DEPARTMENT OF ADMINISTRATIVE SERVICES

PROPOSED CHANGE OF THE CONNECTICUT STATE BUILDING CODE AND FIRE SAFETY CODE

DATE SUBMITTED: 04/15/2024

CODE INFORMATION

Proposed change to: ☑ Building Code ☐ Fire Safety Code

Code section(s): 2024 IBC: 202.1 (Amend); 1705.6.1 (Add); 1809.14 (Add)

PROPONENT INFORMATION

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PROPOSAL INFORMATION

Description of change and reason for change (attach additional information as needed):

Add provisions for Rigid Inclusion Systems. See attachment.

Proposed text change, addition or deletion (attach additional information as needed):

See attachment.

Supporting data and documents (attach additional information as needed)

See attachment.

☐ **This Proposal is original material.** (Note: Original material is considered to be the submitter's own idea based on or as a result of his/her own experience, thought or research and, to the best of his/her knowledge, is not copied from another source.)

☑ **This Comment is not original material, its source (if known) is as follows:** (such as material / code development proposal from a prior development cycle or proposal submitted to model code committee etc.)

Portions of proposal are based on Massachusetts State Building Code (10th edition)

☐ **I would like to make an in-person presentation of my proposal.**

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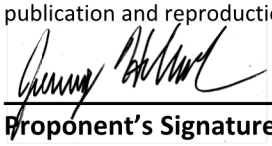

Proponent's Signature

Jeremy A. Haugh, P.E.

Printed Name

PLEASE EMAIL (PREFERRED) TO DAS.CodesStandards@CT.GOV OR MAIL OR FAX (SEE BELOW)

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***DESCRIPTION FOR CHANGE AND REASON FOR CHANGE*:**

Rigid Inclusion Systems are a type of ground improvement system used to enhance the load-bearing capacity of the ground below shallow foundations and to control total and differential settlements within the zone of influence of the foundations. Rigid inclusions are not presently addressed in the IBC. There is no established standard for the design or installation of Rigid Inclusion Systems. Furthermore, there is no minimum factor of safety for Rigid Inclusion Systems; different specialty contractors who design Rigid Inclusion Systems utilize different factors of safety.

In Connecticut, rigid inclusion systems are most often used as an alternative to deep foundations (i.e., pile foundations). Consequently, failures of rigid inclusion systems can have significant impact on the structural integrity of a building. Rigid inclusion systems installed on sites containing organic soils or soft clay do not improve those soils, and load sharing under these conditions is negligible.

The objective of this proposal is to provide consistent requirements for the design, construction, and inspection of Rigid Inclusion Systems in the State of Connecticut.

***PROPOSED TEXT CHANGES*:**

IBC 2024 - CHAPTER 2

(Amd) 202.1 Definitions. Add or amend the following definitions:

> **(Add) RIGID INCLUSIONS.** Vertical elements within the ground consisting of *concrete*, grout, or other combination of cementitious materials mixed with aggregates, or other materials that are significantly stiffer than the ground being improved, together with all strata and materials in which they are installed. Vertical elements are not composed only of aggregate, are not embedded in foundations, and do not resist tension loading.
>
> **(Add) RIGID INCLUSION LOAD TRANSFER LAYER.** Materials placed between *Rigid Inclusions* and shallow foundations.
>
> **(Add) RIGID INCLUSION SYSTEMS.** *Rigid Inclusions*, the strata and materials in which they are installed, and a *Rigid Inclusion Load Transfer Layer*.

IBC 2024 - CHAPTER 17

(Add) 1705.6.1 Rigid Inclusion Systems. Special Inspections and tests shall be performed during installation of Rigid Inclusion Systems as specified in Table 1705.6.1. The approved geotechnical report and *construction documents* prepared by the *registered design professional(s)* shall be used to determine compliance.

Table 1705.6.1

Required Special Inspections and Tests of Rigid Inclusion Systems

TYPE	Continuous Special Inspection	Periodic Special Inspection
1. Inspect installation and load testing operations, and maintain complete and accurate records for each *Rigid Inclusion.*	X	

2. Verify *Rigid Inclusion* materials, placement locations, diameters, and plumbness. Verify embedment into bearing strata and adequate end-bearing strata capacity. Record concrete or grout volumes. Verify top of *Rigid Inclusions* elevations.	X	
3. Perform tests and *special inspections* on *concrete* or grout in accordance with applicable requirements of Section 1705.3.	In accordance with Section 1705.3	
4. During *Rigid Inclusion Load Transfer Layer* installation, verify use of proper materials, procedures, material densities, and lift thicknesses.	X	

IBC 2024 - CHAPTER 18

(Add) 1809.14 Rigid Inclusion Systems.

