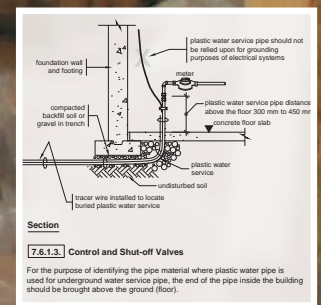
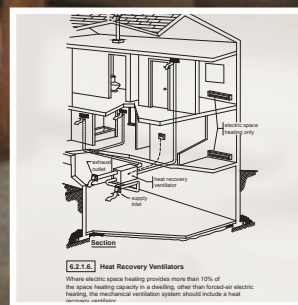
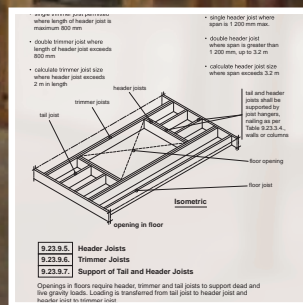
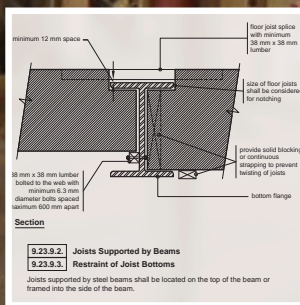


ILLUSTRATED CODE SERIES

HOUSING CONSTRUCTION

BASED ON THE ONTARIO BUILDING CODE 2012, O. REG. 332/12



Anthony Boyko
Steven Penna

Paperless
by **ORDERLINE**

Endorsed by



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PREFACE

GUIDE FOR USERS

Thank you for purchasing *Housing Construction*, your resource for constructing a Building Code-compliant house or dwelling. The scope of the guide is limited to detached, semi-detached homes and townhouses without shared exiting where there is no dwelling unit above another.

This guide provides interpretation and explanation for the requirements of the Ontario Building Code 2012 (Code) with respect to the construction of a house. Illustrations or diagrams are used to provide a further explanation of each Article. The flow chart on the following this section will assist the user on how best to utilize this guide.

Housing Construction is organized into chapters which reflect the common industry stages of construction and the prescribed or mandatory inspections as required by the Code. Everyone involved in the residential housing industry can use this guide to gain a better understanding of how the relevant Articles in Part 9 of the Code influence the construction of a house. It is intended to act as a resource and training manual for:

- Contractors, builders and site superintendents
- Construction trades
- Designers
- Municipal building inspectors
- Home inspectors
- Home owners
- Technology students
- Other industry stakeholders

The Building Code Act, 1992 (Act) and the Ontario Building Code 2012 establish qualification and registration requirements for building practitioners. These practitioners include building officials, certain classes of designers, staff from Registered Code Agencies (RCAs), and on-site sewage installers. Each type of building practitioner has unique qualifications and requirements, including the successful completion of the Ministry of Municipal Affairs and Housing Examination Program. *Housing Construction* can be used as a reference document to help prepare the reader for the Ministry of Municipal Affairs and Housing 2006 qualification exam.

Legislation

The content of this guide is not meant to form a code of mandatory requirements. The mandatory language (“shall”) that is used in the Code has not been used here. Care has been taken to ensure that the intent of the Code requirements is clear to the users of the guide. However, users of the guide must not under any circumstances rely on the guide to determine the current requirements of the Code.

As always, reference must be made to the Code official volumes and any amendments. Orderline and the authors do not assume responsibility for any errors or omissions resulting from the information contained in this guide.

BUILDING INSPECTION SERVICE LEVELS

LEGISLATION

The authority for enforcement of the Act and the Code in Ontario is delegated by the Province through the Minister of Municipal Affairs and Housing under Section 3(1) of the Act to municipal councils: “Council of each municipality is responsible for the enforcement of this Act in the municipality.” The Act does not provide a blueprint on how this enforcement is to be carried out. However, municipalities are obliged to “appoint a chief building official and such inspectors as are necessary for the purposes of enforcement of the Act in the areas in which the municipality has jurisdiction.” The Act does not provide any guidance on how many building officials should be appointed to enforce the Code, nor does it provide an option for chief building officials to decide which provisions of the Code should be within their service level of enforcement.

EXPECTATIONS – PUBLIC AND INSURANCE

Members of the public are becoming increasingly knowledgeable about their rights as citizens and the duty of care their government owes them. They expect the municipality, through their chief building official, to discover contraventions of the Act or Code. This obligation is described within the common law principle of a “Duty of Care.” When a municipality does not exercise its duty of care to all whom it is reasonably foreseeable might be injured, there may be cause for an action of negligence and a liability to pay damages or compensation to an aggrieved party. This duty of care would apply to owners/builders, contractors, subsequent owners or occupiers, neighbours and all entrants to the premises, such as public or workplace buildings.

