



1

# INTRODUCTION



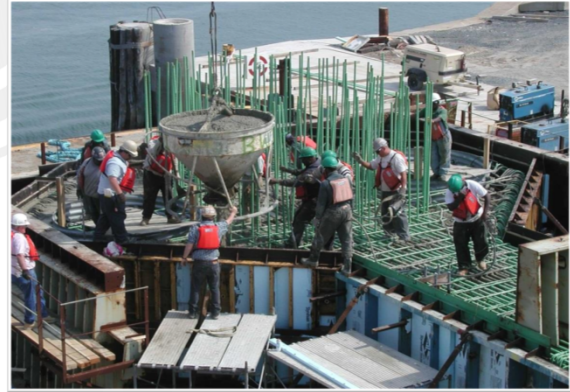
**Michael Padula, PE**  
*Chief Engineer – Pennoni Construction Services*  
*Director of Certifications & Past President – Eastern PA and Delaware Chapter of ACI*  
*PCMA Board Member – Chair of Codes and Standards Committee*



2

## TODAY'S AGENDA

- ◆ Introductions
- ◆ IBC 2021 Chapter 17 Special Inspections Overview
- ◆ Structural Masonry Special Inspections
- ◆ Reinforced Concrete Special Inspections
- ◆ Soil and Foundation Special Inspections
- ◆ 15-minute break
- ◆ Masonry and Soil Laboratory Testing
- ◆ 15-minute Break
- ◆ Concrete Field and Laboratory Testing
- ◆ Concrete NDT and Soils Hands on Demonstrations
- ◆ Final Questions and Answers



3

## TODAY'S LEARNING OBJECTIVES

- ◆ Understand various sections of IBC 2021 Chapter 17 related to the following:
  - ❖ Special Inspector Qualifications
  - ❖ Statement of Special Inspections
  - ❖ Duties and Responsibilities of each Party
  - ❖ Special Inspections for Fabricator/Fabricated Items
- ◆ Know the difference between Continuous versus Periodic Inspections
- ◆ Familiar with the different levels of Masonry Construction Special Inspections
- ◆ Familiar with the different categories of Reinforced Concrete Special Inspections
- ◆ Familiar with the different categories of Soil/Foundation Special Inspections
- ◆ Understand how Masonry components are sampled and laboratory tested
- ◆ Understand how Concrete is sampled and tested
- ◆ Opportunity to see and perform some basic concrete and soil tests



4

# IBC 2021 – CHAPTER 17 SPECIAL INSPECTIONS

Provisions for inspection of structural components were included in the first edition of the Uniform Building Code (UBC) in 1927.

The term “Special Inspections” was first introduced in the 1961 edition of the UBC.

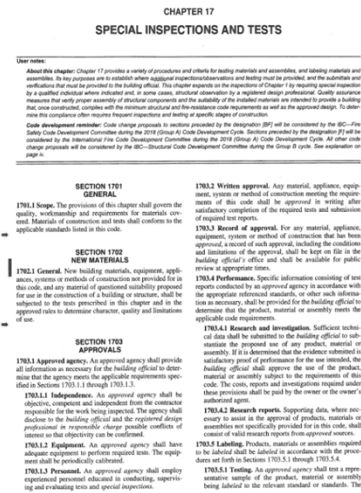
In 1988, Special Inspection requirements were introduced into the National Building Code (BOCA)

In 2000, the first edition of the IBC combined both UBC and BOCA into what we now know as the International Building Code (IBC).

Chapter 17 is where the requirements and regulations were described.

Terminology and requirements evolve in almost every edition of the IBC since inception. Unfortunately, often as a reaction to an unfortunate event.