(Add) 1809.14.1 Design. *Rigid Inclusion Systems* for shallow foundation support shall be designed by a *registered design professional*, referred to in this section as the *Rigid Inclusion System* designer.

The design of *Rigid Inclusion Systems* shall include all applicable components of the compression and lateral loads, and downdrag. The *Rigid Inclusion System* designer shall provide construction documents and calculations to:

1. Document supported shallow foundation structural loads, including vertical, lateral, and rotational stability provided by the building designer.
2. Provide required load-bearing capacity of the *Rigid Inclusion System*.
3. Document *Rigid Inclusion System* design with geotechnical and structural engineering calculations.
4. Provide the load distribution and strain compatibility between the rigid inclusions and surrounding strata and materials being reinforced or improved.
5. Verify the structural compatibility between the rigid inclusions and the shallow foundations including:
   a. Thickness and characteristics of the *Rigid Inclusion Load Transfer Layer*.
   b. Impacts of concentrated reaction loads imposed by the *Rigid Inclusions* on shallow foundations.
   c. Minimum number and configuration of *Rigid Inclusions* to establish vertical, lateral, and rotational stability of isolated and continuous shallow foundations.
6. Determine short-term and long-term settlements of shallow foundations.
7. Specify *Rigid Inclusion* load testing quantity, locations, method, instrumentation, and acceptance criteria necessary to confirm the allowable *Rigid Inclusion* design load and performance. At least one load test shall be performed in each significantly different soil profile into which the *Rigid Inclusions* are to be installed.
8. Confirm axial stresses in *Rigid Inclusions* do not exceed 0.3 f'_c.

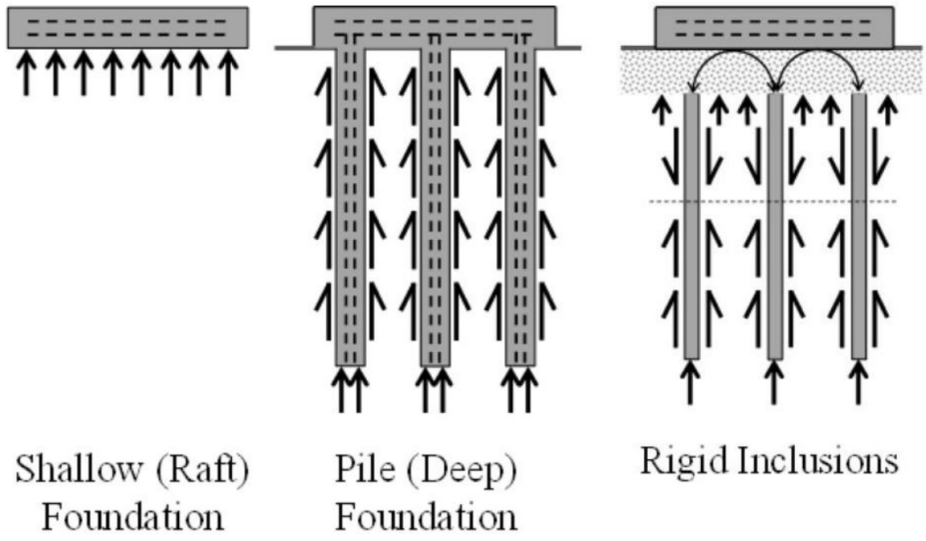
(Add) 1809.14.2 Load Testing. Load tests shall be performed in accordance with ASTM 1143 to demonstrate that *Rigid Inclusions* have the axial capacity to resist two (2.0) times the design load, which is defined herein as 100% of foundation load plus downdrag, as applicable. Any temporary supporting capacity that the soil might provide to the *Rigid Inclusions* during a load test that would dissipate with time shall be eliminated by casing off or by other suitable means, such as increasing the total test load to account for such temporary capacity.

(Add) 1809.14.3 Construction.

1. The *Rigid Inclusions* and the *Rigid Inclusion Load Transfer Layer* shall be constructed and installed in accordance with construction documents provided by the *Rigid Inclusion Systems* designer.
2. *Special Inspections* in accordance with 1705.6.1 shall be provided for *Rigid Inclusion Systems*.
3. As-built drawing(s) and other information as required to document the *Rigid Inclusion System* installation and related activities shall be prepared and sealed by the *Rigid Inclusion System* designer and submitted to the *Building Official* and the *registered design professional in responsible charge*. The information shall include, at a minimum, the load test report, the *Rigid Inclusion* layout, locations and cut-off elevations, and any deviations between the *Rigid Inclusion System* design and the as-built conditions.

SUPPORTING DATA AND DOCUMENTS

Graphical comparison of load paths of rigid inclusion systems and shallow and deep foundation systems:



SUPPORTING DATA AND DOCUMENTS

Detail of a rigid inclusion system: