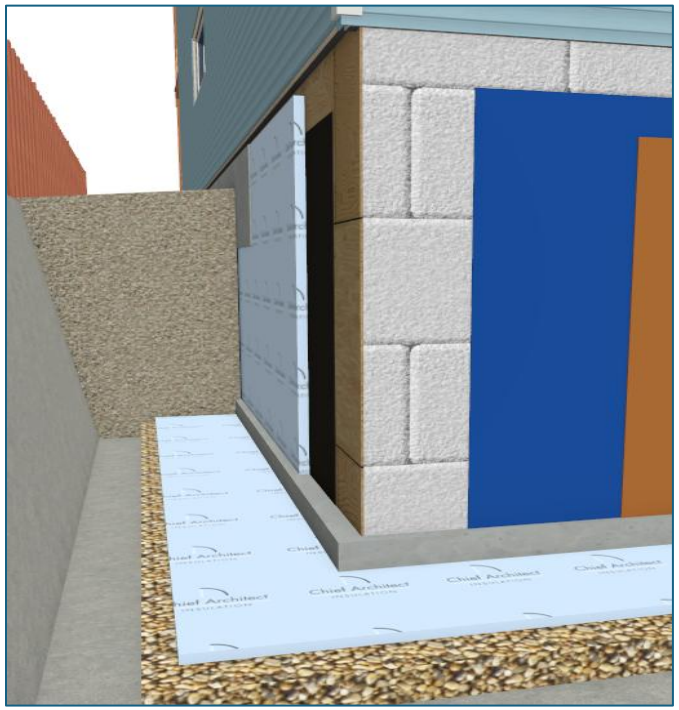
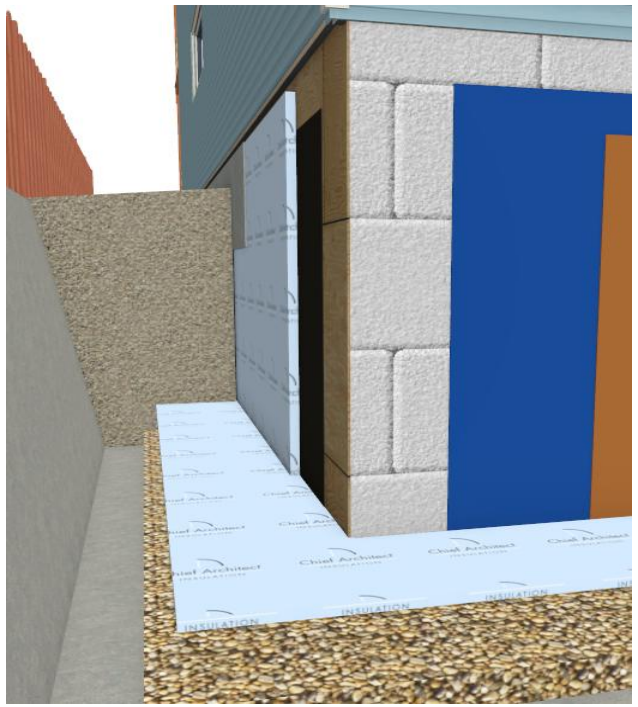


Figure A-9.36.2.8.(9)
Skirt insulation

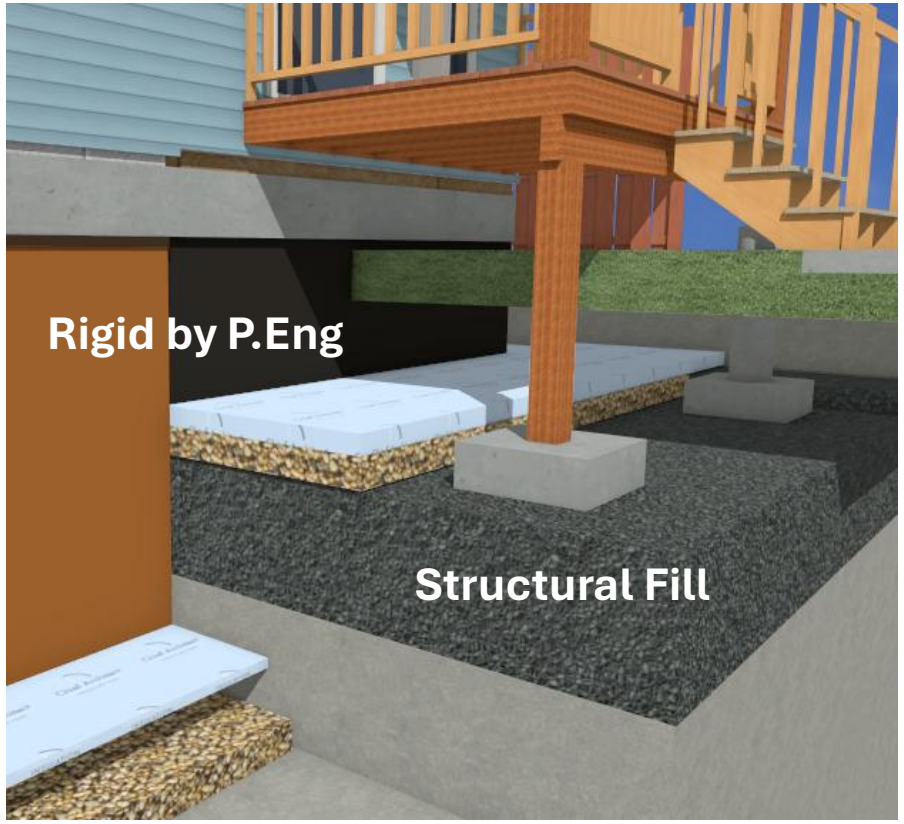
Q - Are we wanting to keep a little heat in or let a little out?

9.12.2.Excavations and Frost Protection





Full Basement - Location of Insul on top of Ftg
Energy efficiency and or Frost protection?



Shallow Crawl Space – Engineered

Q Building Bylaw - 86. Energy Efficiency

(g) Insulation with a thermal resistance of not less than RSI 1.8 (R10) shall be installed around the perimeter of a building extending not less than 600 mm (2 feet) from the building face immediately above or at footing level.

FLYWHEEL BUILDING SOLUTIONS

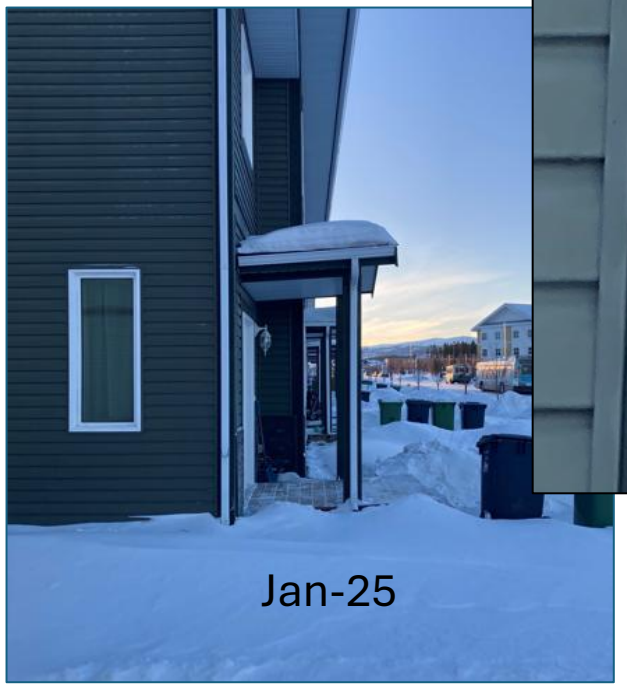
Footings – Frost

On this one you will notice the frost lift porch roof – the bottom stair used to be on the concrete.

This creates 03 significant issues:

- Deck sloping towards house,
- Deck stair risers exceed max at landing,
- Continued cycling of over seasons can lead to building envelope failure and eventually structural failure.

Nov-24



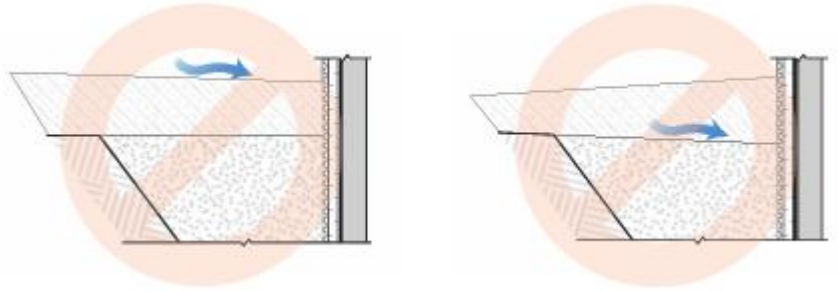
Jan-25

A-9.15.1.1. Application of Footing and Foundation Requirements to Decks and Similar Constructions. Because decks, balconies, verandas and similar platforms support occupancies, they are, by definition, considered as buildings or parts of buildings. Consequently, the requirements in Section 9.15. regarding footings and foundations apply to these constructions.

FLYWHEEL BUILDING SOLUTIONS

9.12.3. Backfill

Two principal causes of basement wall leaks are inadequate grading around the foundation and poor footing drainage. Improper grading may cause drain water from the roof, driveway and surrounding area to flow towards the foundation walls rather than away from them.

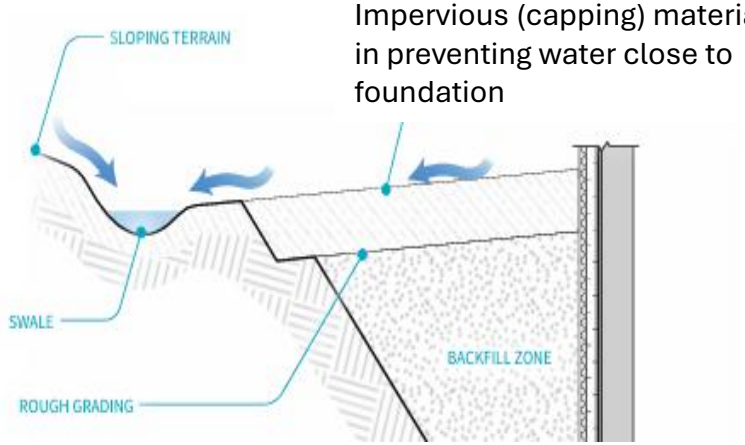


Incorrect final grading.

The ground around the building should have sufficient initial slope away from the building so that future settlement will not cause drainage towards the foundation.

- On average backfill can settle 50mm to 100mm
- Good practice to provide positive slope 1.5m away from foundations.

Final grading – top-soil or gravel. Impervious (capping) materials assist in preventing water close to foundation



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BUILDING SOLUTIONS

9.12.3. Backfill

Part 9, which are summarized as:

- **Section 9.12.3.1**: backfill must be placed to avoid damaging foundation walls.
- **Section 9.12.3.2**: grading should be sufficient to accommodate settlement and remain adequate once settlement is complete.
- **Section 9.12.3.3 (2)**: Backfill should not contain material susceptible to generating ice lenses that will damage the building to the degree that it will affect stability and performance.

Part 9 backfill requirements require that non-frost susceptible soil be used for backfill around the foundation unless other materials are suitable at the recommendation of a geotechnical engineer. Therefore, to backfill around PWF foundations with typical Whistle Bend soil and meet the requirements of Part 9, every house will require additional geotechnical engineering and field review. The only way to get away from needing an engineer for the backfill will be to switch to ICF foundations or import non-frost susceptible backfill, requiring all materials excavated to be hauled away and disposed of.

Adam Mickey, M.Eng., P.Eng.
President | AM2 Geotechnical Inc.

FLYWHEEL BUILDING SOLUTIONS

9.12.4. Trenches

9.12.4.1. Support of Footings

1) The soil in trenches beneath footings for sewers and watermains shall be compacted by tamping up to the level of the footing base or shall be filled with concrete having a strength not less than 10 MPa to support the footing.

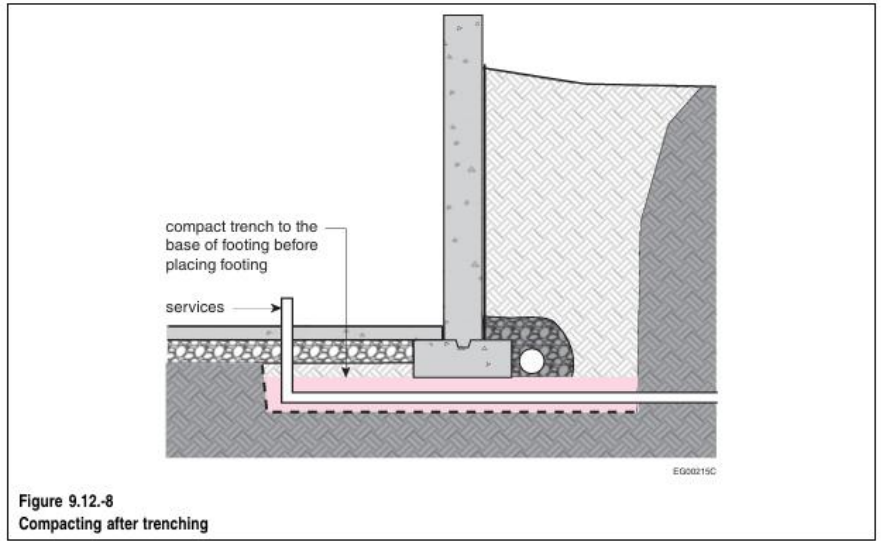


Figure 9.12.-8
Compacting after trenching

10 Minute Break

9.13 Dampproofing, ~~Waterproofing~~ and Soil Gas

- 9.13.1.1.Scope and Application
- 9.13.2.1. Required Dampproofing
- 9.13.3.3. Preparation of Surface
- CSA-S406-16 Dampproofing - Moisture Barriers
- 9.13.4.2. Protection from Soil Gas Ingress
- 9.14.4.3.Providing for the Rough-in for a Subfloor Depressurization System

FLYWHEEL BUILDING SOLUTIONS

9.13 Dampproofing and Soil Gas

9.13.1.1.Scope and Application

1) This Section presents measures to control the ingress of water, moisture and soil gas.

2) Subsection 9.13.2. applies to below-ground walls and floors-on-ground where drainage is provided in accordance with Section 9.14. over and along the entire below-ground portion of the foundation wall.

3) Subsection 9.13.3. applies to below-ground walls, floors-on-ground and roofs of underground structures that are subject to hydrostatic pressure.

4) Subsection 9.13.4. applies to walls, roofs and floors that are in contact with the ground.

9.13.2. Dampproofing,

9.13.2.1. Required Dampproofing

1) Except as provided in Article 9.13.3.1., where the exterior finished ground level is at a higher elevation than the ground level inside the foundation walls, exterior surfaces of foundation walls below ground level shall be dampproofed.

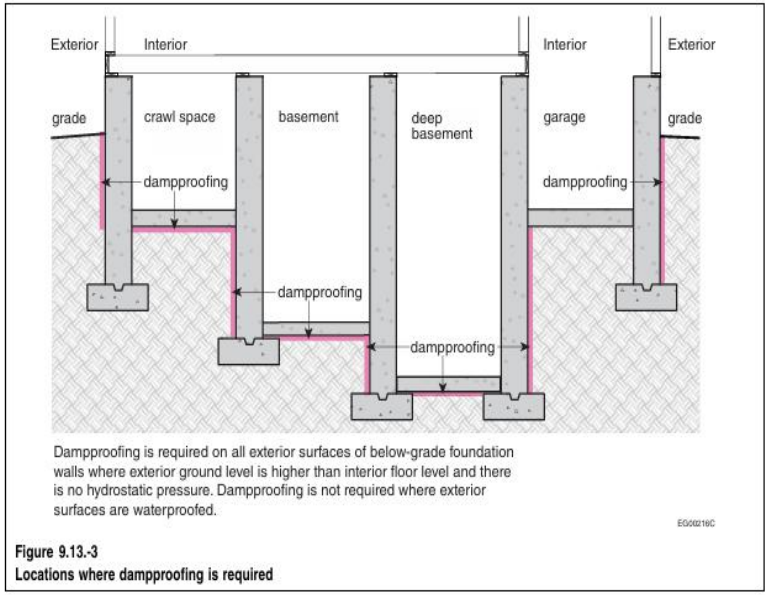
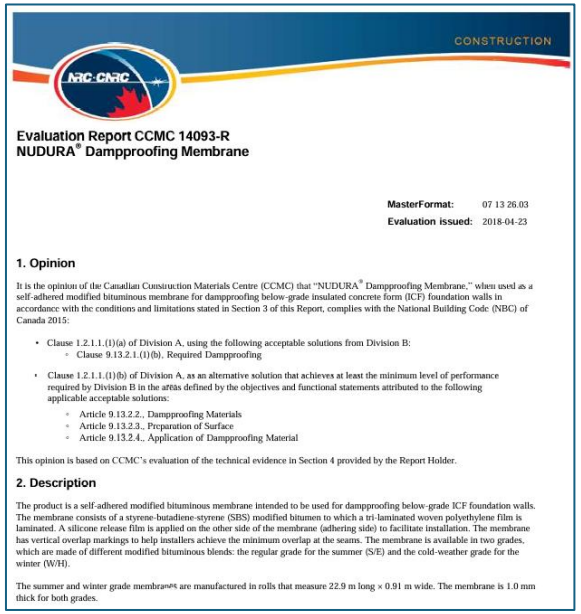


Figure 9.13.-3
Locations where dampproofing is required

9.13.3.3. Preparation of Surface

3) Where the dampproofing material is to be applied on insulating concrete form (ICF) walls, the instructions of the ICF wall manufacturer shall be followed.

Refer to CSA – S406 – 16 for damproofing requirements for PWF


CONSTRUCTION

NRC·CNRC

Evaluation Report CCMC 14093-R
NUDURA® Dampproofing Membrane

MasterFormat: 07 13 26.03
Evaluation issued: 2018-04-23

1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "NUDURA® Dampproofing Membrane," when used as a self-adhered modified bituminous membrane for dampproofing below-grade insulated concrete form (ICF) foundation walls in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code (NBC) of Canada 2015:

- Clause 1.2.1.1.(1)(a) of Division A, using the following acceptable solutions from Division B:
  - Clause 9.13.2.1.(1)(b), Required Dampproofing
- Clause 1.2.1.1.(1)(b) of Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Article 9.13.2.2., Dampproofing Materials
  - Article 9.13.2.3., Preparation of Surface
  - Article 9.13.2.4., Application of Dampproofing Material

This opinion is based on CCMC's evaluation of the technical evidence in Section 4 provided by the Report Holder.

2. Description

The product is a self-adhered modified bituminous membrane intended to be used for dampproofing below-grade ICF foundation walls. The membrane consists of a styrene-butadiene-styrene (SBS) modified bitumen to which a tri-laminated woven polyethylene film is laminated. A silicone release film is applied on the other side of the membrane (adhering side) to facilitate installation. The membrane has vertical overlap markings to help installers achieve the minimum overlap at the seams. The membrane is available in two grades, which are made of different modified bituminous blends: the regular grade for the summer (S/E) and the cold-weather grade for the winter (W/H).

The summer and winter grade membranes are manufactured in rolls that measure 22.9 m long × 0.91 m wide. The membrane is 1.0 mm thick for both grades.

FLYWHEEL BUILDING SOLUTIONS

CSA-S406-16 Dampproofing - Moisture Barriers

5.6.2 Dampproofing

5.6.2.1

Materials installed to provide the required dampproofing shall

a) possess the characteristics necessary to provide protection from moisture transfer from the ground;
b) be compatible with adjacent materials; and
c) be resistant to damage and deterioration in their service environment.

5.6.2.2

Materials used for exterior dampproofing shall

a) be a vapour-resistant coating having a water vapour permeance of not more than 43 ng/Pasm², when tested according to Procedure A of ASTM E96/E96M;
b) be a cold-fluid applied or hot rubberized bituminous dampproofing membranes;
c) be a liquid applied or spray-applied asphalt based emulsion dampproofing;
d) be a type III hot applied asphalt; or
e) conform to
   i) ASTM D1227 Type III, Class I;
   ii) ASTM D4479/D4479M Type III;
   iii) CAN/CGSB-51.34-M; or
   iv) CAN/CSA-A123.4.

5.6.3 Other compounds

Other sealants or dampproofing may be used provided they are compatible with the preservative-treated lumber and sheathing, as well as the moisture barrier used on the exterior of the permanent wood foundation.

5.7 Moisture and vapour barriers

Moisture and vapour barriers shall conform to Part 9 of the *National Building Code of Canada*.

Note: *See also Clause 15.*

FLYWHEEL BUILDING SOLUTIONS

CSA-S406-16 Moisture Barriers

15 Exterior moisture barrier

15.1 General

Except for the case of knee walls, or crawl spaces with trenched footings, the below-grade portion of the exterior face of the wall sheathing on a permanent wood foundation enclosing habitable space shall be protected by the moisture barrier specified in Clause 15.2.

15.2 Attachment of polyethylene sheet

A polyethylene sheet moisture barrier shall be applied to the plywood by means of embedment into vertical beads of sealant, or into dampproofing applied uniformly over the plywood. Joints between polyethylene sheets shall be vertical, lapped a minimum of 600 mm (2 ft), and sealed. When attached with vertical sealant beads, the polyethylene shall not be sealed along the bottom of the wall. The upper edge of the polyethylene shall be looped a minimum of 150 mm (6 in) and secured in place by nailing of the cover plate (see Figure A.29).

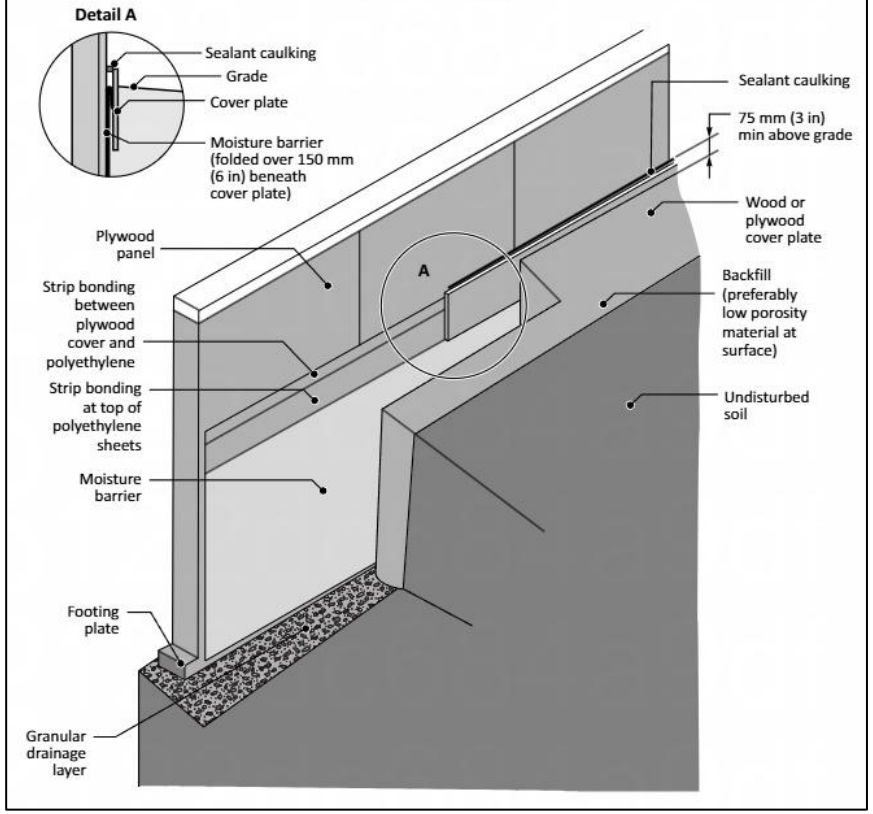
15.3 Protection by cover plate

The moisture barrier shall be protected at its upper edge by covering it with a cover plate consisting of a treated strip of plywood having a minimum thickness of 12.5 mm and a minimum width of 300 mm (12 in). The top edge of this continuous strip shall be embedded in sealant or dampproofing along its full length. The plywood strip may follow the contour of the finished outside grade, but it shall extend above the grade at any point by a minimum of 75 mm (3 in).

15.4 Protection of corners

The moisture barrier shall be protected at interior and exterior corners from mechanical damage by treated plywood strips or other durable corner protection.

Figure A.29
Sealing and dampproofing foundation wall exterior
(See Clause 15.2.)



FLYWHEEL BUILDING SOLUTIONS

9.13.2. Dampproofing,

9.13.2.6. Dampproofing of Floors-on-Ground

Where dampproofing is installed below the floor, it shall consist of

a) polyethylene not less than 0.15 mm thick with joints lapped not less than 100 mm,

b) type S roll roofing with joints lapped not less than 100 mm, or

c) rigid extruded/expanded polystyrene with sealed or ship-lapped joints that has

i) sufficient compressive strength to support the floor assembly, and

ii) a water vapour permeance complying with Clause 9.13.2.2.(2)(a).

FLYWHEEL BUILDING SOLUTIONS

9.13.4. Soil Gas Control

9.13.4.2. Protection from Soil Gas Ingress

1) All wall, roof and floor assemblies separating conditioned space from the ground shall be protected by an air barrier system conforming to Subsection 9.25.3.

2) Unless the space between the air barrier system and the ground is designed to be accessible for the future installation of a subfloor depressurization system, dwelling units and buildings containing residential occupancies shall be provided with the rough-in for a radon extraction system conforming to Article 9.13.4.3. (unfinished crawl spaces)

3) Where buildings are used for occupancies other than those described in Sentence (2), protection from radon ingress and the means to address high radon concentrations in the future shall conform to a) Article 9.13.4.3., or b) Parts 5 and 6 (see Article 5.4.1.1. and 6.2.1.1.). (See Note A-9.13.4.2.(3).)

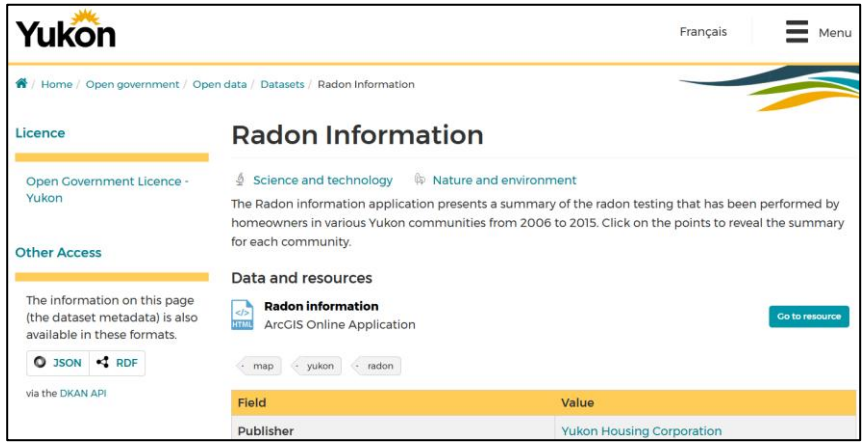
FLYWHEEL BUILDING SOLUTIONS

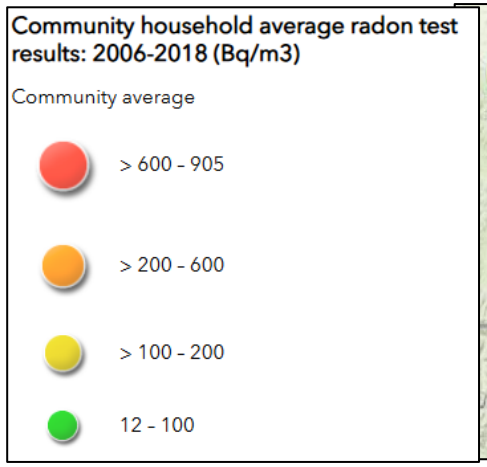
Soil Gas Control - Radon

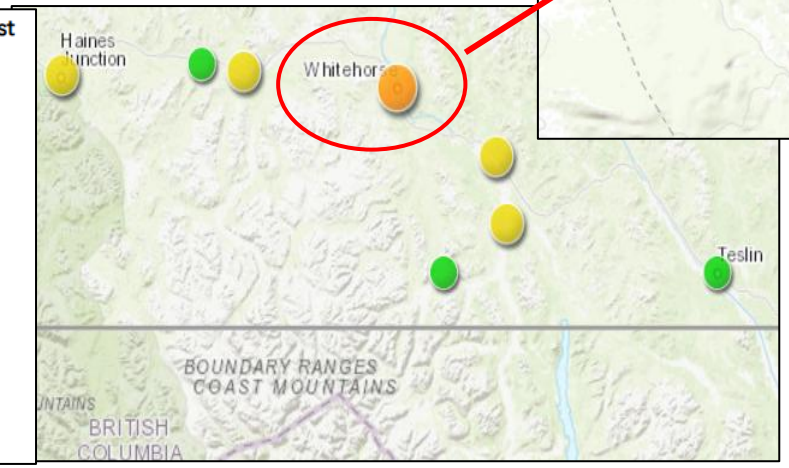
Existing YG Radon info

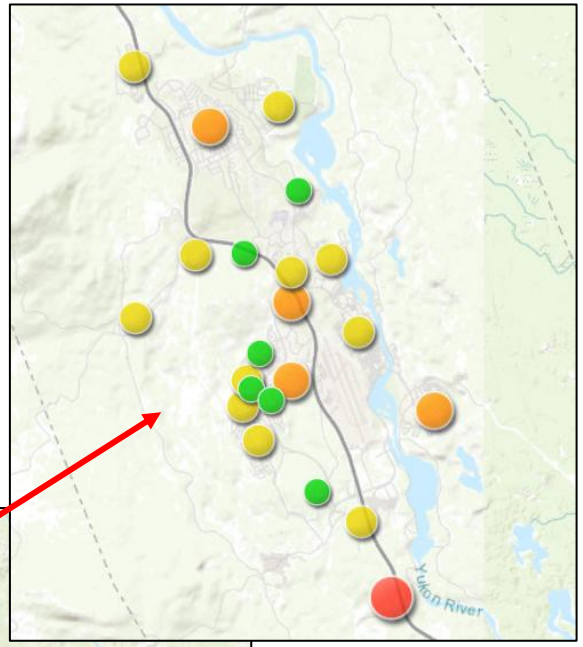
[Radon Information | Government of Yukon]

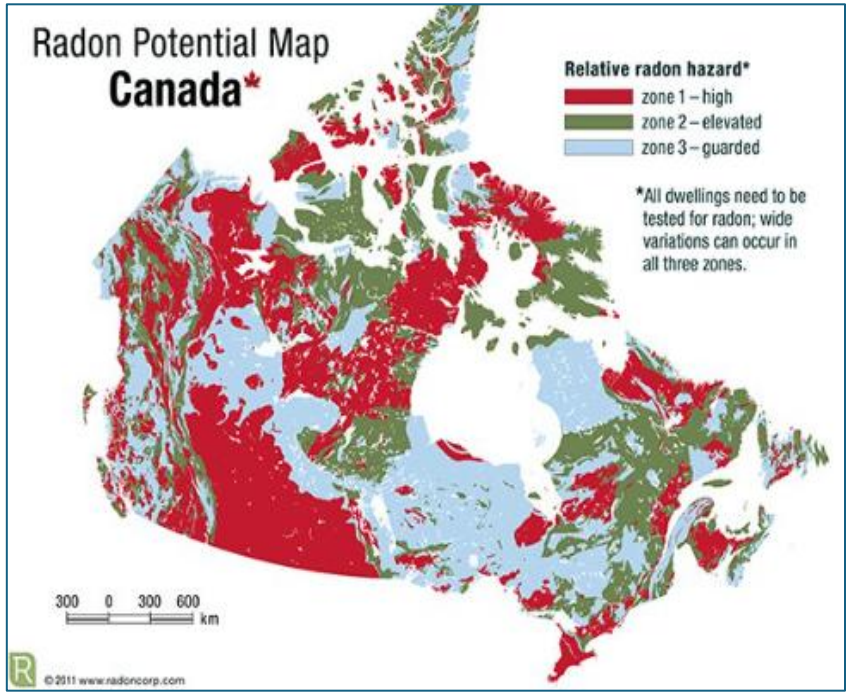
[Mapping radon risk communication — Radon Environmental]











FLYWHEEL
BUILDING SOLUTIONS

Radon - Depressurization

9.14.4.3.Providing for the Rough-in for a Subfloor Depressurization System

9.13.4.3. Providing for the Rough-in for a Subfloor Depressurization System
(See Note A-9.13.4.3.)

1) Floors-on-ground shall be provided with a rough-in for subfloor depressurization consisting of
- a) a gas-permeable layer, an inlet and an outlet as described in Sentence (2), or
- b) clean granular material and a pipe as described in Sentence (3).

2) The rough-in referred to in Clause (1)(a) shall include
- a) a gas-permeable layer installed in the space between the air barrier and the ground to allow the depressurization of that space,
- b) an inlet that allows for the effective depressurization of the gas-permeable layer (see Note A-9.13.4.3.(2)(b) and (3)(b)(i)), and
- c) an outlet in the *conditioned space* that
  - i) permits connection to depressurization equipment,
  - ii) is sealed to maintain the integrity of the *air barrier system*, and
  - iii) is clearly labeled to indicate that it is intended only for the removal of radon from below the floor-on-ground.

A-9.13.4.3.(2)(b) and (3)(b)(i) Effective Depressurization. To allow effective depressurization of the space between the air barrier and the ground, the extraction opening (the pipe) should not be blocked and should be arranged such that air can be extracted from the entire space between the air barrier and the ground. This will ensure that the extraction system can maintain negative pressure underneath the entire floor (or in heated crawl spaces underneath the air barrier). The arrangement and location of the extraction system inlet(s) may have design implications where the footing layout separates part of the space underneath the floor.

