CITY OF RAPID CITY

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MEMORANDUM

TO: Legal and Finance Committee

FROM: Carla Cushman, Assistant City Attorney

DATE: April 29, 2015

RE: Provisions concerning shifting, compressible, and expansive soils adopted in other jurisdictions.

Summary

The general provisions in the International Residential Code regarding soils and foundations give the Building Official the discretion to require soils testing based on the circumstances at hand. Some jurisdictions have adopted the IRC code provisions without amendment, and the building official does not regularly exercise that discretion to require soils test and/or engineered designs; this has been the general practice in Rapid City in the past. Other jurisdictions (Cheyenne, Gillette) adopt the IRC code provisions without amendment, yet apply them by generally requiring soils test or engineered designs on new structures. Finally, some cities (Ft. Collins CO, Longmont CO) do not adopt the IRC provisions and instead codify a soils testing requirement within their ordinance. Each of these options is discussed more fully below.

Adopting the International Residential Code without amendments

The 2012 version of the International Residential Code (IRC) has been adopted by many jurisdictions, and like Rapid City, these jurisdictions amend certain provisions in the IRC to impose additional requirements for that area. The following jurisdictions have adopted the IRC provisions regarding soils that are excerpted below in their entirety, *without* any amendments:

Sioux Falls, SD

Aberdeen, SD

Spearfish, SD	Gillette, WY
Watertown, SD	Cheyenne, WY
Fargo, ND	Casper, WY

The IRC generally gives the Building Official discretion to require soils testing or additional items when the circumstances warrant. Its relevant provisions state *(emphasis added)*:

R401.4 Soil tests.

Where quantifiable data created by accepted soil science methodologies indicate expansive, compressible, shifting or other questionable soil characteristics are likely to be present, *the building official shall determine whether to require a soil test to determine the soil's characteristics at a particular location*. This test shall be done by an approved agency using an approved method.

R401.4.1 Geotechnical evaluation.

In lieu of a complete geotechnical evaluation, the load-bearing values in Table R401.4.1 shall be assumed.

TABLE R401.4.1 PRESUMPTIVE LOAD-BEARING VALUES OF FOUNDATION MATERIALS[a]

CLASS OF MATERIAL	LOAD-BEARING PRESSURE (pounds per square foot)
Crystalline bedrock	12,000
Sedimentary and foliated rock	4,000
Sandy gravel and/or gravel (GW and GP)	3,000
Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000
Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500[b]

For SI: 1 pound per square foot = 0.0479 kPa.

a. When soil tests are required by Section R401.4, the allowable bearing capacities of the soil shall be part of the recommendations.

b. *Where the building official determines that in-place soils with an allowable bearing capacity of less than 1,500 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.*

R401.4.2 Compressible or shifting soil.

Instead of a complete geotechnical evaluation, when top or subsoils are compressible or shifting, they shall be removed to a depth and width sufficient to assure stable moisture content in each active zone and shall not be used as fill or stabilized within each active zone by chemical, dewatering or presaturation.

These provisions allow for the Building Official to determine when and if a soils test will be required, leaving much discretion within the Building Official's authority to determine when to require a soils test, and when to issue a building permit without a soils test. In the past, our Building Services office has not exercised its discretion to require soils testing except when it was aware that the residence would be constructed upon a fill area.

Regarding expansive soils, the IRC provides as follows:

R403.1.8.1 Expansive soils classifications.

Soils meeting all four of the following provisions shall be considered expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. Plasticity Index (PI) of 15 or greater, determined in accordance with ASTM D 4318.

2. More than 10 percent of the soil particles pass a No. 200 sieve (75 μm), determined in accordance with ASTM D 422.

3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422.

4. Expansion Index greater than 20, determined in accordance with ASTM D 4829.

Adopting a policy of requiring soils testing / engineered design under the IRC code

Jurisdictions adopting the above IRC provisions verbatim have applied them in such a way as to require soils testing and/or engineered designs for foundations. In the same way, Rapid City could also adopt the IRC general provisions and apply them to require a soils test and/or engineered design in every case because of the frequency of bad soils in this area.

In applying the provisions adopted above, Cheyenne requires foundation plans stamped by a professional engineer or architect to obtain a building permit.[1] And Gillette's adoption of the above provisions has manifested in a requirement that "[f]or all new construction and residential additions, written verification from the soils engineer indicating the type of footing/foundation

[1] *www.cheyennecity.org/DocumentCenter/Home/View/469*

required shall be on file prior to the [footing] inspection."[2] So as a practical matter, both Cheyenne and Gillette adopt the IRC provisions above and interpret them to require professional input into foundations and/or soils in every case of a new residence, prior to receipt of a building permit.

Amending the IRC to codify testing to address expansive soils

Jurisdictions may amend the IRC to adopt different or additional provisions beyond what the IRC requires. Ft. Collins, Colorado has done so, adopting the following amendment to the IRC for soils testing *(emphasis added)*:

> **R401.1 Application**. The provisions of this chapter shall control the design and construction of the foundation and foundation spaces for all buildings. In addition to the provisions of this chapter, the design and construction of foundations in areas prone to flooding as established by Table R301.2(1) shall meet the provisions of Section R322. *All foundations shall be designed by a qualified professional licensed in the State of Colorado. Such designs shall be performed in accordance with accepted and approved engineering practices, including considerations for soil load-bearing capacities, surface and subsurface water conditions, adequate foundation and floor drainage, adequate ventilation of enclosed interior foundation spaces, and foundation waterproofing and damp-proofing. Final engineer's reports, indicating his/her acceptance of the above requirements, shall be submitted to the* building official *prior to the issuance of the Certificate of Occupancy.*
>
> **Exception**:
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> Foundations for accessory buildings and minor additions that are not located on expansive, compressible, or shifting soils, soils of unknown characteristics, or for other valid reasons as determined by the building official, need not be designed by a licensed professional.
>
> [. . .]

Fort Collins Municipal Code Sec. 5-30(47)[3]. So, Fort Collins has adopted, within its ordinances, a presumptive requirement of an engineered foundation for each home, unless it can be shown that the area does not have expansive, compressible, or shifting soils.

Longmont, CO has amended IRC 403.1.8, foundations on expansive soils, as follows:

> Sections R403.1.8 of the International Residential Code is amended by the deletion of this section in its entirety and replacing it with the following:

[2] *See www.gillettewy.gov/Modules/ShowDocument.aspx?documentid=1205.*
[3] *www.colocode.com/fcmunihtml.html.*

Section R403.1.8 Foundations on expansive soils. Foundations and structural floor slabs for buildings located on expansive soils shall be designed by a Colorado registered professional engineer.