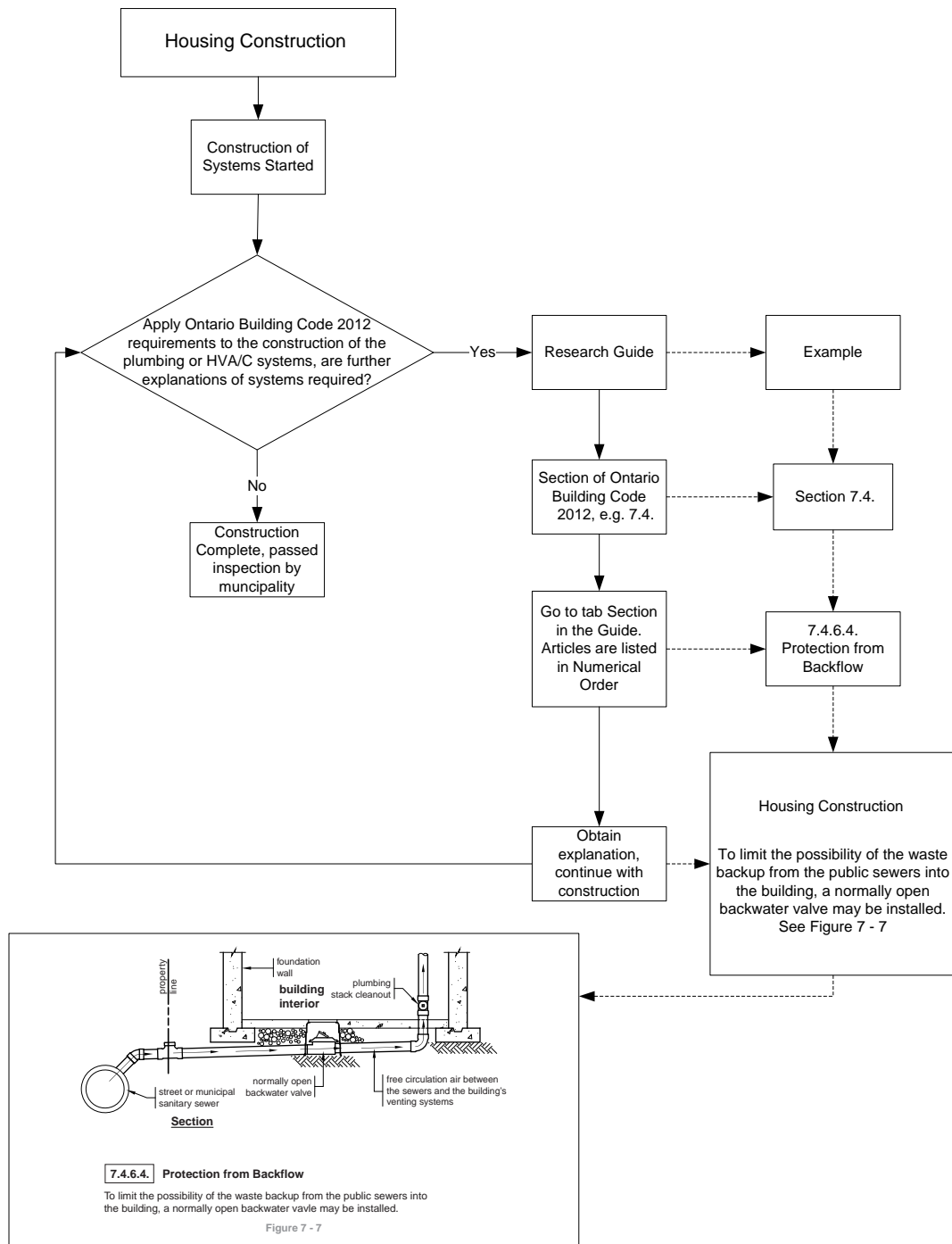
Building inspections are a potentially significant source of liability for municipalities. More and more claims are being advanced in which negligent inspection is alleged. It is therefore important for municipalities to ensure detailed inspection records are maintained and kept and that they exercise the powers accorded under the Code and Act, where appropriate, to ensure compliance.⁽¹⁾

CODE SERVICE LEVEL AND THIS GUIDE

Chief building officials are tasked with creating policies and procedures for the consistent application of the Code requirements in a professional manner, in other words, establishing a level of service or service level. Central to the level of service is the capability of staff to perform the service. Building officials require training and the resources to effectively perform their duties. Housing Construction offers both training and resources to help building officials establish and maintain appropriate service levels. This guide provides a level of service: it identifies the necessary components of dwellings that should be reviewed at the prescribed (mandatory) stages of inspection, allowing inspection staff to apply the requirements of the Code to the construction of the dwelling.