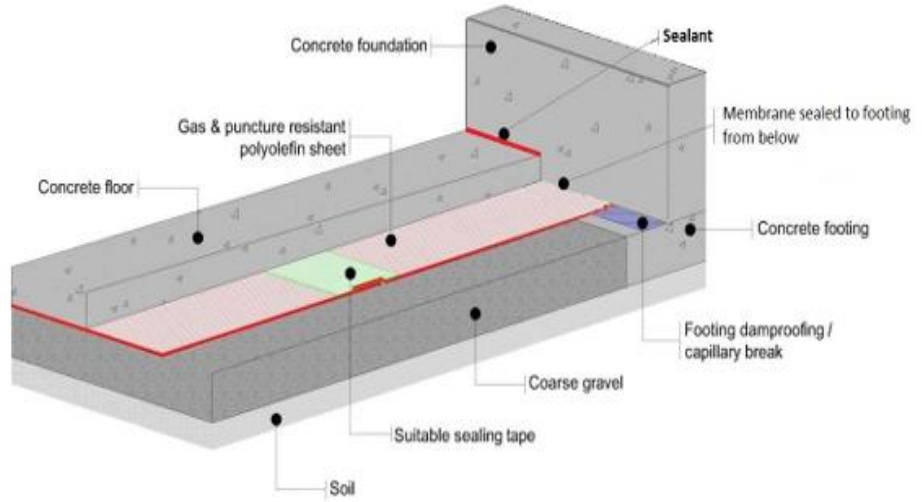


Figure 7.1.4.5.6 — Sealing sub-slab membrane horizontally to concrete footing prior to slab pour and of the slab/wall expansion joint after the slab pour

CAN/CSGB-149.11-2019

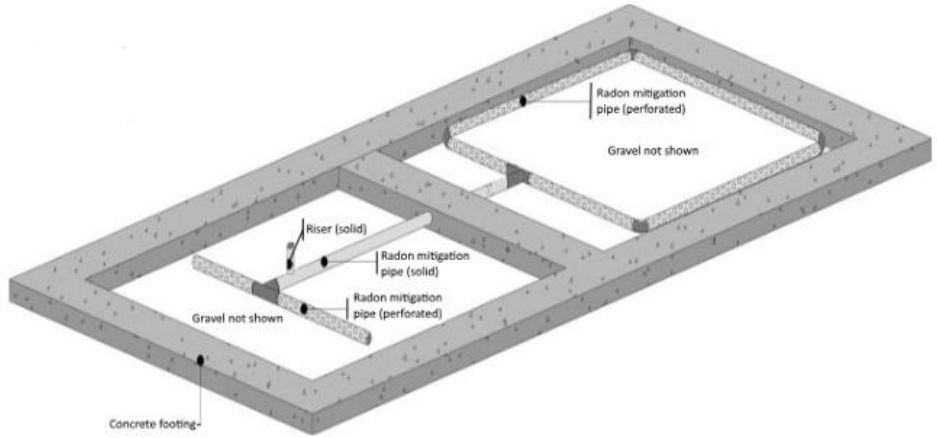
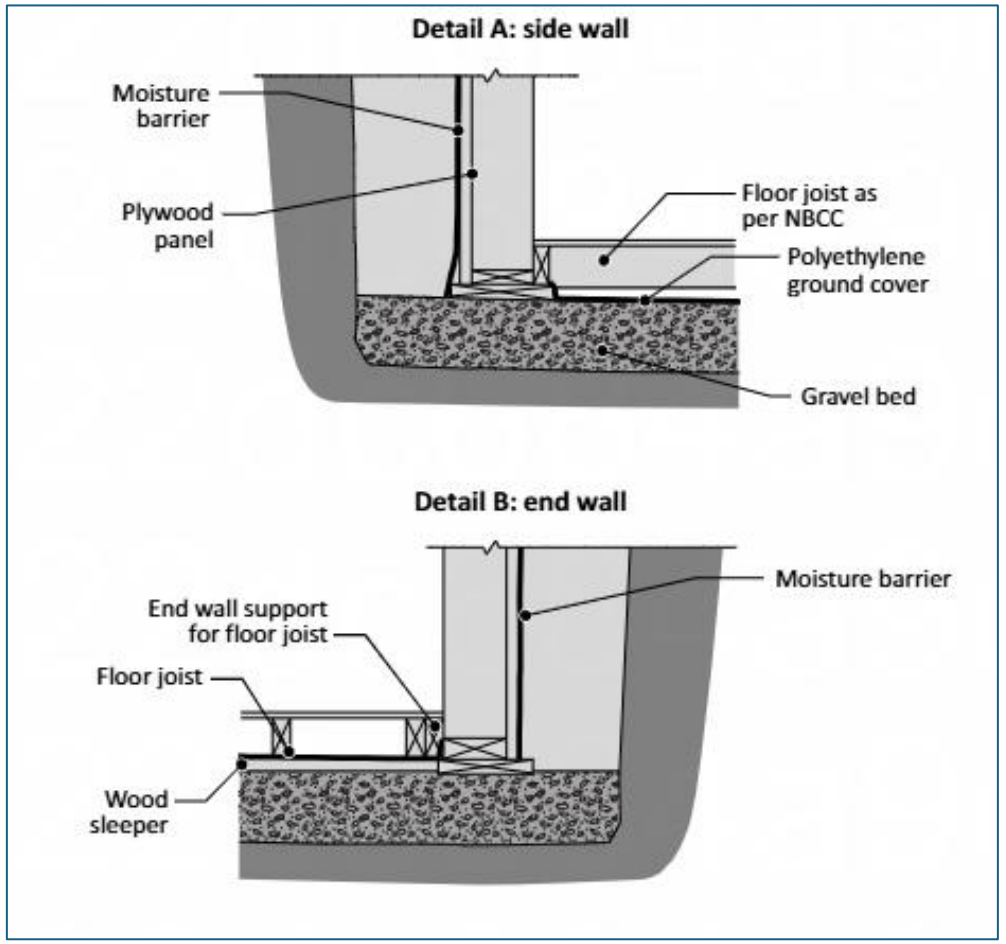


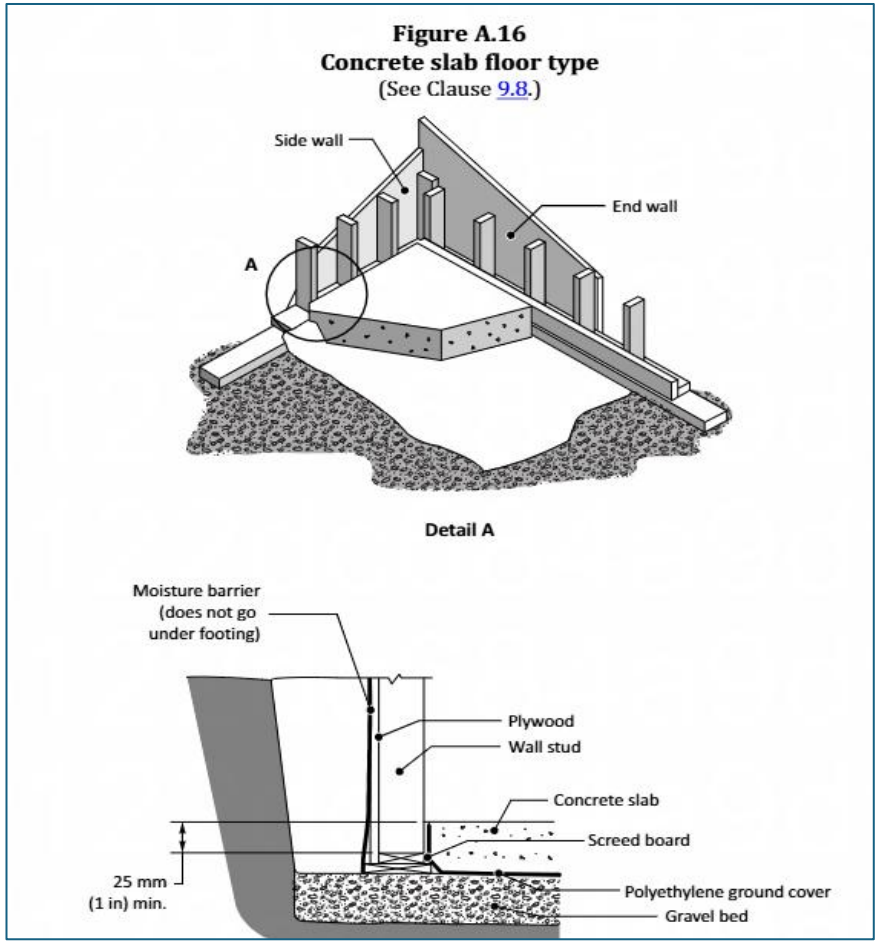
Figure 7.1.2.7— Possible interconnection of two gas permeable layers

Radon – Depressurization - PWF

Refer to CSA-S406-16 for air barrier details.

9.14.4.3.Providing for the Rough-in for a Subfloor Depressurization System





FLYWHEEL BUILDING SOLUTIONS

Radon - Depressurization

3) The rough-in referred to in Clause (1)(b) shall include

a) clean granular material installed below the floor-on-ground in accordance with Sentence 9.16.2.1.(1), and

b) a pipe not less than 100 mm in diameter installed through the floor, such that

i) its bottom end opens into the granular layer required in Clause (a) at or near the centre of the floor and not less than 100 mm of granular material projects beyond the terminus of the pipe measured along its axis (see Note A-9.13.4.3.(2)(b) and (3)(b)(i)),

ii) its top end permits connection to depressurization equipment and is provided with an airtight cap, and

iii) the pipe is clearly labeled near the cap and, if applicable, every 1.8 m and at every change in direction to indicate that it is intended only for the removal of radon from below the floor-on-ground.

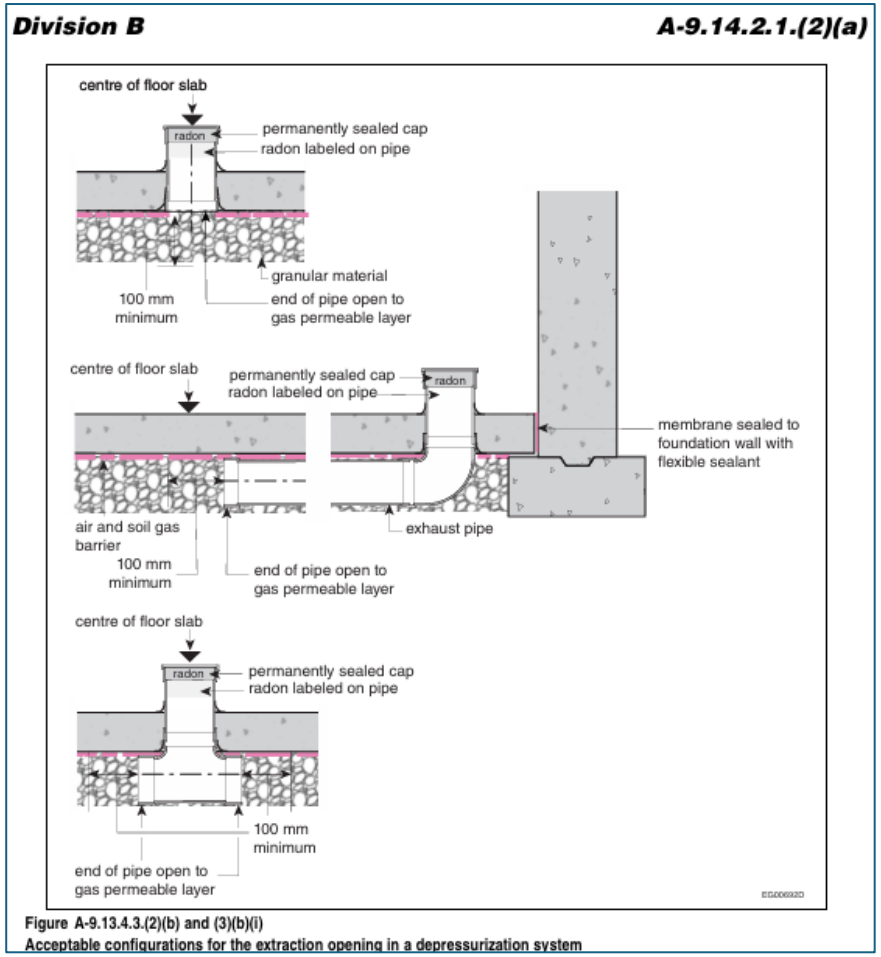


Figure A-9.13.4.3.(2)(b) and (3)(b)(i)
Acceptable configurations for the extraction opening in a depressurization system

9.16.2.1. Required Installation of Granular Material

1) Except as provided in Sentence (2), not less than 100 mm of coarse clean granular material containing not more than 10% of material that will pass a 4 mm sieve shall be placed beneath floors-on-ground. (See also Subsection 9.13.4. and Note A-9.13.4.)

9.14.4.1. Type of Granular Material Fdn Drainage layer

1) Granular material used to drain the bottom of a *foundation* shall consist of a continuous layer of crushed stone or other coarse clean granular material containing

a) not more than 10% of material that will pass a 4 mm sieve, and

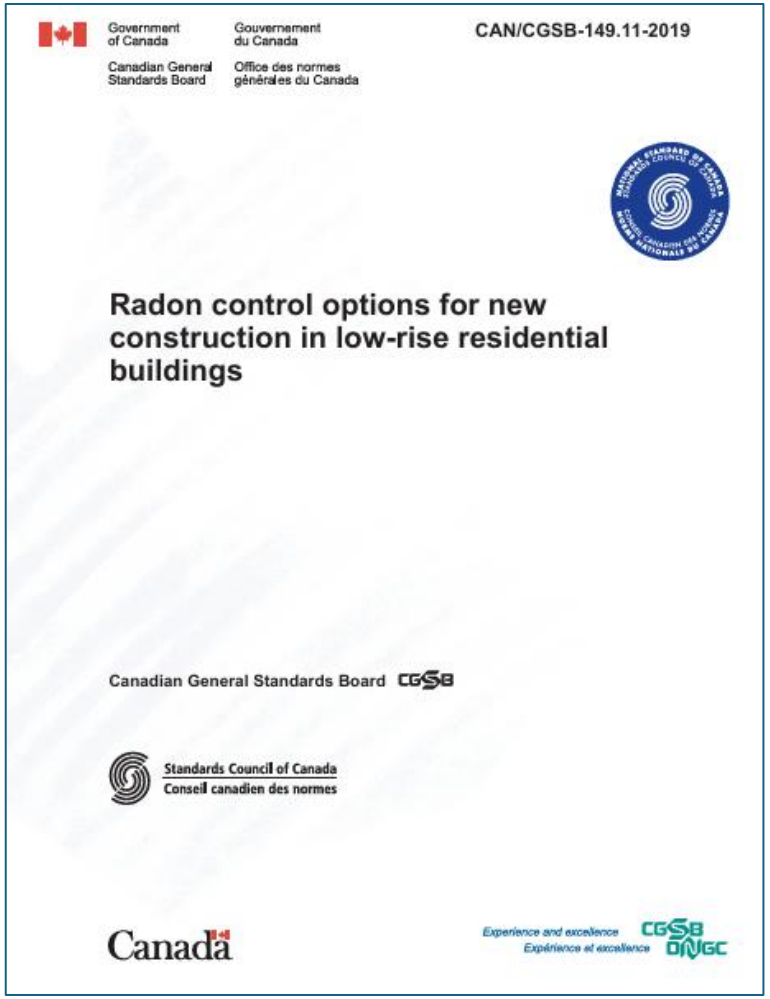
b) no pyritic material in a concentration that will damage the *building* to a degree that would adversely affect its stability or the performance of assemblies (see Note A-9.4.4.4.(1)).

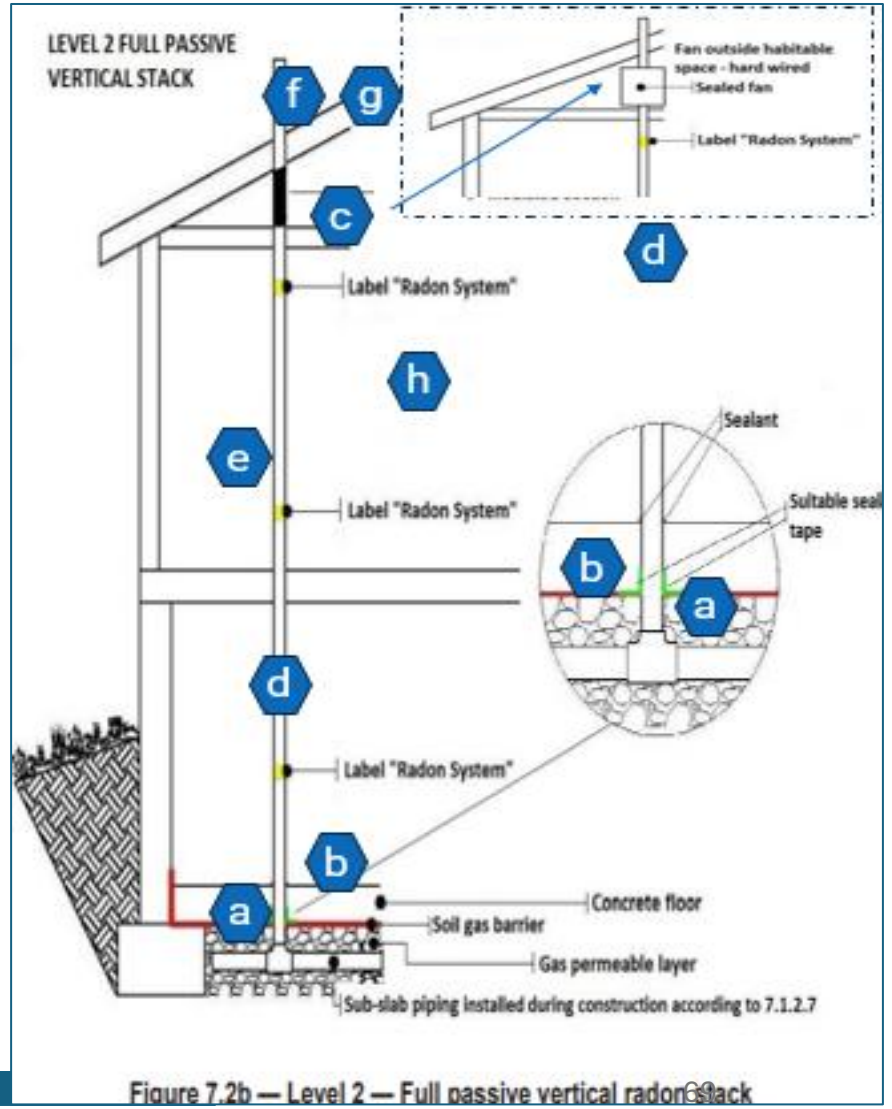
Radon piping
CAN/CSGB-149.11-2019

Outline for thru house passive vent piping. Not required (2020 NBC)

Refer to this standard for an overview of rough-in, full passive or full active systems.

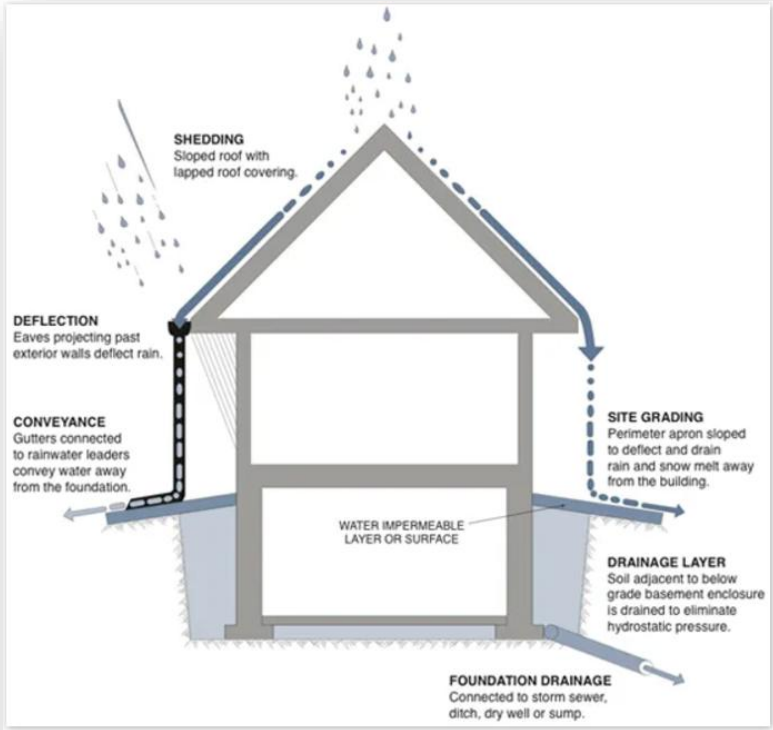
[Link - P29-149-011-2019-eng.pdf]





9.14 Drainage

- 9.14.2.1. Foundation Wall Drainage
- 9.14.4. Granular Drainage Layer
- CSA – S406-16
- Site & Roof Drainage
- City Requirements



[Graphic courtesy Whole Building Design Guide]

9.14 Drainage

9.14.2.1. Foundation Wall Drainage

1) Unless it can be shown to be unnecessary, the bottom of every exterior foundation wall shall be drained by drainage tile or pipe laid around the exterior of the foundation in conformance with Subsection 9.14.3. or by a layer of gravel or crushed rock in conformance with Subsection 9.14.4.

2) Where mineral fibre insulation or crushed rock backfill is provided adjacent to the exterior surface of a foundation wall,

a) the insulation or backfill shall extend to the footing level to facilitate the drainage of ground water to the foundation's drainage system (see Note A-9.14.2.1.(2)(a)), and

b) any pyritic material in the crushed rock shall be limited to a concentration that will not damage the building to a degree that would adversely affect its stability or the performance of assemblies (see Sentence 9.12.3.3.(2) and Note A-9.4.4.4.(1)).

9.14.4 Granular Drainage Layer

9.14.4.1. Type of Granular Material

1) Granular material used to drain the bottom of a foundation shall consist of a continuous layer of crushed stone or other coarse clean granular material containing

a) not more than 10% of material that will pass a 4 mm sieve, and

b) no pyritic material in a concentration that will damage the building to a degree that would adversely affect its stability or the performance of assemblies (see Note A-9.4.4.4.(1)).

9.14.4.2. Installation

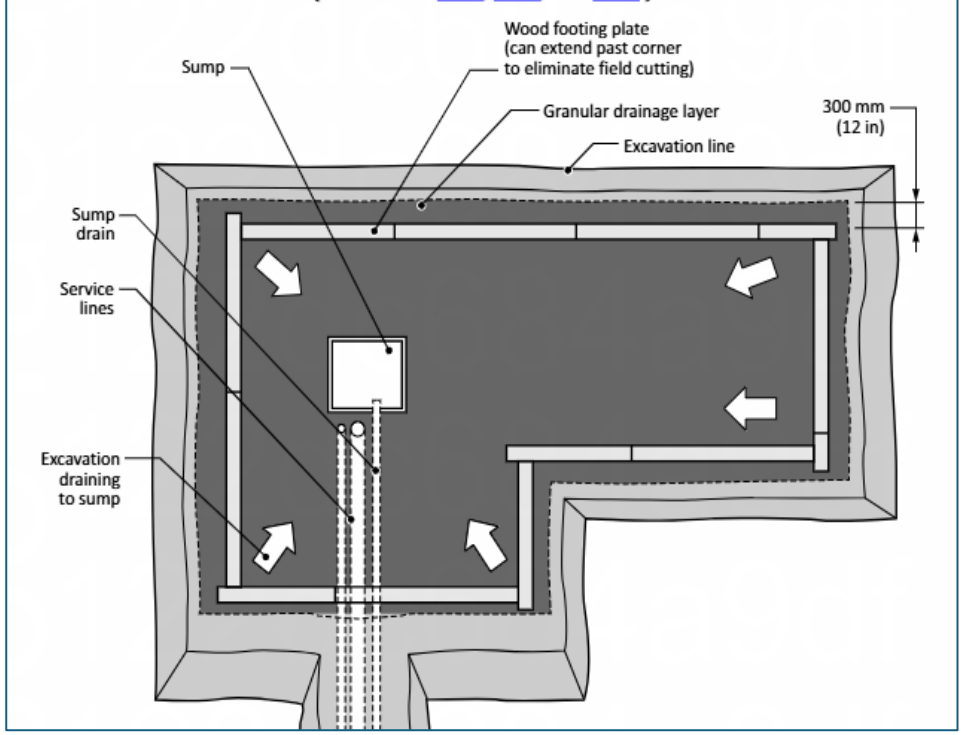
1) Granular material described in Article 9.14.4.1. shall be laid on undisturbed or compacted soil to a minimum depth of not less than 125 mm beneath the footing of the building and extend not less than 300 mm beyond the outside edge of the footings.

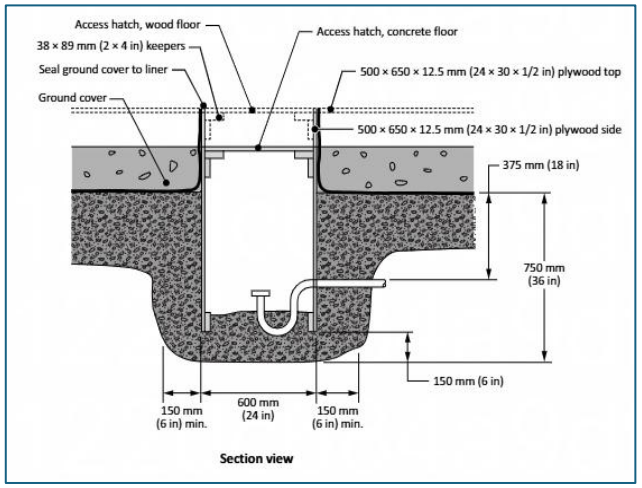
9.14.4.3. Grading

1) The bottom of an excavation drained by a granular layer shall be graded so that the entire area described in Article 9.14.4.2. is drained to a sump conforming to Article 9.14.5.2

Foundation Drainage – S406-16

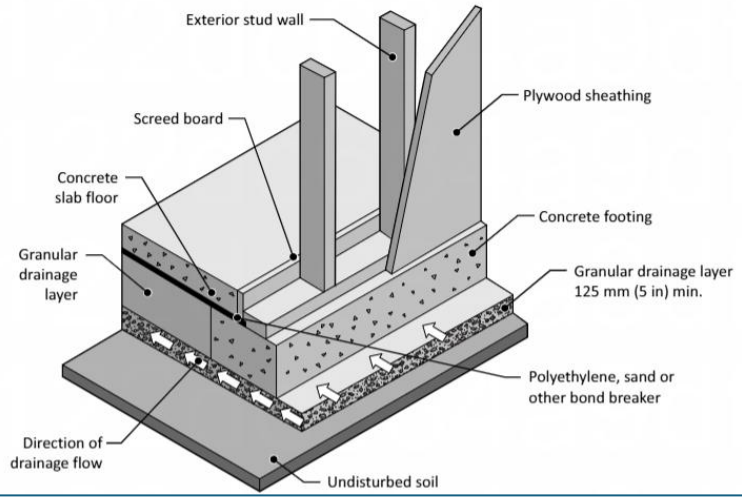
Figure A.3
Excavation plan showing continuous wood footing plate and drainage and service lines layout
(See Clauses 7.2.1, 7.2.2, and 8.2.4.)



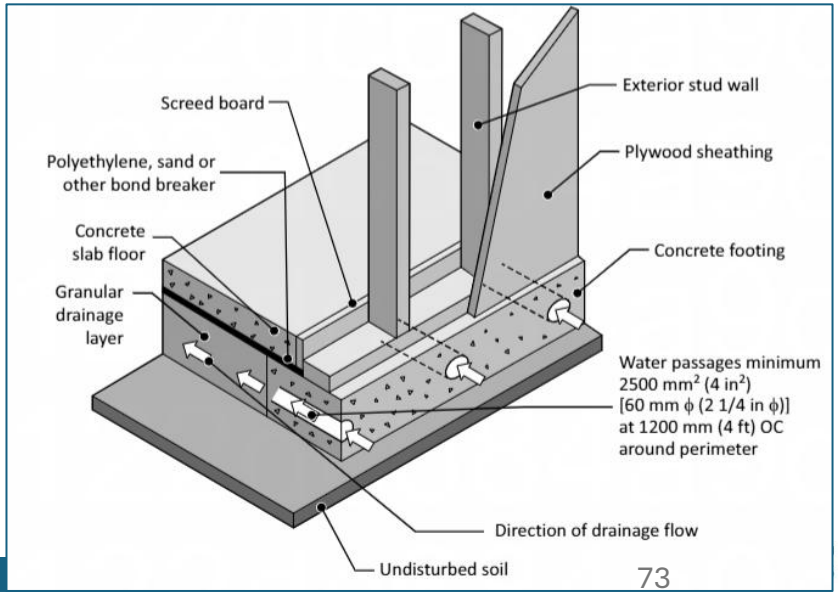


With a conc footing – drainage layer

Figure A.6
Granular drainage with concrete footings
(See Clauses 7.2.4, 8.4.3, and 15.5.)



With a conc footing – no drainage layer



9.14.6 Surface Drainage

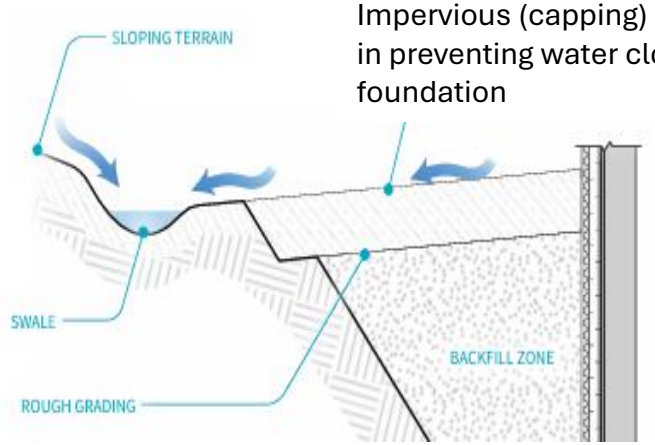
9.14.6.1. Surface Drainage

The building shall be located or the building site graded so that water will not accumulate at or near the building.

9.14.6.5. Downspouts

1) Downspouts shall conform to Article 9.26.18.2.

Final grading – top-soil or gravel. Impervious (capping) materials assist in preventing water close to foundation



Roof Drainage Disposal

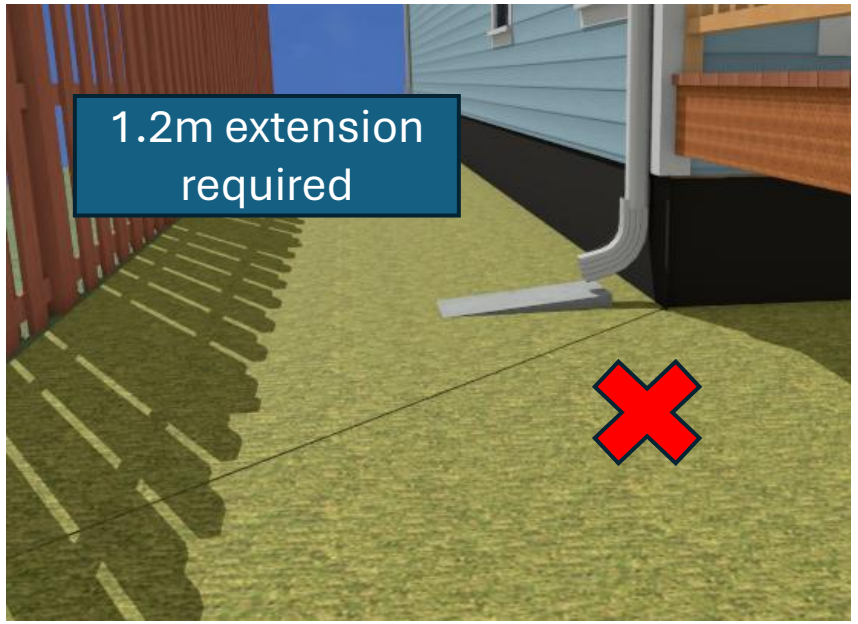
9.26.18. Roof Drains and Downspouts

9.26.18.1. Roof Drains

1) When roof drains are provided they shall conform to Part 7.

9.26.18.2. Downspouts

1) Where downspouts are provided and are not connected to a sewer, extensions shall be provided to carry rainwater away from the building in a manner which will prevent soil erosion.



Roof Drainage - downspouts terminating min 4 ft from building onto a splash pad, compacted to 95 spd backfill.

FLYWHEEL BUILDING SOLUTIONS

Foundation Drainage

City Drainage Standards for Building Foundations (found on website)

Alternatives

If you wish to pursue an alternative to the prescriptive standards outlined, there are options that can be proposed. One option is to provide site specific soil analysis that meets the conditions for a "free draining" soil type verified by a stamped report from a Yukon licensed engineer experienced in soils analysis. When this "free draining" soil type designation is obtained, the drainage layer and sump assembly can be omitted.

Another option available is for a building designed under Part 4 of the NBC. This prescriptive requirement foundation drainage may be omitted/altered by a structural engineer's letter of design assurance and field review.

Lastly a building constructed "slab on grade" need not provide the sump pit and associated equipment.

Effective October 25, 2010

City of Whitehorse

BUILDING ADVISORY - OCTOBER 25, 2010

City of Whitehorse
Planning and Development Services Department

RE: Building Advisory October 25, 2010 – Drainage Standards for Building Foundations

This building advisory is to alert contractors, home builders, designers and property owners that all building permit applications for new buildings with subsurface foundations constructed in Whitehorse will need to adhere to prescriptive standards for drainage effective immediately. Drawings and specifications are attached to this advisory.

The construction of all new occupied buildings with permanent wood foundations must follow the standard as outlined in CAN/CSA S-406-92 "Construction of Preserved Wood Foundations" as identified by the National Building Code (NBC).

Similarly, concrete foundations must follow the prescriptive standard as cited in the NBC 2005, Section 9.14 "Drainage", which describes the minimums for foundation drainage, drainage tile and pipe, granular drainage layers, drainage disposal and surface drainage.

The NBC allows for standards to be varied by the authority having jurisdiction (City of Whitehorse) based upon local conditions and past performance. Historically, permanent wood foundations and concrete foundations have not had to include a drainage layer or drainage system such as a sump and drainage pit as soils were deemed to be "free draining" relative to the local precipitation. This assessment was supported by over 35 years of demonstrated performance.

Microsoft Word - Foundation Advisory Oct 25 2010 FINAL.docx

Drainage

6.1.2. ROOF DRAINAGE

Downspouts are to direct roof drainage away from all buildings and towards the street and/or rear yard.

Under no circumstances are downspouts to direct run-off onto neighbouring properties. Downspouts must have an elbow with an extension to convey surface run-off away from the building foundation.

6.1.8. SWALES - Internal Rear-Yard Swales

Internal 'rear-yard' swales are to be located in backyard areas of lots that are designed to adhere to a rear to front drainage pattern. A rear-yard swale is created where the rear to front design grades meet the required positive grade from building footprints. Typically, drainage is directed to shared or internal swales in the side yard area.

Link - CoW-Lot-Grading-Guidelines_Simple-Developments_Sept2023.pdf

FLYWHEEL BUILDING SOLUTIONS

9.15 Footing and Foundations

- 9.15.1.1. General.
- 9.15.3. Footings
- 9.15.4.1. Flat Wall Insulating Concrete Form Units
- 9.15.4.5. Reinforcement for Flat Insulating Concrete Form Foundation Walls
- CSA-S406-16 Overview - anchorage

FLYWHEEL BUILDING SOLUTIONS

Section 9.15. Footings and Foundations

9.15.1.1. General

(See Notes A-9.15.1.1. and A-9.4.4.6. and 9.15.1.1.)

1) Except as provided in Articles 9.15.1.2. and 9.15.1.3., this Section applies to

    a) concrete or unit masonry foundation walls and concrete footings not subject to surcharge

    i) on stable soils with an allowable bearing pressure **of 75 kPa or greater, a**nd

    ii) for buildings of wood-frame or masonry construction,

Section 9.15. Footings and Foundations

9.15.1.1. General

b) **wood-frame foundation** walls and wood or concrete footings not subject to surcharge

i) on stable soils with an allowable **bearing pressure of 75 kPa or greater**, and

ii) **for buildings of wood-frame construction**, and

c) **flat insulating concrete form foundation walls and concrete footings not subject to surcharge (**see Note A-9.15.1.1.(1)(c) and 9.20.1.1.(1)(b))

i) on stable soils with an allowable **bearing pressure of 75 kPa or** greater, and

ii) for buildings of light-frame or flat insulating concrete form construction that are not more than **2 storeys in building height, with a maximum floor-to-floor height of 3 m.**

2) Foundations for applications other than as described in Sentence (1) shall be designed in accordance with **Section 9.4.**

Section 9.15. Footings and Foundations

Structural Load considerations

Foundations carry their own weight and the loads transferred to them from the superstructures they support to the ground. Vertical loads include the weight of the superstructure itself (dead load) and that of its occupants and contents (live load) in combination with the roof snow load. Wind and earthquake loads must also be resisted by the foundation.

Where foundations extend into the ground and enclose space such as basements and crawl spaces, they must also adequately resist lateral soil and water pressures acting against them. **Foundations should not settle significantly or unevenly over time. They should remain unaffected by the freezing and thawing of soils, and moisture expansion and contraction in the soil**

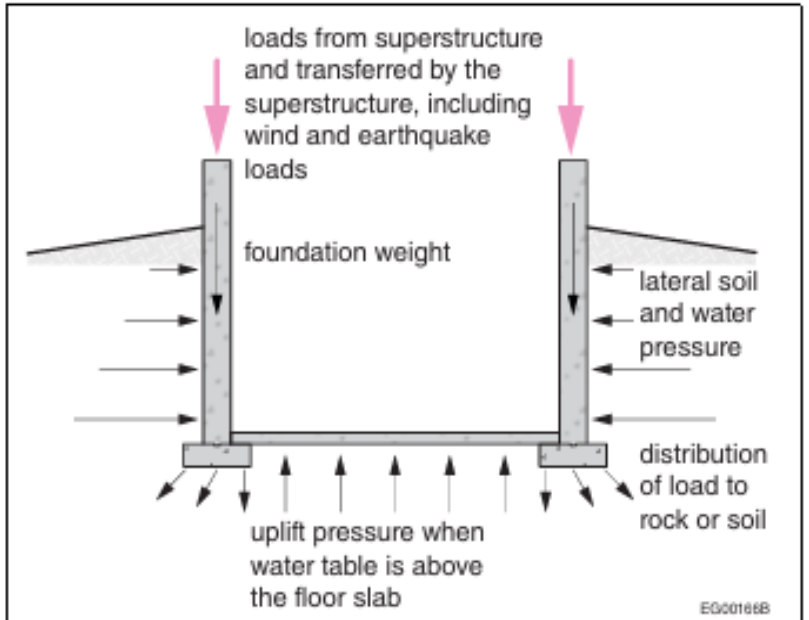


Figure 9.15.-1
Structural considerations for footings and foundations

9.15.3. Footings

9.15.3.2. Support of Footings

1) Footings shall rest on undisturbed soil, rock or compacted granular fill.

9.15.3.4.Basic Footing Widths and Areas

1) Except as provided in Sentences (2) and (3) and in Articles 9.15.3.5. to 9.15.3.7., the minimum footing width or area shall comply with Table 9.15.3.4.

2) When Joist span exceeds 4.9m (16ft)

3) High water table – within less than the width of footing

FLYWHEEL BUILDING SOLUTIONS

Footing Alternative

Bearing capacity may still be an issue in some parts of WH – requiring deeper piles.

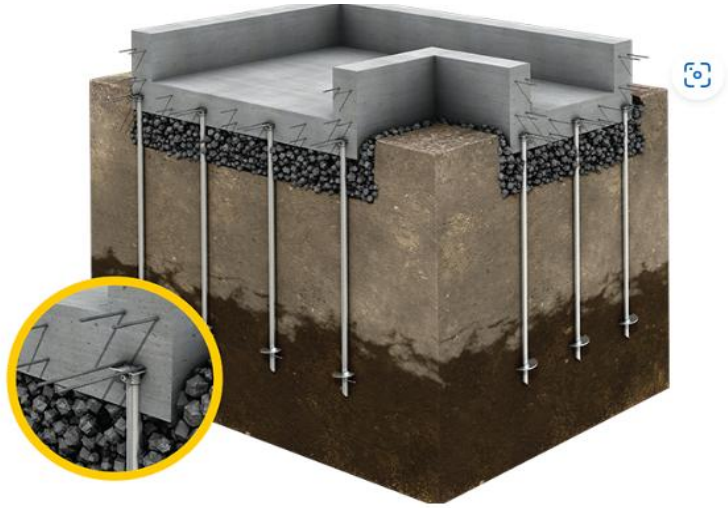
Screw-piles are becoming more popular in Alberta (NBC - Alberta) and BC.

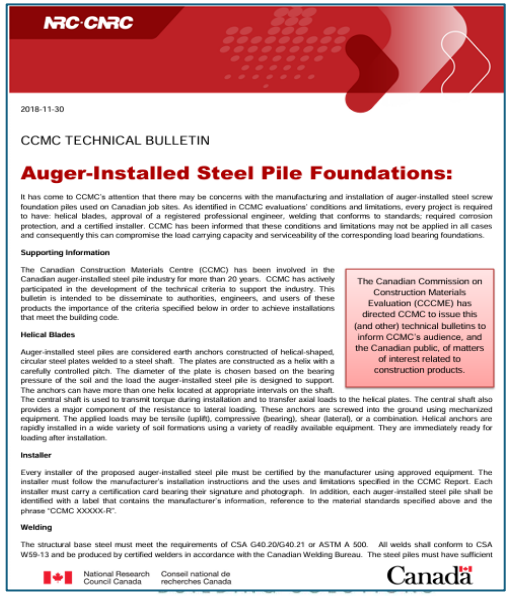
Would this help with issues related to frost protection?

Geotechnical Engineering is required

Structural for concrete grade beams?

Still needs to go beyond frost level.





NRC·CNRC

2018-11-30

CCMC TECHNICAL BULLETIN

Auger-Installed Steel Pile Foundations:

It has come to CCMC's attention that there may be concerns with the manufacturing and installation of auger-installed steel screw foundation piles used on Canadian job sites. As identified in CCMC evaluations' conditions and limitations, every project is required to have: helical blades, approval of a registered professional engineer, welding that conforms to standards; required corrosion protection, and a certified installer. CCMC has been informed that these conditions and limitations may not be applied in all cases and consequently this can compromise the load carrying capacity and serviceability of the corresponding load bearing foundations.

Supporting Information

The Canadian Construction Materials Centre (CCMC) has been involved in the Canadian auger-installed steel pile industry for more than 20 years. CCMC has actively participated in the development of the technical criteria to support the industry. This bulletin is intended to be disseminate to authorities, engineers, and users of these products the importance of the criteria specified below in order to achieve installations that meet the building code.

The Canadian Commission on Construction Materials Evaluation (CCCME) has directed CCMC to issue this (and other) technical bulletins to inform CCMC's audience, and the Canadian public, of matters of interest related to construction products.

Helical Blades

Auger-installed steel piles are considered earth anchors constructed of helical-shaped, circular steel plates welded to a steel shaft. The plates are constructed as a helix with a carefully controlled pitch. The diameter of the plate is chosen based on the bearing pressure of the soil and the load the auger-installed steel pile is designed to support. The anchors can have more than one helix located at appropriate intervals on the shaft. The central shaft is used to transmit torque during installation and to transfer axial loads to the helical plates. The central shaft also provides a major component of the resistance to lateral loading. These anchors are screwed into the ground using mechanized equipment. The applied loads may be tensile (uplift), compressive (bearing), shear (lateral), or a combination. Helical anchors are rapidly installed in a wide variety of soil formations using a variety of readily available equipment. They are immediately ready for loading after installation.

Installer

Every installer of the proposed auger-installed steel pile must be certified by the manufacturer using approved equipment. The installer must follow the manufacturer's installation instructions and the uses and limitations specified in the CCMC Report. Each installer must carry a certification card bearing their signature and photograph. In addition, each auger-installed steel pile shall be identified with a label that contains the manufacturer's information, reference to the material standards specified above and the phrase "CCMC XXXXX-R".

Welding

The structural base steel must meet the requirements of CSA G40.20/G40.21 or ASTM A 500. All welds shall conform to CSA W59-13 and be produced by certified welders in accordance with the Canadian Welding Bureau. The steel piles must have sufficient

National Research Council Canada | Conseil national de recherches Canada | Canada

9.15.3. Footings

Table 9.15.3.4.
Minimum Footing Sizes
Forming Part of Sentence 9.15.3.4.(1)

No. of Floors Supported	Minimum Width of Strip Footings, mm		Minimum Footing Area for Columns Spaced 3 m o.c.,(1) m²
	Supporting Exterior Walls(2)	Supporting Interior Walls(3)	
1	250	200	0.4
2	350	350	0.75
3	450	500	1.0

Notes to Table 9.15.3.4.:
(1) See Sentence 9.15.3.7.(1).
(2) See Sentence 9.15.3.5.(1).
(3) See Sentence 9.15.3.6.(1).

9.15.3.7. Adjustments to Footing Area for Columns
1) The footing area for column spacings other than shown in Table 9.15.3.4. shall be adjusted in proportion to the distance between columns.

9.15.3.5. 1) Adjustments to Footing Widths for Exterior Walls
1) The strip footing widths for exterior walls shown in Table 9.15.3.4. shall be increased by a) 65mmfor each storey of masonry veneer over wood-frame construction supported by the foundation wall,
b) 130mmforeachstorey of masonry construction supported by the foundation wall, and
c) 150 mm for each storey of flat insulating concrete form wall construction supported by the foundation wall.

9.15.3.6. 1) Adjustments to Footing Widths for Interior Walls
1) The minimum strip footing widths for interior loadbearing masonry walls shown in Table 9.15.3.4. shall be increased by 100 mm for each storey of masonry construction supported by the footing.

9.15.3. Footings

9.15.3.8. Footing Thickness

1) Footing thickness shall be not less than the greater of

a) 100 mm, or

b) the width of the projection of the footing beyond the supported element.

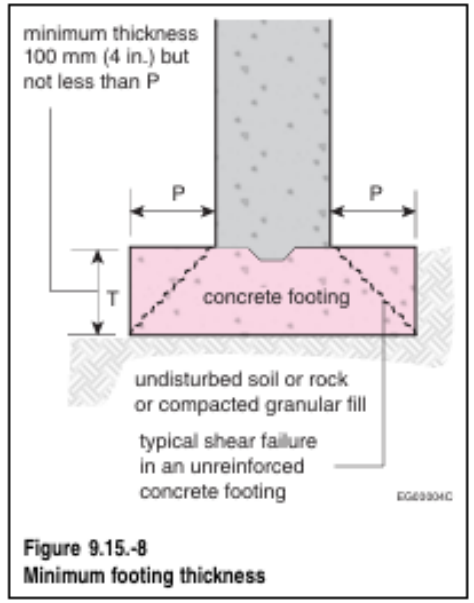


Figure 9.15.-8
Minimum footing thickness

Images from 2015 Illustrated guide

9.15.3.9. Step Footings

1) Where step footings are used,

a)The vertical rise between horizontal portions shall not exceed 600mm, and

b) the horizontal distance between risers hall not be less than 600mm.

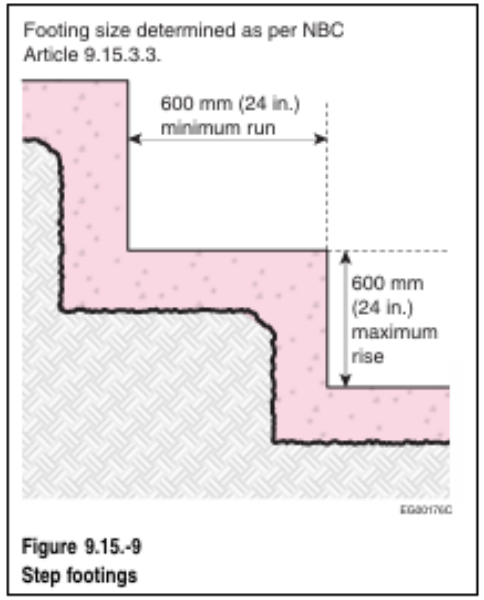
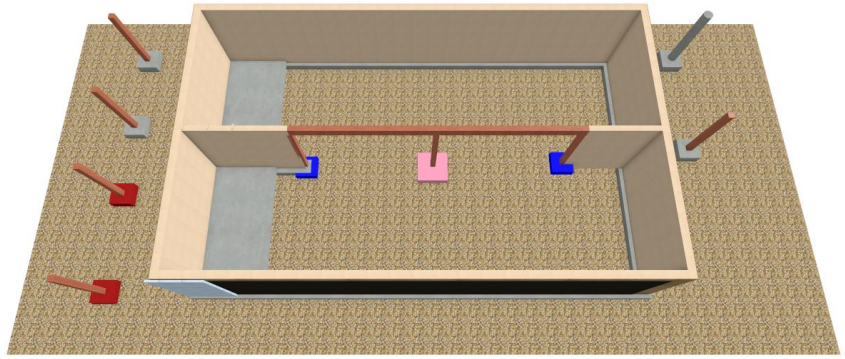
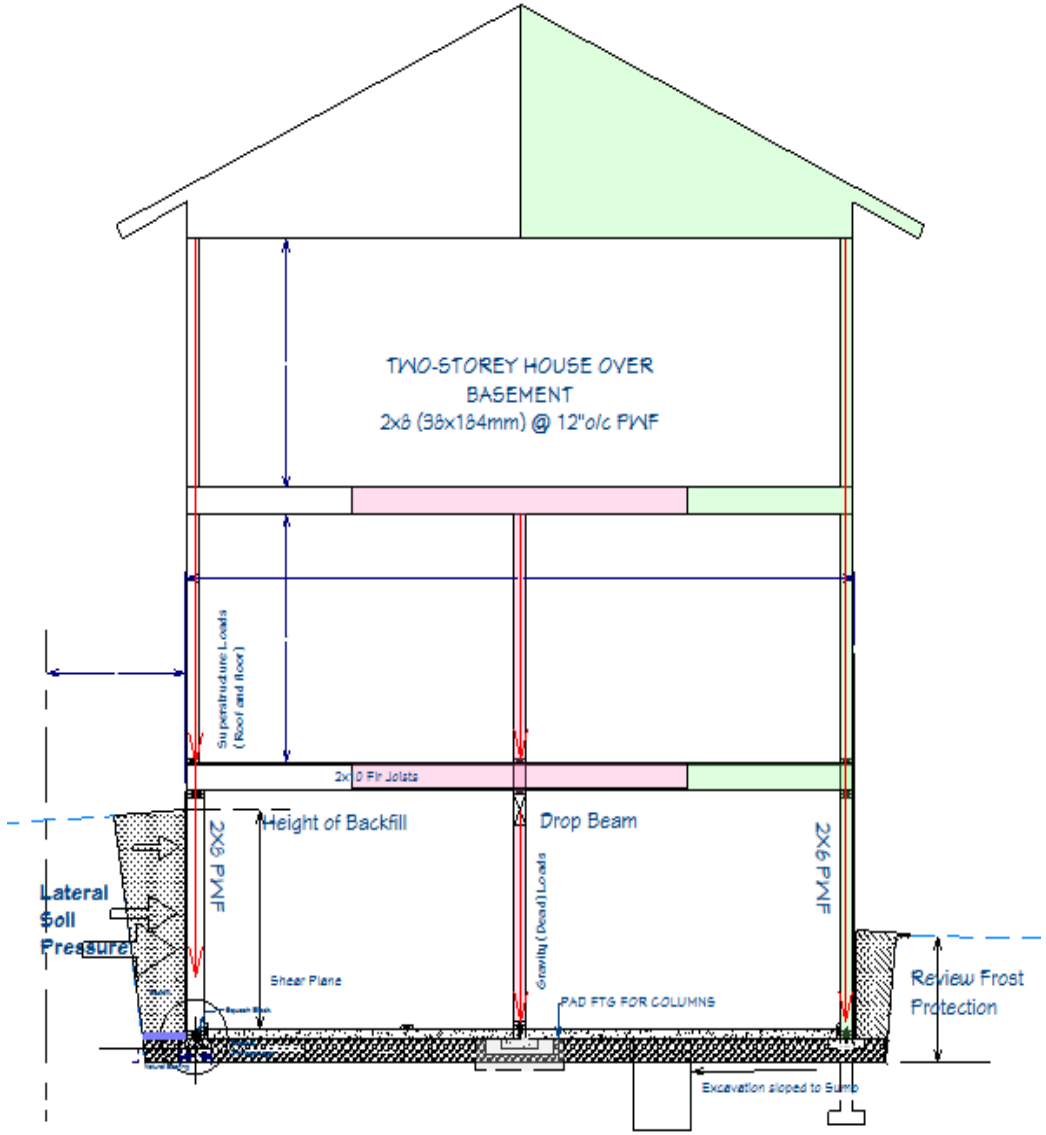


Figure 9.15.-9
Step footings

9.15.3. Footings Case Example

Two storey house over PWF basement
House 24ft w X 40ft L
Attic Trusses – mid bearing wall/beam support
Concrete bsmt slab & footings





9.15.3. Footings Case Example

Two storey house over PWF basement
House 24ft w X 40ft L
Attic Trusses
Concrete footings

Exterior Strip Footing
2 storeys = 350mm (14")

Interior Strip Footing
2 storeys = 350mm (14")

Ftg depth (unreinforced)
14" – 7.5" (2x8 wall) = 6.5
D = 6.5/2 = 4" minimum (100mm)

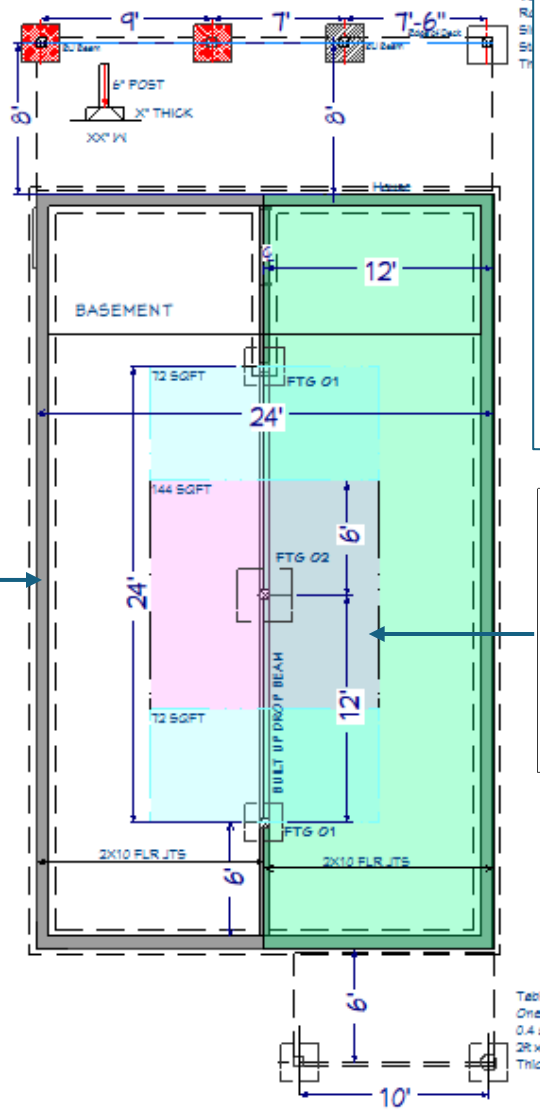
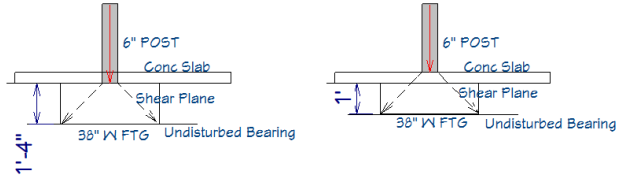


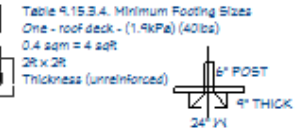
Table 9.15.3.4.
Minimum Footing Sizes
Forming Part of Sentence 9.15.3.4.(1)

No. of Floors Supported	Minimum Width of Strip Footings, mm		Minimum Footing Area for Columns Spaced 3 m o.c.,(1) m²
	Supporting Exterior Walls(2)	Supporting Interior Walls(3)	
1	250	200	0.4
2	350	350	0.75
3	450	500	1.0

Notes to Table 9.15.3.4.:
(1) See Sentence 9.15.3.7.(1).
(2) See Sentence 9.15.3.5.(1).
(3) See Sentence 9.15.3.6.(1).

Table 9.15.3.4. Minimum Footing Sizes
FTG 02 - Interior column spacing (12ft) 3.65m
Supporting 2 floors (2.4kPa) (50 psf = 40 Dead 10 Live)
9.15.3.7. Adjustment for Footing Area for Columns
Two Storeys supported
Table 9.15.3.4. = 0.75 sqm (8 sqft)
Spacing ratio adjustment
12ft/10ft x 0.75 = 0.9 sqm (9.7 sqft) round up 10 sqft (1,440 sq in)
38x38 Proposed Ftg = 1,444 sq in - OK
Depth = 16" or 12"





Prelim – Foundation Plan

9.15.3. Footings Case Example

Rear Deck – Single level (storey)

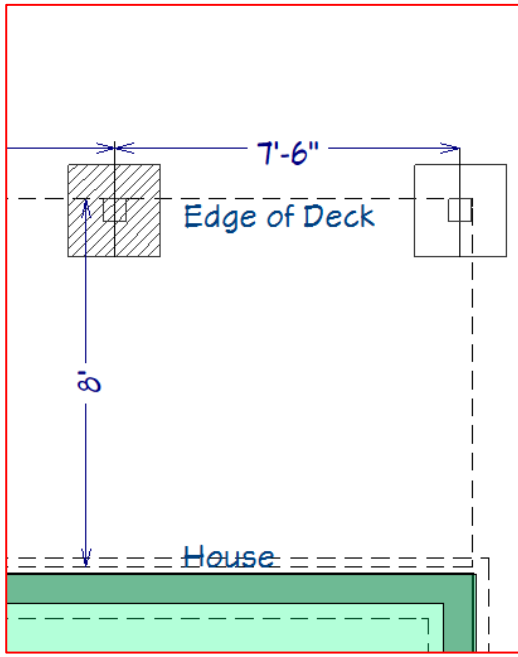
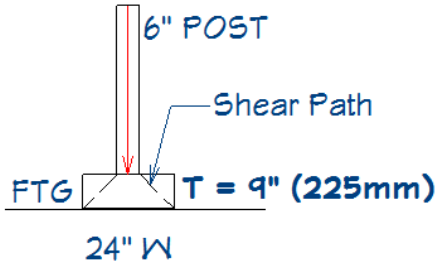
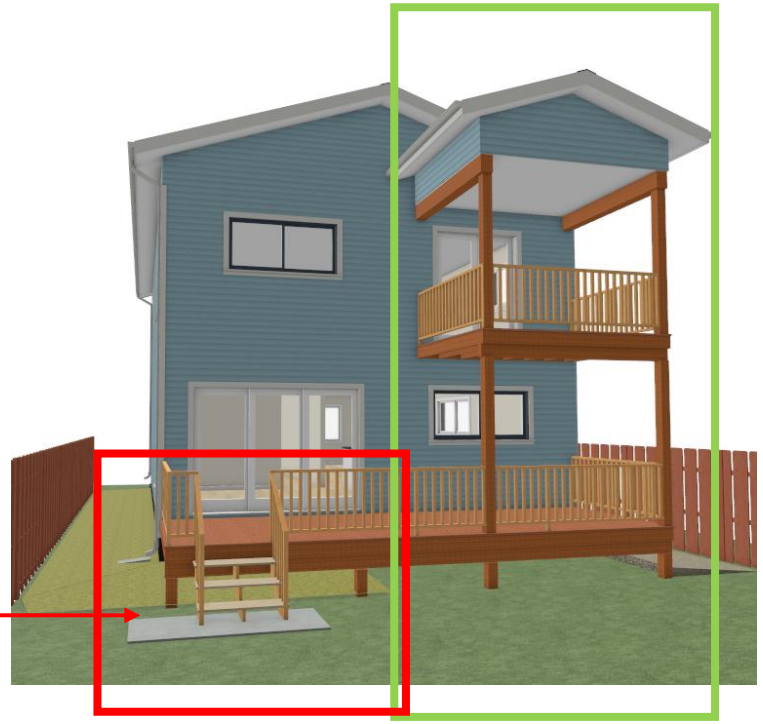


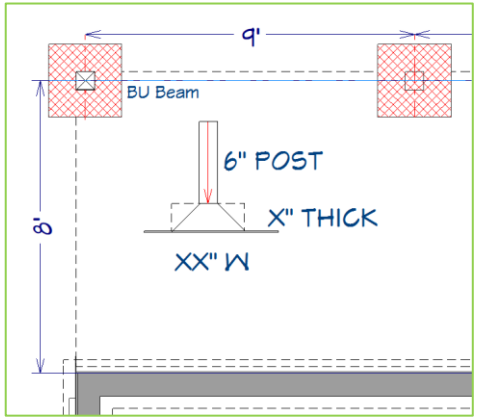
Table 9.15.3.4. Minimum Footing Sizes
Roof deck load - (1.9kPa) (40lbs)
Single storey = 0.4 sqm = 4 sqft (2ft x 2ft)
Standard spacing 3.0m (10') - Ok - 7'6" proposed
Thickness (unreinforced) = 9" (225mm)



24" w – 6" post = 18" / 2 = 9"Depth



How would you calculate the pad footing size for two decks and roof?



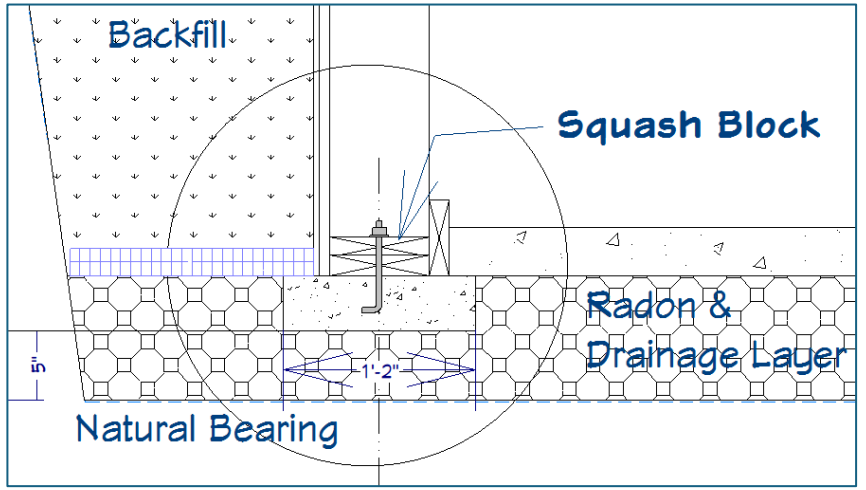
Anchor Bolts – PWF - lateral support

8.4 Concrete Footings (S406-16)

If holes are to be drilled through the bottom plate to accept anchor bolts or hold downs to connect exterior or interior loadbearing walls to concrete footings, then

a) The holes shall be slightly larger than the anchor bolt;
b) Two applications of preservative treatment shall be poured into the hole prior to placement of the washer and nut;
c) For anchor bolts, a squash block of the same cross-sectional dimensions as the bottom plate shall be nailed on top of the bottom plate with the anchor bolt passing through both. The bottom plate and the squash block, and a 50 mm (2 inch) washer shall be installed below the nut; and
d) Lateral resistance to inward soil pressure at the bottom of the exterior wall shall be provided in accordance with Clauses:

- 4.5.2.,
- 9.7.2,
- 9.8.1., and
- 9.8.2.



4.5.2

To resist inward pressures, exterior foundation walls shall be braced laterally by the floor system at the top of the wall, and at the bottom (see Figure A.1) by

a) a concrete slab floor;
b) a suspended wood floor;
c) a wood sleeper floor;
d) bracing in the case of a crawl space foundation, as specified in Clause 11.2; or
e) other construction methods, in accordance with Clause 4.2.

FLYWHEEL
BUILDING SOLUTIONS

Building Permit Inspections – New SFH

• BP Inspections

1) Siting and Foundation/Water and Sewer Service

This is a critical inspection to ensure all parties are aware of the permit conditions. It is important to update the Building Official of any proposed changes or questions related to the issued permit package.

Minimum on-site conditions and documents reviewed:

- **Permit card posted**
- **Issued permit package to be on site,**
- **Site safety (Part 8 BCBC) – no negative impact to neighbouring properties/city,**
- **Working in a protected area – water course/steep slope, etc.**
- Exposed Soils condition – may require Geotechnical review if not already involved,
- Geotechnical and/or structural engineer (if applicable) to provide applicable field review and testing reports before inspection,
- Cold weather provisions (when applicable),

Standard documents required:

- location certificate and main floor elevation
- field reviews for foundation and frost protection if engineered
- for sewer/water trench the declaration and geo confirmation for compaction is required
- for all rough in plumbing a test must be on when inspected per the bylaw and the NPC

FLYWHEEL BUILDING SOLUTIONS

Building Permit Inspections – New SFH

• BP Inspections

1) Siting and Foundation/Water and Sewer Service (cont'd)

- Stepped footings (lack of footing bearing support)
- Pad footing sizes
- Minimum frost protection or finished grade clearances (drop footings at below grade entrance)
- Visual Siting - Zoning setbacks
- Frost protection at the exterior door at the bottom of the stair well.
- Footing thickness shall not be less than the greater of 100m or the width of the projections of the footing beyond the supported element.

Plumbing

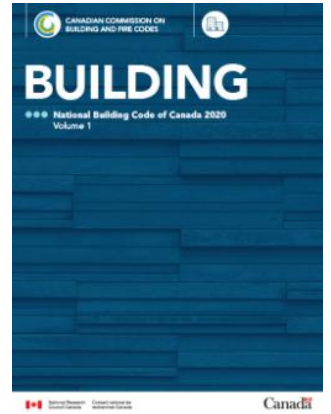
- Pipe size & material,
- Depth,
- Bedding material,
- test

Standard documents required:

- location certificate and main floor elevation
- field reviews for foundation and frost protection if engineered
- for sewer/water trench the declaration and geo confirmation for compaction is required
- for all rough in plumbing a test must be on when inspected per the bylaw and the NPC

FLYWHEEL BUILDING SOLUTIONS

9.15.4. Foundation Walls



9.15.4.1. Flat Wall Insulating Concrete Form Units

1)Flat wall insulating concrete form units shall conform to **CAN/ULC S717.1,"Standard for Flat Wall Insulating Concrete Form (ICF) Units–Material Properties."**

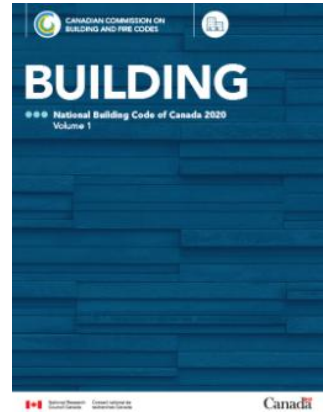
9.15.4.2. Foundation Wall Thickness and Required Lateral Support

1) Except as required in Sentence (2), the thickness of foundation walls made of unreinforced concrete block, concrete core in flat wall insulating concrete forms or solid concrete and subject to lateral earth pressure shall conform to Table 9.15.4.2.-A for walls not exceeding 3.0 min unsupported height.

2) The concrete core in flat insulating concrete form foundation walls shall be not less than the greater of a) 150mm,or b) the thickness of the concrete in the wall above.

FLYWHEEL BUILDING SOLUTIONS

9.15.4. Foundation Walls



9.15.4. Foundation Walls Considered to be Laterally Supported at the Bottom

A-Table 9.15.4.2.-A Flat Insulating Concrete Form Walls as Foundation Walls.

Article 9.15.4.2. allows insulating concrete forms (ICFs) to be used to form **both laterally supported and laterally unsupported flat**, plain (unreinforced) concrete foundation walls intended to support wood-frame walls, floors and roofs under the conditions stipulated in Table 9.15.4.2.-A. Where the limits stated in the Table are exceeded, or where the ICF foundation wall is intended to support one or two storeys of concrete walls formed with flat wall ICFs above ground, Article 9.15.4.5. applies.

