

## Inspection and Technical Services

### Limit States Design for Housing and Small Buildings

ITS 20-015

The purpose of this bulletin is to provide information about the Manitoba Building Code requirements pertaining to housing and small buildings that require the construction of deep foundations.

#### Limit States Design

Limit States Design (LSD) is a structural design method used for the design of steel, concrete, wood, masonry, and foundation structures under the Manitoba Building Code (MBC). LSD must be used for the design of deep foundations. The MBC requires that:

##### **9.4.1.1. General**

- 1) Subject to the application limitations defined elsewhere in this Part, structural members and their connections shall
  - a) conform to the requirements provided elsewhere in this Part,
  - b) be designed according to good engineering practice such as that provided in CWC 2009, "Engineering Guide for Wood Frame Construction," or
  - c) be designed according to Part 4 using the loads and deflection and vibration limits specified in
    - i) Part 9, or
    - ii) Part 4,

##### **4.2.4.1. Design Basis**

- 1) The foundations of a building shall be capable of resisting all the loads stipulated in Section 4.1., in accordance with limit states design in Subsection 4.1.3.

#### Deep Foundation

*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. Pile means a slender deep foundation unit made of materials such as wood, steel or concrete or a combination thereof, that is either pre-manufactured 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.*

#### Design

The design of deep foundations must meet the objectives of Part 4 of the MBC and be based on the site subsurface conditions. The design must be carried out by a professional engineer licensed to practice in the Province of Manitoba and skilled in the area of work concerned.

## **Subsurface Investigation**

Subsurface conditions must be taken into consideration by the professional engineer completing a deep foundation design under Part 4 of the MBC. The MBC requires that:

### **4.2.2.1. Subsurface Investigation**

1) A *subsurface investigation*, including *groundwater* conditions shall be carried out by or under the direction of a professional engineer having knowledge and experience in planning and executing such investigations to a degree appropriate for the *building* and its use, the ground and the surrounding site conditions. (See Appendix A)

**A-4.2.2.1.(1) Subsurface Investigation.** Where acceptable information on subsurface conditions already exists, the investigation may not require further physical subsurface exploration or testing.

## **Field Review**

A field review must be undertaken to confirm that the design is consistent with the subsurface conditions. Part 4 provides clear direction about the field review process as follows:

### **4.2.2.3. Field Review**

- 1) A field review shall be carried out by the designer or by another qualified person responsible to the designer to ascertain that the subsurface conditions are consistent with the design and that construction is carried out in accordance with the design and good engineering practice. (see Appendix A.).
- 2) The review required in Sentence (1) shall be carried out
  - a) on a continuous basis
    - i) during the construction of all deep foundation units with all pertinent information recorded for each unit,
    - ii) during the installation and removal of retaining structures and related backfilling operations, and
  - b) as required, unless otherwise directed by the authority having jurisdiction,
    - i) in the construction of all shallow foundation units, and
    - ii) in excavating, dewatering and other related works.

### **4.2.2.4 Altered Subsurface Condition**

- 1) If, during construction, the soil, rock or groundwater is found not to be of the type or in the condition used in design and as indicated on the drawings, the design shall be reassessed by the designer.
- 2) If, during construction, climatic or any other conditions change the properties of the soil, rock or groundwater, the design shall be reassessed by the designer.

Loads that may be applied to a deep foundation depend not only on the properties of the foundation as a structural unit, but also on the properties of the foundation soil (or rock) and of the soil/foundation system. Geotechnical criteria are determined on the basis of site investigations and geotechnical analyses.

## **Further information**

Please contact the Inspection and Technical Services at 204-945-3373 with any questions or for clarifications.