(1) The Risk Reporter, Issue 04 February 2012, Giffen LLP Lawyers, www.giffenlawyers.com

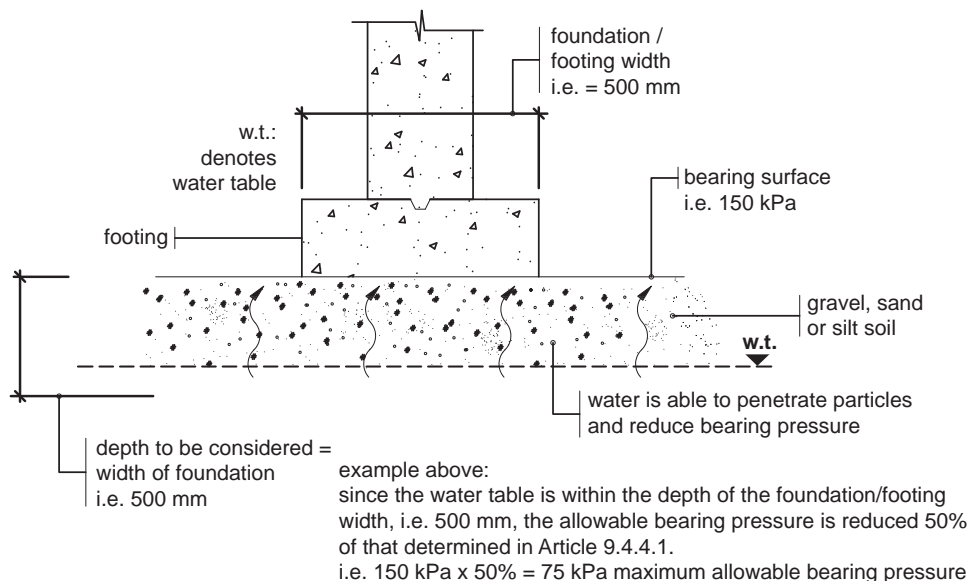
Flow Chart on the Use of Housing Construction



9.4.4.3.

9.4.4.3. HIGH WATER TABLE

Water table is the height of the natural ground water in a soil. The water table is at its highest in the spring. When the water table is encountered within the width of the footings the allowable bearing pressure is to be reduced by 50% from that in Table 9.4.4.1. For example if the maximum allowable bearing pressure of a soil is 150 kPa and the designed footing width is 350 mm and the height of the water table is less than 350 mm to the underside of the footings then the allowable bearing pressure of the soil must be reduced to 75 kPa. See Figure 2 – 2



9.4.4.3. High Water Table

A high water table can reduce the soil's ability to carry loads. Where a foundation bears on gravel, sand or silt, and the water table is within a distance below the bearing surface equal to the width of the foundation, the allowable bearing pressure should be 50% of that determined in Article 9.4.4.1.

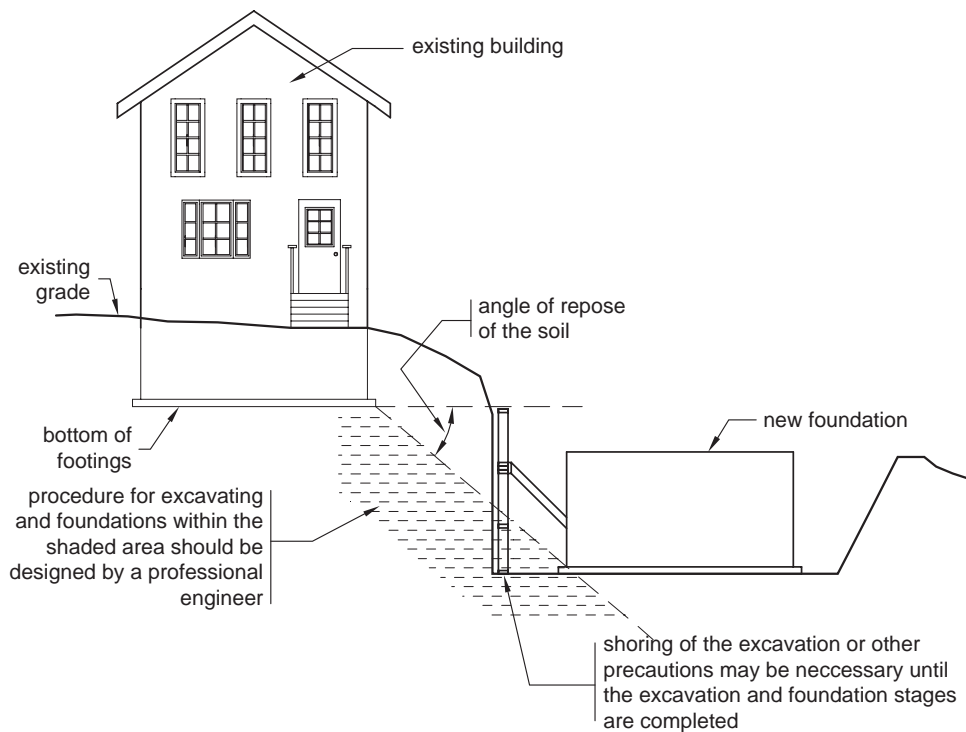
Figure 2 – 2

This is why it is important for the builder/contractor to determine where the high water table is on a property before constructing the footings. If during the excavation for house ground water is encountered at the footing level the builder/contractor should consult with the designer and building inspector prior to proceeding.

9.4.4.4. SOIL MOVEMENT

Soil movement can occur in certain types of soils when there are changes in the temperature or moisture content of the soil causing significant expansion and contraction, damaging footings, foundations and slabs on grade.

9.12.2.1.



Elevation

1.2.1.1. Division C, Part 1 - Design by Architect or Professional Engineer

Where the angle of repose of the soil is critical or where the existing footing of an adjacent building are within the angle of repose of the soil, the foundations and the procedures for excavation should be designed and reviewed during construction by a professional engineer.

Figure 3 – 7

Design specifications should provide that excavations for foundations should extend to undisturbed soil. Builders should assure themselves that the allowable bearing pressure of the soil is not exceeded by the specified loads from the building or structure. Exceeding the allowable bearing pressure can result in soil shear failure or excessive settlement. As a rule-of-thumb, soil bearing capacity typically ranges from 48 kPa (1 000 lb./ft.²) for relatively weak soils to over 478 kPa (10 000 lb./ft.²) for bedrock. Frequently, designs are initially prepared on a presumed bearing capacity. It is then the builder's responsibility to verify actual site conditions. The actual soil bearing capacity should be determined.

A builder may employ the services of an engineering firm as one method of confirming the maximum allowable bearing pressure of the soil to be constructed on.

9.14.4.2.

9.14.4.2. INSTALLATION

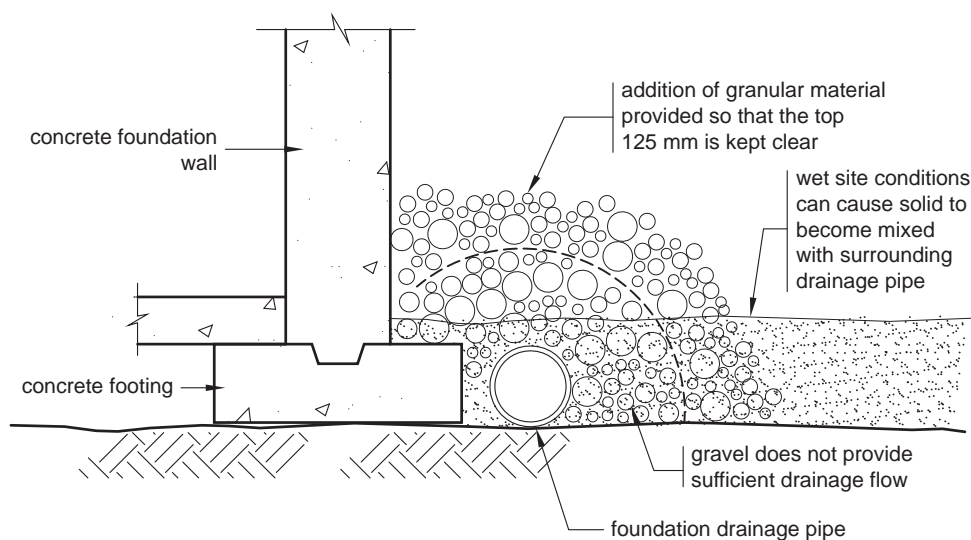
The depth of the granular material impacts the drainage flow capacity of the water. A minimum of 125 mm depth of granular material should be laid on undisturbed or compacted soil and extend not less than 300 mm beyond the outside edge of the footings. The extension of the layer will permit the collection of water prior to it arriving at the foundation and footings. See Figure 4 – 30 on page 99

9.14.4.3. GRADING

The bottom of the excavation should be graded so that the entire area under the building and extending not less than 300 mm beyond the outside edge of the footings can be drained to a sump for disposal. See Figure 4 – 30 on page 99

9.14.4.4. WET SITE CONDITIONS

It is critical for the granular material layer to be maintained in a clean condition so that its capacity to provide sufficient drainage flow remains unaffected. In wet site construction conditions, soil can become mixed with the granular drainage material making it less porous. When this mixture occurs, additional granular material should be provided so that the top 125 mm is kept from soil. See Figure 4 – 31



Section

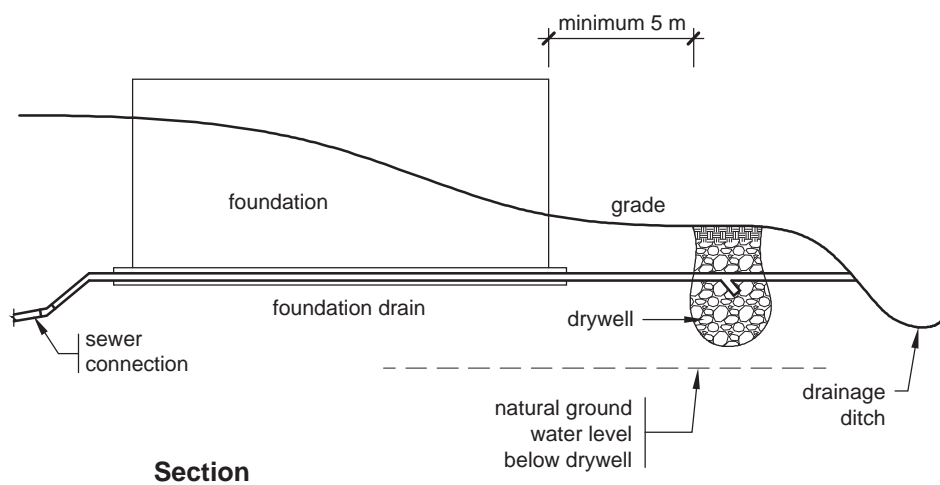
9.14.4.4. Wet Site Conditions

It is critical for the granular material layer to be maintained in a clean condition so that its capacity to produce sufficient drainage flow remains unaffected.

Figure 4 – 31

9.14.5.1. DRAINAGE DISPOSAL

Foundation drains should be installed to remove the water away from the area immediately. They should be connected to a sewer, usually the storm sewer, (check with the municipality where the construction is taking place), drainage ditch or dry well. Foundation drains can be routed to drainage ditches where the grading of the site allows. However, all water drained on to the surface should be retained on the building site and not allowed to pass onto the neighbouring property. See Figure 4 – 32



Section

9.14.5.1. Drainage Disposal

9.14.5.3. Dry Wells

Remove water from area around building to suitable disposal; sewer connection, dry well or drainage to ditch.

Figure 4 – 32

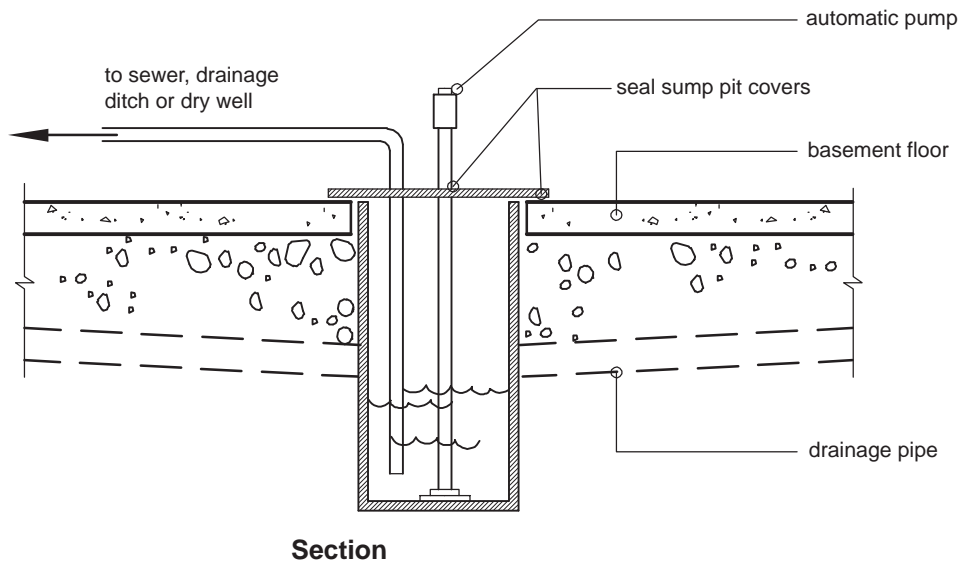
9.14.5.2. SUMP PITS

When gravity drainage is not practical, foundation drains may drain to a covered sump. The water from the sump should be pumped into a sewer, drainage ditch or dry well. The sump pit should meet these requirements;

- Have sufficient capacity to collect and hold water
- Be equipped with an automatic pump that will cycle on-off
- A cover to prevent soil gas and moisture from entering the dwelling (sealed in accordance with Sentence 9.25.3.3.(16))
- A cover designed to resist removal by children

See Figure 4 – 33

9.14.5.3.



9.14.5.2. Sump Pits

Sump pump.

Where gravity drainage is not practical, a covered sump with an automatic pump should be installed to discharge the water into a sewer, drainage ditch or dry well.

Covers for sump pits shall be,

- designed to resist removal by children, and
- sealed in accordance with Sentence 9.25.3.3.(16).

Figure 4 – 33

9.14.5.3. DRY WELLS

Foundation drains may flow to a dry well as an alternative to a sewer or dry well. They should only be used when located in areas where the natural groundwater level is below the bottom of the dry well and where soil conditions permit. A test pit should be dug to determine the level of the groundwater. Groundwater is defined as a free standing body of water in the ground.

To prevent percolating water from reaching the building foundation, the dry well should be located not less than 5 m from the building foundation. It should also be located so that drainage is away from the building. Avoid placement of the dry well where there is a significant natural slope of the ground towards the building. Drainage should be away from the building. See Figure 4 – 32 on page 101

9.14.6.1. SURFACE DRAINAGE

Surface water percolating down through the soil adjacent to the building can be a major cause for moisture problems in basements. The location of the building should be considered when siting the construction. Locating a building on the downward side of a steep slope will require complex grading designs. The building site should be graded so that water will not accumulate at or near the building and will not adversely affect adjacent properties. Swales are used between properties to control the flow of water away from buildings or flooding neighbouring properties.