FLYWHEEL BUILDING SOLUTIONS

9.15.4. Foundation Walls

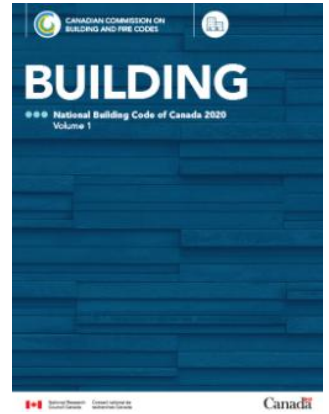


Table 9.15.4.2.-A
Thickness of Solid Concrete, Concrete Core in Flat Wall Insulating Concrete Form and Unreinforced Concrete Block Foundation Walls
Forming Part of Sentence 9.15.4.2.(1)

Type of *Foundation* Wall	Minimum Thickness of Concrete or Concrete Block, mm	Maximum Height of Finished Ground Above *Basement* Floor or Crawl Space Ground Cover, m			
		Height of *Foundation* Wall Laterally Unsupported at the Top[1][2]	Height of *Foundation* Wall Laterally Supported at the Top[1][2]		
		≤ 3.0 m	≤ 2.5 m	> 2.5 m and ≤ 2.75 m	> 2.75 m and ≤ 3.0 m
Solid concrete and concrete core in flat wall insulating concrete forms,[3] 15 MPa min. strength	150	0.8	1.5	1.5	1.4
	200	1.2	2.15	2.15	2.1
	250	1.4	2.3	2.6	2.5
	300	1.5	2.3	2.6	2.85
Solid concrete and concrete core in flat wall insulating concrete forms,[3] 20 MPa min. strength	150	0.8	1.8	1.6	1.6
	200	1.2	2.3	2.3	2.2
	250	1.4	2.3	2.6	2.85
	300	1.5	2.3	2.6	2.85
Unreinforced concrete block	140	0.6	0.8	—	—
	190	0.9	1.2	[4]	[4]
	240	1.2	1.8	[4]	[4]
	290	1.4	2.2	—	—

Notes to Table 9.15.4.2.-A:
(1) See Article 9.15.4.3.
(2) See Article 9.15.4.6.
(3) See Note A-Table 9.15.4.2.-A.
(4) See Table 9.15.4.2.-B.

FLYWHEEL BUILDING SOLUTIONS

9.15.4. Foundation Walls

9.15.4.3. Foundation Walls Considered to be Laterally Supported at the Top

(5) Flat insulating concrete form foundation walls shall be considered to be laterally supported at the top if the floor joists are installed according to Article 9.20.17.5.

9.20.17.5.(4) Floor joists and building frames supported on the top of flat insulating concrete form walls shall be anchored in conformance with Article 9.23.6.1.

9.23.2.1. Anchorage of Building Frames

2) Except as provided in Sentences (3) to (6), anchorage shall be provided by

a) embedding the ends of the first floor joists in concrete, or

b) fastening the sill plate to the foundation with not less than 12.7 mm diam. anchor bolts spaced not more than 2.4 m o.c.

5) **Anchor bolts** referred to in Sentences (2) to (4) shall be

a) fastened to the sill plate with nuts and washers,

b) embedded not less than 100 mm in the foundation, and

c) so designed that they may be tightened without withdrawing them from the foundation.

FLYWHEEL BUILDING SOLUTIONS

9.15.4. Foundation Walls

9.15.4.4. Foundation Walls Considered to be Laterally Supported at the Bottom

1) Flat insulating concrete form foundation walls shall be considered to be laterally supported at the bottom where the foundation wall

a) supports backfill not more than 1.2 m in height,

b) is supported at the footing by a shear key and at the top by the ground floor framing, or

c) is doweled to the footing with not less than

i) 15M bars spaced not more than 1.2 m o.c., or

ii) 10M bars spaced not more than 600 mm o.c.

(b) there appears to be no size for a shear key – perhaps a beveled 2x4?

(c) There appears to be no minimum length for dowels

FLYWHEEL BUILDING SOLUTIONS

9.15.4. Foundation Walls

9.15.4.5. Reinforcement for Flat Insulating Concrete Form Foundation Walls

1) Horizontal reinforcement in flat insulating concrete form foundation walls shall

a) consist of

i) one 10M bar placed not more than 300 mm from the top of the wall, and

ii) 10M bars at 600 mm o.c., and

b) be located

i) in the inside half of the wall section, and

ii) with a minimum cover of 30mm from the inside face of the concrete.

2) Vertical reinforcement in flat insulating concrete form foundation walls shall be

a) provided in accordance with

i) Table 9.15.4.5.-A for 150 mm walls,

ii) Table 9.15.4.5.-B for 190 mm walls, and

iii) Table 9.15.4.5.-C for 240 mm walls,

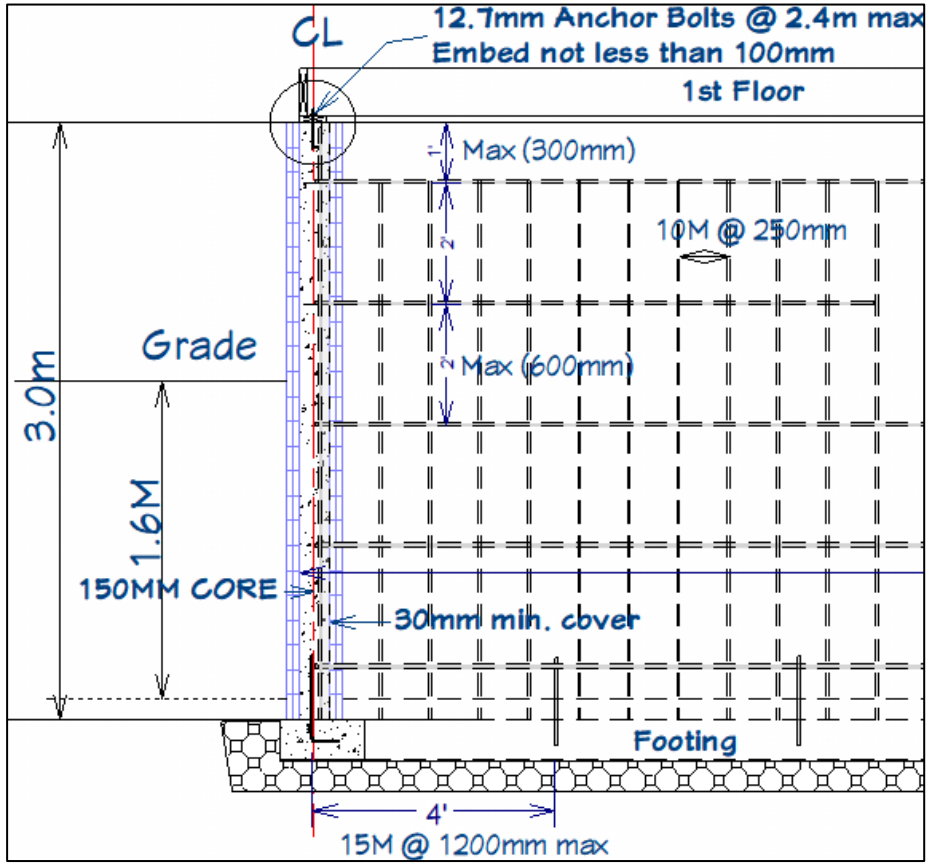


Table 9.15.4.5.-A & B

Table 9.15.4.5.-A
Vertical Reinforcement for 150 mm Flat Insulating Concrete Form Foundation Walls
Forming Part of Sentence 9.15.4.5.(2)

Max. Height of Finished Ground Above Finished *Basement* Floor, m	Minimum Vertical Reinforcement		
	Maximum Unsupported *Basement* Wall Height		
	2.44 m	2.75 m	3.0 m
1.35	10M at 400 mm o.c.	10M at 400 mm o.c.	10M at 400 mm o.c.
1.6	10M at 400 mm o.c.	10M at 380 mm o.c.	10M at 380 mm o.c.
2	10M at 380 mm o.c.	10M at 380 mm o.c.	10M at 380 mm o.c.
2.2	10M at 250 mm o.c.	10M at 250 mm o.c.	10M at 250 mm o.c.
2.35	n/a	10M at 250 mm o.c.	10M at 250 mm o.c.
2.6	n/a	10M at 250 mm o.c.	10M at 250 mm o.c.
3	n/a	n/a	15M at 250 mm o.c.

Table 9.15.4.5.-B
Vertical Reinforcement for 190 mm Flat Insulating Concrete Form Foundation Walls
Forming Part of Sentence 9.15.4.5.(2)

Max. Height of Finished Ground Above Finished *Basement* Floor, m	Minimum Vertical Reinforcement		
	Maximum Unsupported *Basement* Wall Height		
	2.44 m	2.75 m	3.0 m
2.2	None required	10M at 400 mm o.c.	10M at 400 mm o.c.
2.35	n/a	10M at 300 mm o.c.	10M at 300 mm o.c.
2.6	n/a	10M at 300 mm o.c.	15M at 400 mm o.c.
3.0	n/a	n/a	15M at 400 mm o.c.

FLYWHEEL BUILDING SOLUTIONS

9.15.4. Foundation Walls

9.15.4.5. Reinforcement for Flat Insulating Concrete Form Foundation Walls

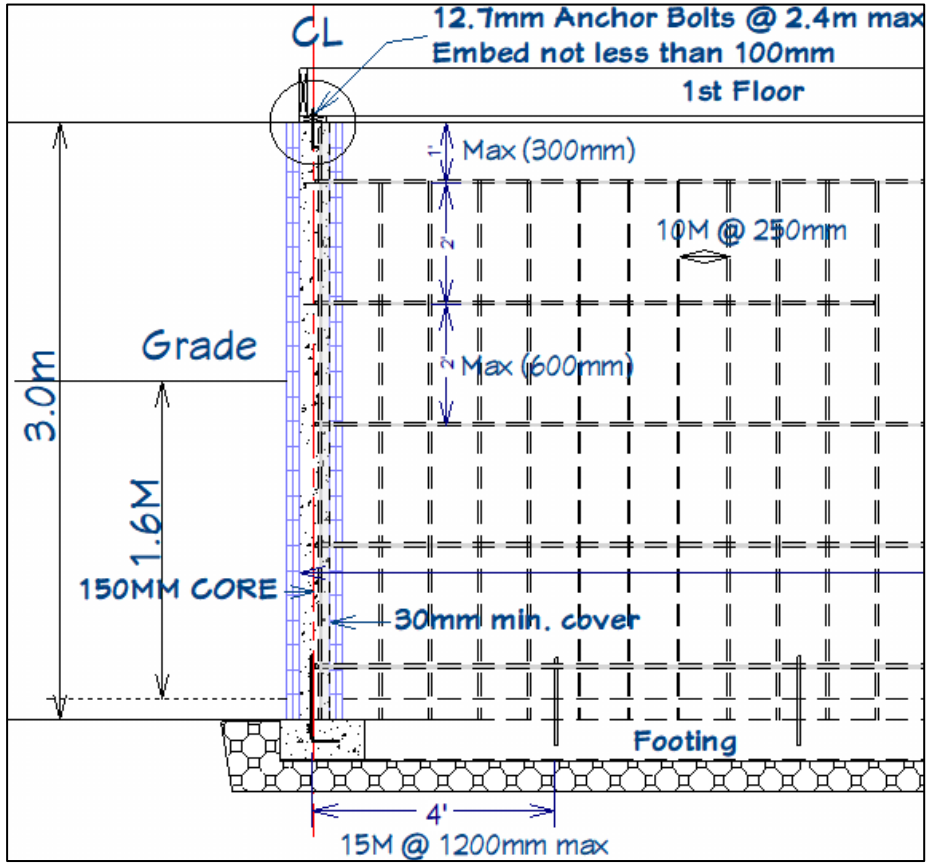
2) b) located in the inside half of the wall section with a minimum cover of 30 mm from the inside face of the concrete wall, and

c) where interrupted by wall openings, placed not more than 600 mm from each side of the openings.

3) Cold joints in flat insulating concrete form foundation walls shall be reinforced with no less than one 15M bar spaced at not more than 600 mm o.c. and embedded 300mm on both sides of the joint.

(In between pours)

4) Reinforcing around openings in flat insulating concrete form foundation walls shall comply with **Article 9.20.17.3. or 9.20.17.4.**



9.15.4. Foundation Walls

9.20.17.3. Openings in Non-Loadbearing Flat Insulating Concrete Form Walls

1) No openings shall occur **within 1 200 mm of interior and exterior corners** of exterior non-loadbearing flat insulating concrete form walls.

2) **Portions of walls above openings in non-loadbearing flat insulating concrete form walls shall have a minimum depth of concrete of no less than 200 mm across the width of the opening**.

3) Openings that are **more than 600 mm but not more than 3 000 mm** in width in non-loadbearing flat insulating concrete form walls shall be reinforced at the top and bottom with one 10M bar.

4) Openings **more than 3 000** mm in width in non-loadbearing flat insulating concrete form walls shall be reinforced on all four sides with two 10M bars.

5) Reinforcing bars described in Sentences (3) and (4) shall extend 600 mm beyond the edges of the opening.

6) The cumulative width of openings in non-loadbearing flat insulating concrete form walls shall not make up more than 70% of the length of any wall.

9.15.4. Foundation Walls

9.20.17.4. Openings in Loadbearing Flat Insulating Concrete Form Walls

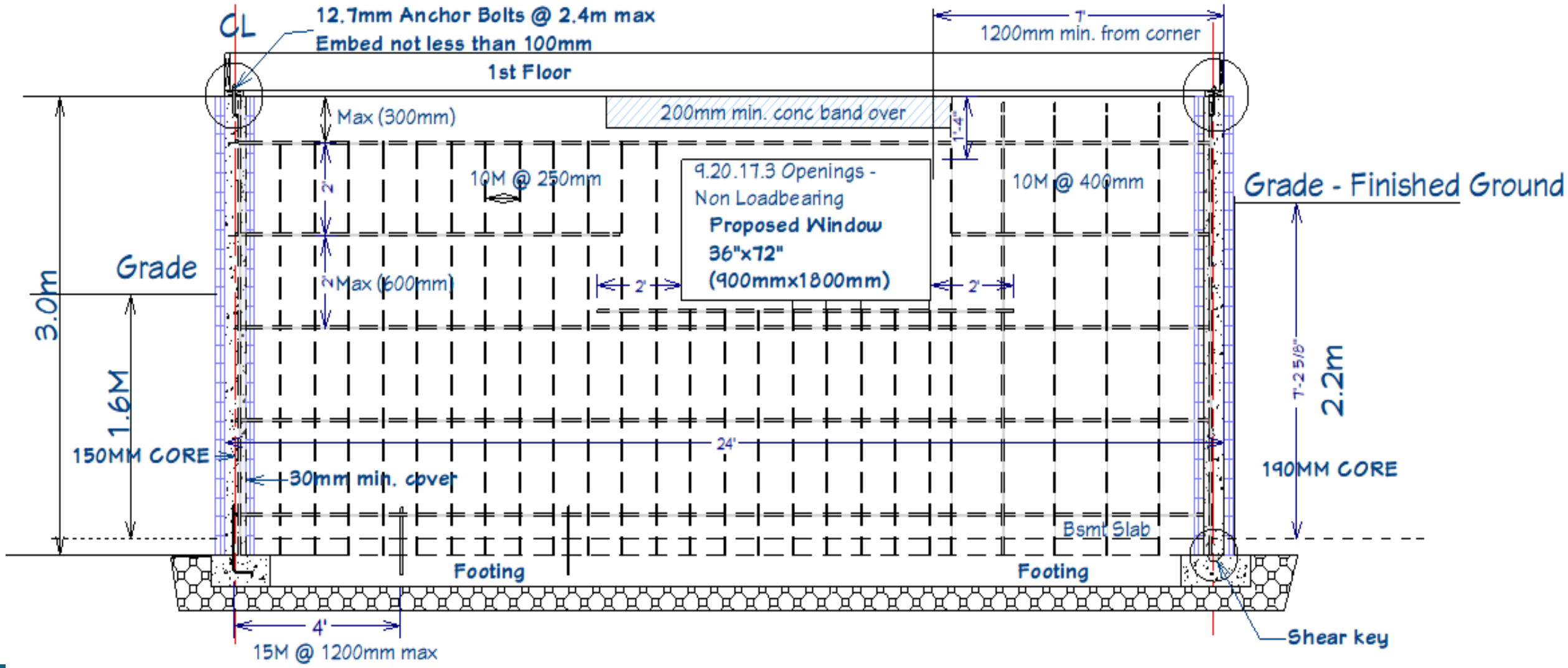
1) No openings shall occur within 1 200 mm of interior and exterior corners of exterior loadbearing flat insulating concrete form walls.

2) In loadbearing flat insulating concrete form walls, lintels shall be provided over all openings wider than 900 mm.

3) Lintels described in Sentence (2) shall be constructed in accordance with Span Table 9.20.17.4.-A, 9.20.17.4.-B or 9.20.17.4.-C.