- ◆ New York City – World Trade Center (2001)
- ◆ Atlantic City – Tropicana Garage Collapse (2003)
- ◆ Philadelphia – American Red Cross (2013)



5

# IBC 2021 – CHAPTER 17 SPECIAL INSPECTIONS

## Responsibilities of Each Party

- ◆ Design Professional - Prepares the Statement of Special Inspections
- ◆ Owner – Engages an approved special inspection agency
- ◆ CM/GC/Contractor – Scheduling of Inspections and Providing and Maintaining Safe Access to the areas requiring Special Inspections
- ◆ Special Inspections Agency – Provide adequately qualified individuals to perform the required special inspections and tests



6



# IBC 2021 – CHAPTER 17 SPECIAL INSPECTIONS

- ◆ **Special Inspector Qualifications**
  - ❖ **Individuals with knowledge, training, certifications in the areas where they will be performing inspections**
    - ❖ **ICC Special Inspector Certification**
      - › Structural Masonry
      - › Structural Steel Bolting and Welding
      - › Reinforced Concrete and Precast Concrete
      - › Spray Applied Fire Proofing
      - › Soils
      - › Tall Mass Timber Buildings
    - ❖ **Other Recognized Certifications**
      - › American Concrete Institute
      - › American Welding Society
      - › International Firestop Council
  - ❖ **Registered Design Professional can serve as the Special Inspector (provided they have adequate experience)**



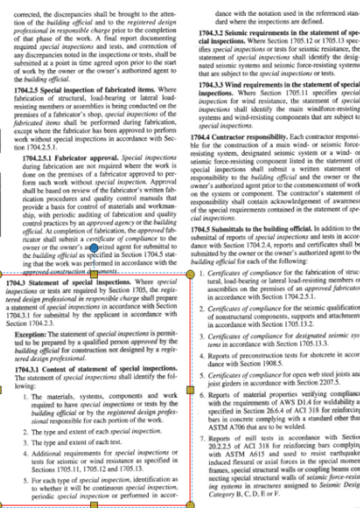
7

# IBC 2021 – CHAPTER 17 SPECIAL INSPECTIONS

## Where does it all start?

### Starts with a Statement of Special Inspections

- ◆ **Document prepared by the registered design professional (engineer or architect)**
- ◆ **Identifies the materials, systems, components and work that require special inspections**
- ◆ **Identifies the extent of each special inspection and test**
- ◆ **Identifies areas of special consideration for example high seismic or wind resistance**
- ◆ **Identifies what special inspections are continuous versus periodic**



8



# IBC 2021 – CHAPTER 17 SPECIAL INSPECTIONS

Department of Licenses and Inspections  
CITY OF PHILADELPHIA

\*\*\*DO NOT MAIL THIS FORM\*\*\* INTERNAL USE ONLY

Date Received: \_\_\_\_\_ Application Number: \_\_\_\_\_

**Statement of Special Inspections Schedule**  
(International Building Code)

In accordance with the provisions of Chapter 17 of the 2021 International Building Code, the form is to list the Special Inspections as required for the proposed construction project at the property address indicated below.

Property Address: \_\_\_\_\_

Design Professional or Manufacturer: \_\_\_\_\_

Special Inspections Details:

Special Inspections Details	Inspection Category	Inspection and Approval	Inspection	Approval	Agency Name
Foundation	Foundation	Foundation			
Structural Steel	Structural Steel	Structural Steel			
Concrete	Concrete	Concrete			
Roofing	Roofing	Roofing			
Exterior Cladding	Exterior Cladding	Exterior Cladding			
Other	Other	Other			

10, 2021, 2021 Codes

Statement of Special Inspections Schedule

Page 1 of 1

Example - Statement of Special Inspections for City of Philadelphia



9

# IBC 2021 – CHAPTER 17 SPECIAL INSPECTIONS

- ◆ Continuous versus Periodic Special Inspections
  - ❖ Continuous Special Inspections – The inspection of construction or work that requires special inspection in accordance with the statement of special inspections and, due to the nature of the work, is inspected by an approved special inspector who is continuously present in the area when and where the construction or work is being performed.
    - ❖ For example: The installation of overhead or horizontal post installed concrete adhesive anchors that are used to resist sustained tension loading.
  - ❖ Periodic Special Inspections – The inspection of construction or work that requires special inspection in accordance with the statement of special inspection and, due to the nature of the work, is inspected by an approved special inspector who is intermittently present in the area when and where the construction or work has been or is being performed.
    - ❖ For example: The installation of reinforcing steel for concrete elements, provided no welding of the reinforcing steel is required.