9.14.6.2. DRAINAGE AWAY FROM WELLS OR LEACHING BEDS

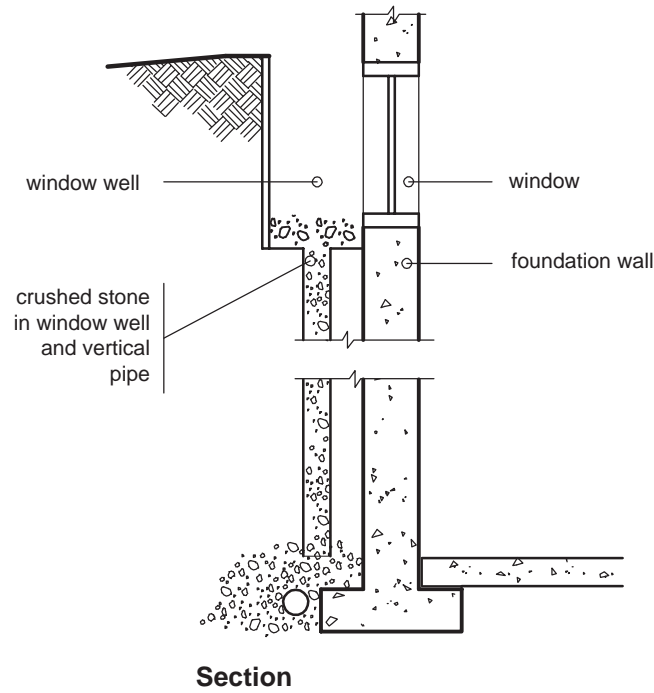
Wells contain potable water suitable for drinking by humans. Surface drainage water is considered non-potable or contaminated as it may contain bacteria and other hazards from animal droppings or garbage. Run off of surface drainage towards or into a well may contaminate the potable water, therefore it should be directed away from the location of a water supply well.

Leaching beds will fail (meaning effluent will rise to the surface) when the bed is exposed to excessive amounts of surface drainage water. The disposal field will become saturated and the rising effluent poses a potential health hazard. Proper grading to direct surface drainage water away from the septic tank disposal bed should be performed.

9.14.6.3.

9.14.6.3. WINDOW WELLS

Window wells will act like a water reservoir if provisions are not taken to adequately drain them. Every window well should be drained to the footing where foundation drains are located or another suitable location away from the building. Improperly installed window well drains can cause water leakage through the foundation into the basement. See Figure 4 – 34



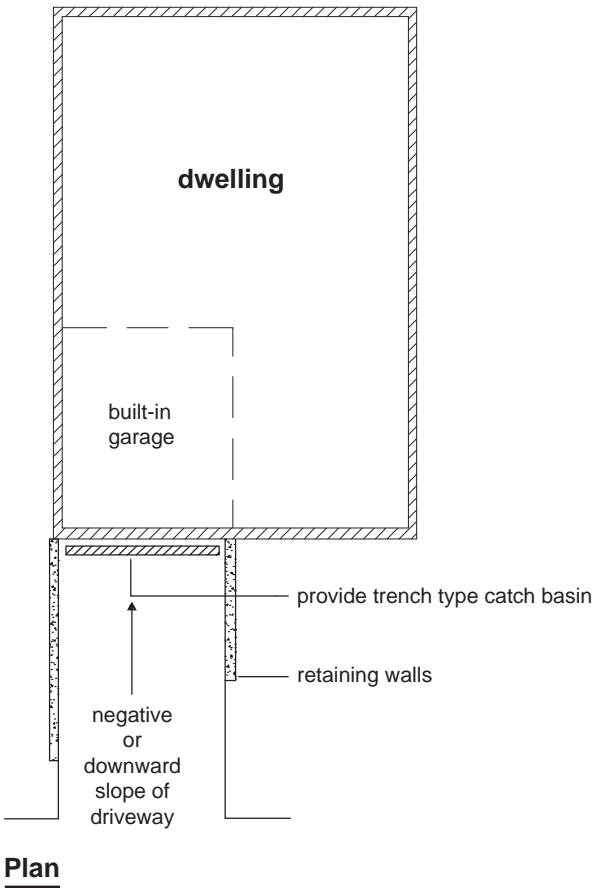
9.14.6.3. Window Wells

Window well drainage provided by crushed stone in vertical pipe to weeping tile.

Figure 4 – 34

9.14.6.4. CATCH BASIN

Reverse driveways, driveways with a negative slope or driveways that slope downward from the street level towards the dwelling should have provisions to collect surface water drainage. A catch basin or trench drain should be installed to prevent water from entering the garage or accumulating in front of the garage. See Figure 4 – 35



9.14.6.4. Catch Basin

Catch basins must be provided for sufficient drainage of negative sloped driveways.

Figure 4 – 35

9.14.6.5.

9.14.6.5. DOWNSPOUTS

Downspouts are not a mandatory Code requirement. However, where downspouts are installed and not connected to a sewer, usually the storm sewer, extensions should be provided to carry rainwater or snow melt away from the building. A concrete pad should be provided to disperse the water and prevent soil erosion.

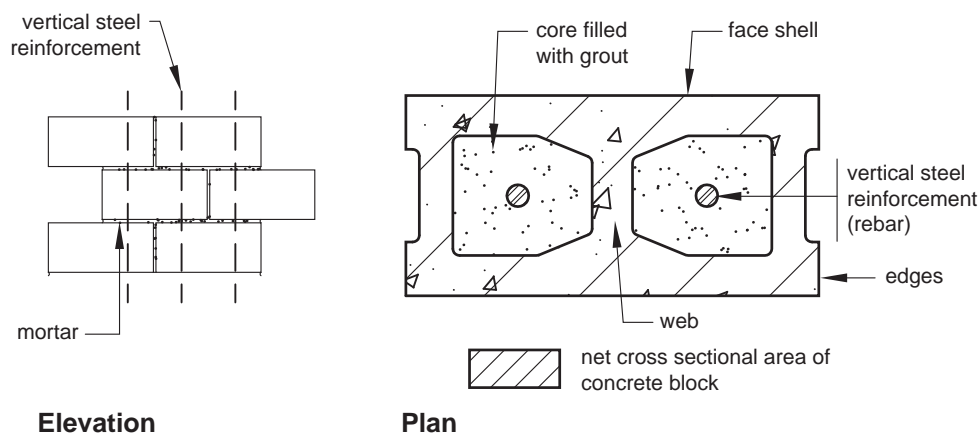
9.15.2.2. UNIT MASONRY CONSTRUCTION

Concrete block masonry units should have the necessary compressive strength to resist lateral and compressive loads. Their durability for use in foundations should be consistent with the life expectancy of the dwelling. Concrete blocks used in unit masonry construction should be manufactured in accordance with the CSA standard A165.1, "Concrete Block Masonry Units" and should have a compressive strength over the average net cross-sectional area of the block of not less than 15 MPa. Mortar, grout, mortar joints, corbelling and protection for unit masonry should conform to Section 9.20.

Reinforced concrete block foundations are able to be constructed to a height greater than unreinforced concrete block for the same thickness of block. However, materials and their method of installation are different for reinforced concrete block foundations. Concrete block foundation walls are required to be reinforced as follows:

- Mortar should be Type S, conforming to CSA A179, "Mortar and Grout for Unit Masonry"
- Grout should be coarse, conforming to CSA A179, "Mortar and Grout for Unit Masonry"
- Placement of grout should conform to CSA A371, "Masonry Construction for Buildings"

See Figure 4 – 36



9.15.2.2. Unit Masonry Construction

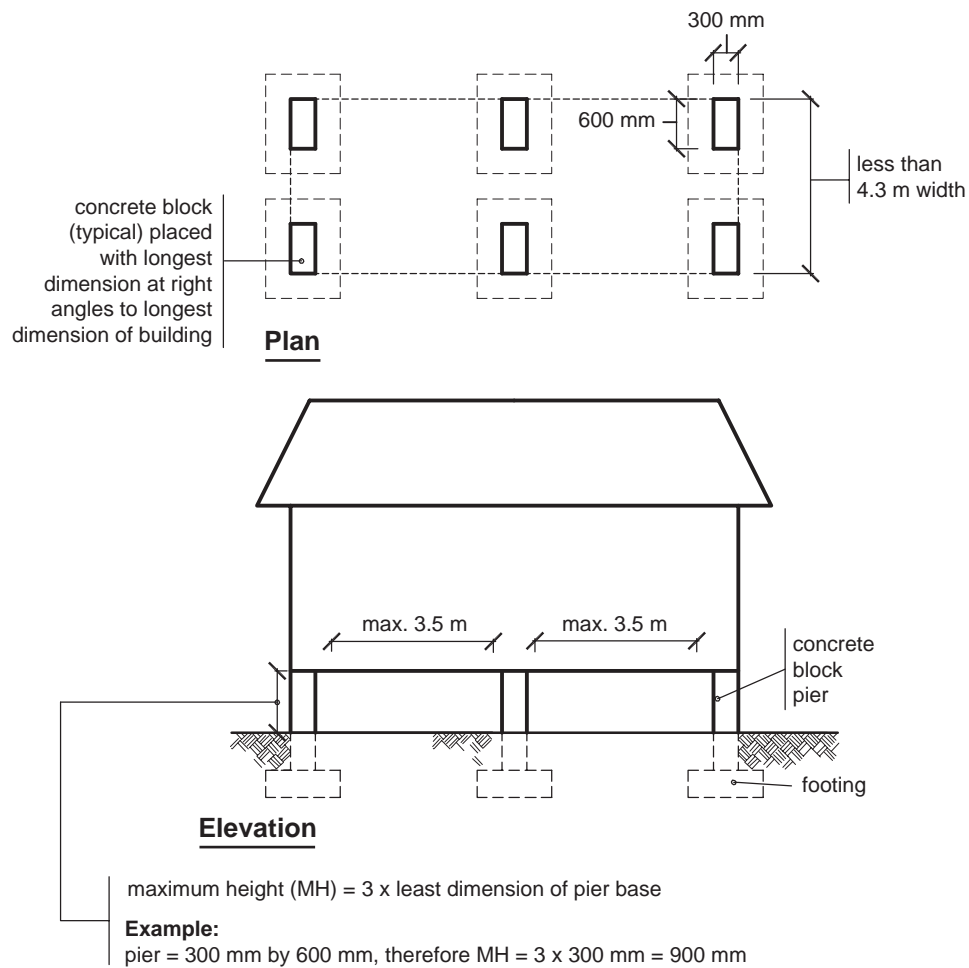
Concrete block masonry units should have necessary compressive strength to resist lateral and compressive loads. Their durability for use in foundation walls should be consistent with the life expectancy of the dwelling.

Figure 4 – 36

9.15.2.3. PIER TYPE FOUNDATIONS

This Article is applicable to pier type foundations supporting buildings of one storey in building height. The prescriptive requirements of the Code can be utilized since the superstructure loads and wind forces can be reasonably small. The piers must be constructed in accordance with the design drawings, as the design of the pier foundations has considered the support of the applied loads from the superstructure. The piers should be installed to support the main framing members, such as beams and columns, and should be spaced not to exceed 3.5 m apart along the framing. The beams and piers work in conjunction to elevate the building, while providing vertical and lateral support and transfer loads on the building and foundation to the ground below. The spacing may exceed 3.5 m where the designer has designed the piers and footings for an increase in spacing and the loading that results from such an increase. See Figure 4 – 37

9.15.2.3.



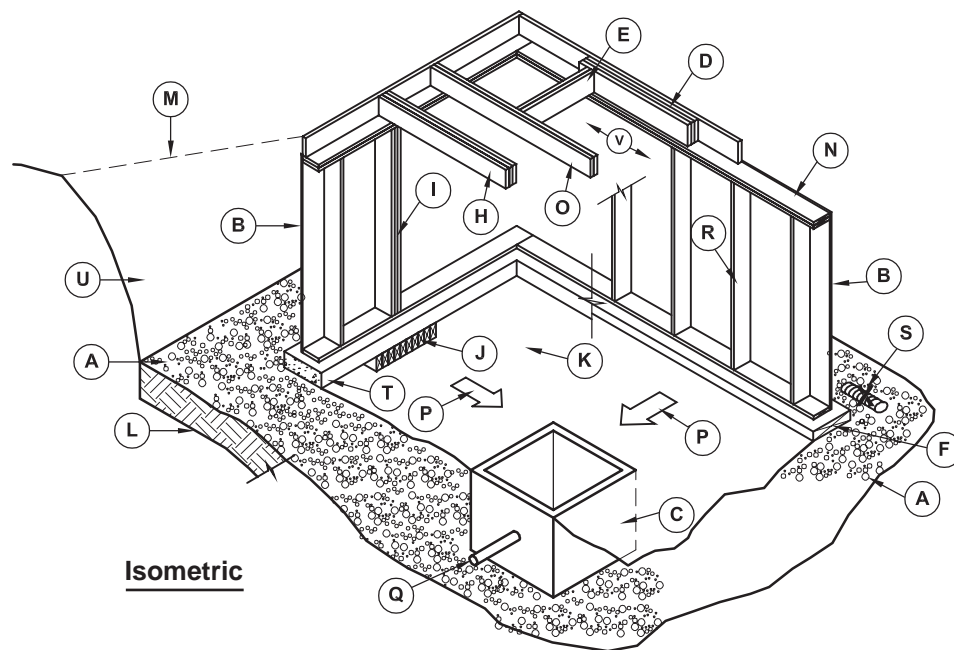
9.15.2.3. Pier Type Foundations

Pier type foundations should be designed to support loads from the superstructure and resist wind loads.

Figure 4 – 37

The height of the piers above their base should be restricted. Piers must be able to resist buckling and lateral forces, such as wind and impact forces. The height of piers should not exceed 3 times their least dimension at the base of the pier. The compressive strength of concrete blocks is measured with the cores in a vertical direction. Concrete block used for piers should be laid with cores placed vertically and where the width of the building is 4.3 m or less, placed with their longest dimension at right angles to the longest dimension of the building.

9.15.2.4.



LEGEND OF TYPICAL ELEMENTS

- | | |
|---|--|
| (A) Granular drainage layer (bed) | (M) Final grading slope away from foundation |
| (B) Plywood sheathing with moisture barrier | (N) 2-top plates (one is acceptable under specific conditions) |
| (C) Sump | (O) Floor joist, truss or I-joist at top of foundation |
| (D) Stairwell beam | (P) Direction of drainage flow |
| (E) Headers | (Q) Drain to suitable disposal |
| (F) Footing plate | (R) Treated wall stud |
| (G) Bottom wall plate or (T) | (S) Foundation drainage tile not permitted |
| (H) Built-up wood beam | (T) Concrete footing or (G) |
| (I) Built-up wood column | (U) Excavation |
| (J) Footing plate | (V) Stairwell opening |
| (K) Polyethylene ground cover / soil protection | |
| (L) Undisturbed soil | |

9.15.2.4. Wood Frame Construction

Foundation of wood frame construction should conform to Standard CAN/CSA-S406, "Construction of Preserved Wood Foundation" or Part 4 of the Code. The Standard provides the requirements for the selection of materials for, and the fabrication and installation of preserved wood foundations. In addition to the requirements in the Standard, the requirements for wood frame construction found in the Code should also be adhered to.

Note: All lumber and plywood used in a preserved wood foundation should be treated with a preservative in accordance with the CSA Standard 080.15. Treated wood should be identified by a certification mark stamped on the material conforming it has been treated in conformance with the applicable CSA Standard such as 0322.

Figure 4 – 38