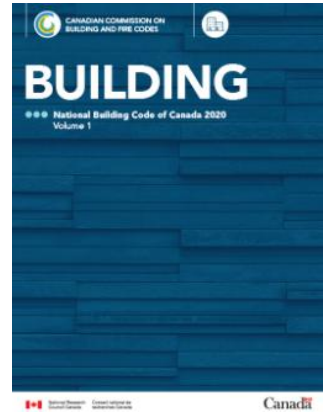
4) Lintels described in Sentence (2) over openings wider than 1 200 mm shall be reinforced for shear with 10M stirrups at a maximum spacing of half the distance from the bottom reinforcing bar to the top of the lintel.

9.15.4. Foundation Walls



Foundation Types

Permanent Wood Foundations (PWF) – Session 03



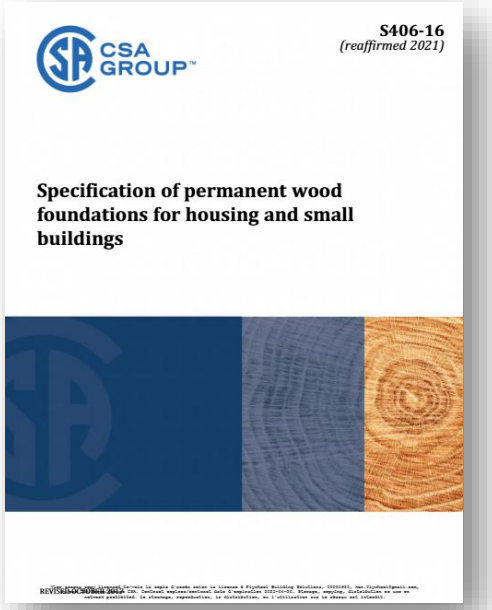
9.15.2.4. Wood-Frame Foundations

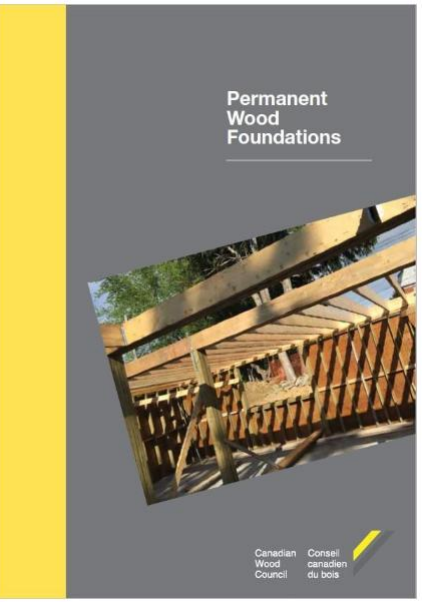
1) Foundations of wood-frame construction shall conform to
a) CSA S406, “Specification of permanent wood foundations for housing and small buildings,” or
b) Part 4.
(See Note A-9.15.2.4.(1).)

9.16.5.1. Wood

Wood-Frame Floors

1) Floors-on-ground constructed of wood shall conform to CSA S406, “Specification of permanent wood foundations for housing and small buildings.”





CSA S406 Permanent Wood Foundations - The Canadian Wood Council - CWC

CSA	S406-16	Specification of permanent wood foundations for housing and small buildings	9.15.2.4.(1) 9.16.5.1.(1) A-9.15.2.4.(1)

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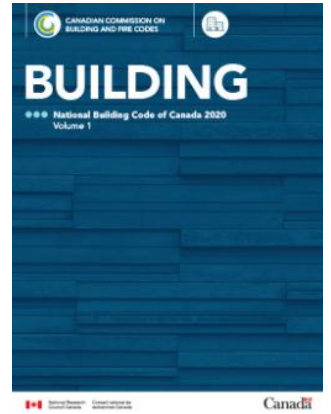
Foundation Types

Permanent Wood Foundations (PWF)



A-9.15.2.4.(1) Preserved Wood Foundations – Design Assumptions. Tabular data and figures in CSA S406, "Specification of permanent wood foundations for housing and small buildings," are based upon the general principles provided in CSA O86, "Engineering design in wood," with the following assumptions:

- soil bearing capacity: 75 kPa or more,
- clear spans for floors: 5 000 mm or less,
- floor loadings: 1.9 kPa for first floor and suspended floor, and 1.4 kPa for second storey floor,
- foundation wall heights: 2 400 mm for slab floor, 3 000 mm for suspended wood floor,
- top of granular layer to top of suspended wood floor: 600 mm,
- lateral load from soil pressure: equivalent to fluid pressure of 4.7 kPa per metre of depth,
- ground snow load: 3 kPa,
- basic snow load coefficient: 0.6,
- roof loads are carried to the exterior wall,
- dead loads:

roof	0.50 kPa
floor	0.47 kPa
wall (with siding)	0.32 kPa
wall (with masonry veneer)	1.94 kPa
foundation wall	0.27 kPa
partitions	0.20 kPa

- Table 9.4.4.1. Allowable Bearing Pressure for Soil or Rock
- 5.0m =
- Standard loads – 1.9kPa & 1.4kPa
- Fdn wall – 2.4m (ft), 3.0m (ft)
-

CSA	S406-16	Specification of permanent wood foundations for housing and small buildings	9.15.2.4.(1) 9.16.5.1.(1) A-9.15.2.4.(1)

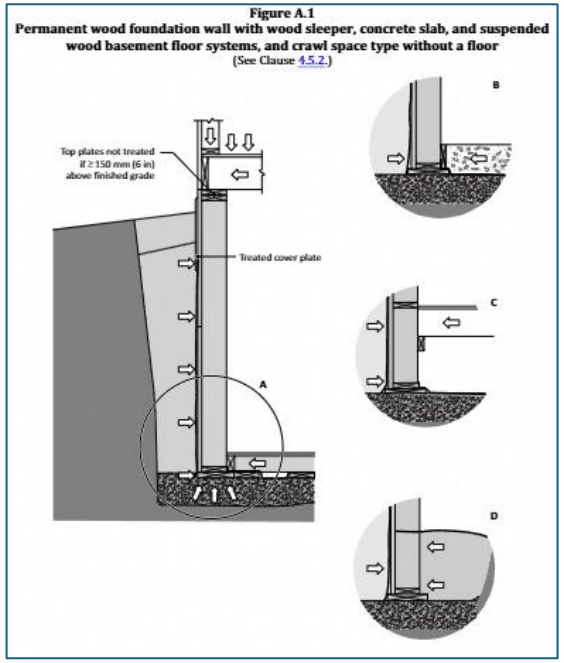
Foundation Types

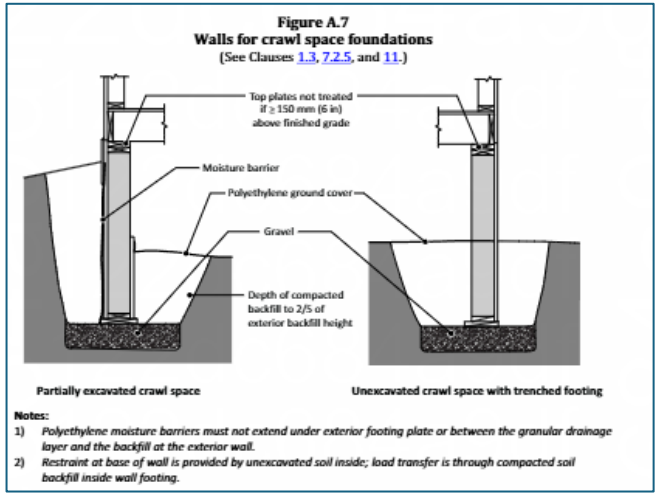
Permanent Wood Foundations (PWF) – CSA S406-16

Scope

1.2 buildings up to three storeys in building height above the foundation and having a building area not exceeding 600 sqm.

1.3. This standard provides for the optional use of wood sleeper, poured concrete slab, and suspended wood basement floor systems as components of the permanent wood foundation, and for the use of permanent wood foundations enclosing crawl spaces (see Figures A.1 and A.7)





Permanent Wood Foundations

Benefits of PWF

- Cold weather application
- Trade centric – framing
- Lower cost over concrete

Challenges

- Backfilling – specific materials
- Framing – Part 9 (ledgers)
- Wall height limitations (w/out Eng)

5.11 Backfill

Native soils as permeable as the granular drainage material specified in Clause 5.10.1 may be used as backfill material when the backfill must be drained. All backfill material placed within 600 mm (24 in) of the foundation walls shall be free of deleterious debris, frozen clumps, and boulders larger than 150 mm (6 in) in diameter.

Note: *See also Clause 16.*

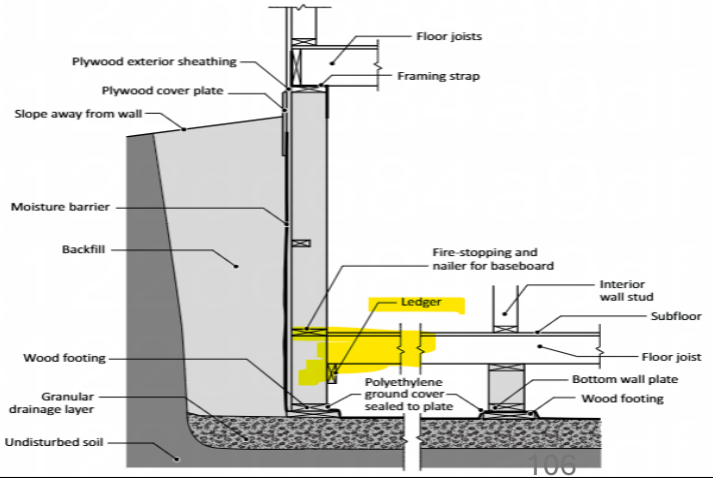
16.6 Problem soils

The backfill and drainage system shall be designed by a qualified engineer when the foundation is to be installed in a soil having a high volume change potential or where soils susceptible to frost heave are present around unheated portions of foundation walls.

16.7 Site grading

Backfill shall be placed such that the final grade after the fill settles shall fall away from the walls at a minimum slope of 1 in 12 (see Figure A.4).

Figure A.17
Exterior foundation wall and interior loadbearing foundation wall with suspended wood floor
(See Clauses 10.1, 10.6, and 13.7.2.)



Foundation Types - ICF

9.15.4 Flat Insulating Concrete Form Units

Benefits of ICF

- Section 9.12.3.3 (3) allows frost susceptible backfill against concrete and ICF walls,
- Higher Foundation walls
- Prescriptive Installation - rebar
- Ledger attachments
- Thermal ratings and air tightness
- Cold weather applications

Challenges

- Supply?
- Training
- Reinforcing, Foam, Concrete
  - high carbon footprint
- Some cases of interior mold growth

9.15.4. Foundation Walls

9.15.4.1. Flat Wall Insulating Concrete Form Units

1) Flat wall insulating concrete form units shall conform to CAN/ULC-S717.1, "Standard for Flat Wall Insulating Concrete Form (ICF) Units – Material Properties."

9.15.4.2. Foundation Wall Thickness and Required Lateral Support

1) Except as required in Sentence (2), the thickness of *foundation* walls made of unreinforced concrete block, concrete core in flat wall insulating concrete forms or solid concrete and subject to lateral earth pressure shall conform to Table 9.15.4.2.-A for walls not exceeding 3.0 m in unsupported height.

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Building Permit Inspections – New SFH

2) Foundation and Damp-proofing/Plumbing Rough-in Under Slab

Minimum on-site conditions and documents reviewed:

- Previous deficiencies to be corrected
- Permit package on site
- Wood foundation (if applicable) shall comply with CSA-S406 "Specification of permanent wood foundations for housing and small buildings" or Part 4 (Engineering) including but not limited to lateral restraint requirements in compliance with S406-16 clause 4.5.2 and inside corner reinforcement in compliance with S406-16 clause 4.5.6
- ICF and Rebar installation
- Dampproofing appropriate for use (PWF, ICF, etc)
- Radon control
- Confirmation of back-fill material to be used.

Typical deficiencies to avoid:

- plumbing tests to be in place to be verified by Building Official
- galvanized fasteners for PWF and treat all cut/drilled areas
- no notching or drilling of pwf
- underslab insul and poly in the right order (poly in top)

NOTE – this is a benchmark inspection – all previous deficiencies, required documents and updated drawings (when applicable) are required prior to continuing (backfilling). Failure to ensure all outstanding items are provided may result in a Stop Work posting.

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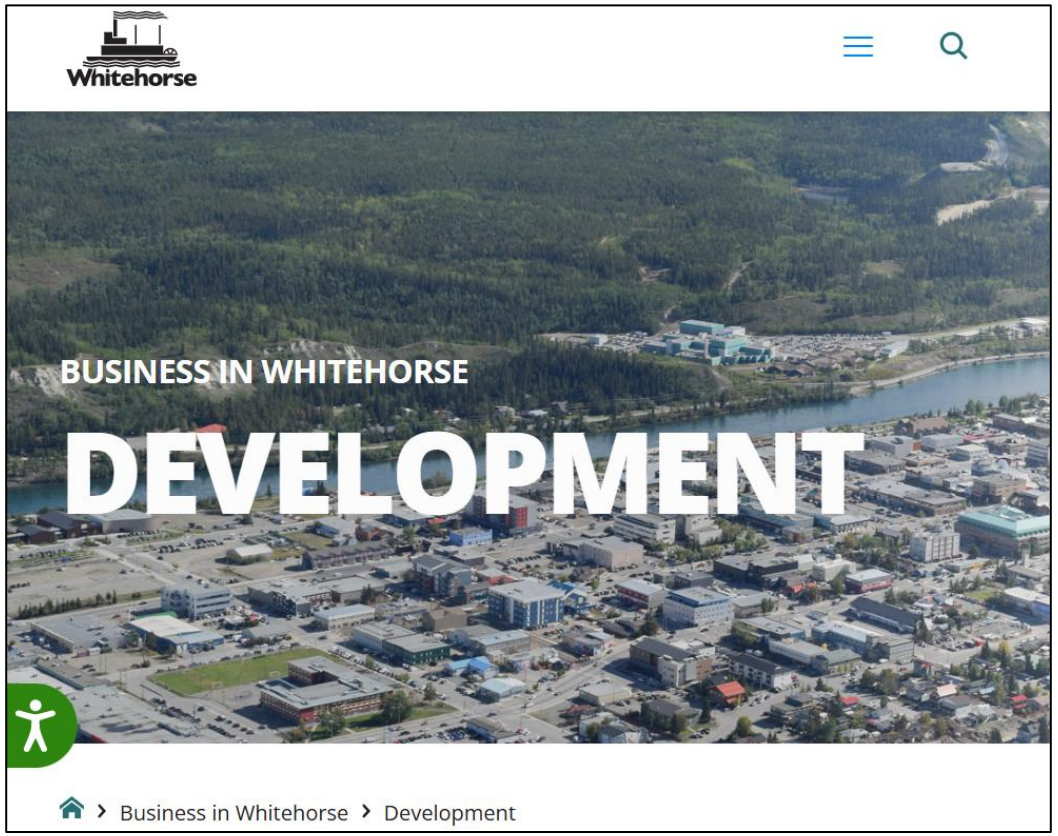
When in doubt – reach out

Development - City of Whitehorse



Land And Building Services

Land and Building Services: 867-668-8346, 867-668-8340, or 867-668-8330
Land Services including subdivisions and lot sales: land@whitehorse.ca
Business Licenses: adminbuilding@whitehorse.ca
Building Inspections: inquirybuilding@whitehorse.ca
Development Permits, Zoning Inquiries: development@whitehorse.ca

Duke, Peter

Manager, Land and Building Services
peter.duke@whitehorse.ca

Gau, Mike

Director, Development Services
mike.gau@whitehorse.ca

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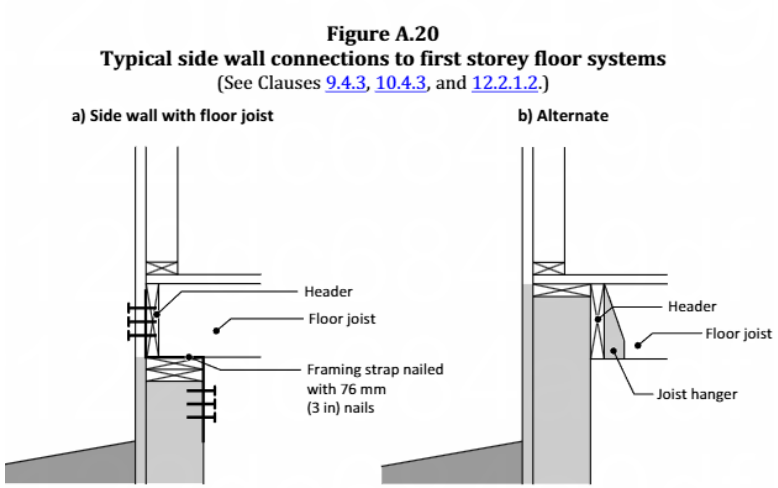
BUILDING SOLUTIONS

Next Session – February 12 – 9am

Framing including PWF S406-16

Please forward any questions or comments to Ken at ken.flywheel@gmail.com



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