10

## IBC 2021 – CHAPTER 17 SPECIAL INSPECTIONS

### Steel and Concrete Fabrication

Exception: Special Inspections of the steel fabrication process shall not be required where the fabrication process for the entire building or structure does not include any welding, thermal cutting or heating operation of any kind.

Where fabrication of structural, load-bearing or lateral load-resisting members or assemblies is being conducted on the premises of a fabricator's shop, special inspections of the fabricated items shall be performed during fabrication, except where the fabricator has been approved to perform work without special inspections in accordance with Section 1704.2.5.1

Section 1704.2.5.1 states that the fabricator shall provide a qualification package that summarizes their quality control plan, including various internal auditing records, to an approved agency or the building official for approval to operate without special inspections.



AISC or PCI certification alone does NOT meet requirements for the waiver.

Requires a *Certificate of Compliance* by Fabricator



11

## IBC 2021 – CHAPTER 17 SPECIAL INSPECTIONS

### Steel and Concrete Fabrication

Exception: Special Inspections of the steel fabrication process shall not be required where the fabrication process for the entire building or structure does not include any welding, thermal cutting or heating operation of any kind.

Where fabrication of structural, load-bearing or lateral load-resisting members or assemblies is being conducted on the premises of a fabricator's shop, special inspections of the fabricated items shall be performed during fabrication, except where the fabricator has been approved to perform work without special inspections in accordance with Section 1704.2.5.1

Section 1704.2.5.1 states that the fabricator shall provide a qualification package that summarizes their quality control plan, including various internal auditing records, to an approved agency or the building official for approval to operate without special inspections.



AISC or PCI certification alone does NOT meet requirements for the waiver.

Requires a *Certificate of Compliance* by Fabricator



12

# STRUCTURAL MASONRY SPECIAL INSPECTIONS

## Chapter 17 – Section 1705.4

### 1705.4 Masonry construction. INSIGHTS



Special inspections and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602.

**Exception:** Special inspections and tests shall not be required for:

1. Empirically designed masonry, *glass unit masonry* or masonry veneer designed in accordance with Section 2109, Section 2110 or Chapter 14, respectively, where they are part of a structure classified as *Risk Category I*, *II* or *III*.
2. Masonry foundation walls constructed in accordance with Table 1807.1.6.3(1), 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4).
3. Masonry fireplaces, masonry heaters or masonry chimneys installed or constructed in accordance with Section 2111, 2112 or 2113, respectively.

### IBC 2021 References TMS 402/602-16



13

# STRUCTURAL MASONRY SPECIAL INSPECTIONS

## ♦ Start with TMS 402-16 Chapter 3, Table 3.1

Table 3.1 Minimum Quality Assurance Level

Designed in accordance with	Risk Category I, II or III	Risk Category IV
Part 3 or Appendix B or Appendix C	Level 2	Level 3
Part 4	Level 1	Level 2
Appendix A	Level 1	Not permitted

## ♦ The Inspection Level is a function of the Occupancy Risk Category as defined in ASCE 7

- ♦ Risk I – Low Hazard to Human Life to Risk 4 – Essential Facility

## ♦ Select a Structural Design Method

- ♦ Part 3 – Engineered Masonry
- ♦ Appendix B/C – Masonry Infills/Limit Design Method
- ♦ Part 4 – Prescriptive Design Methods
- ♦ Appendix A – Empirical Design Methods



14



# STRUCTURAL MASONRY SPECIAL INSPECTIONS

## ◆ Next look at TMS 602-16 Chapter 3, Table 3 – Sampling Frequencies

Table 3 Minimum Verification Requirements

Minimum Verification	Required for Quality Assurance <sup>(a)</sup>			Reference for Criteria
	Level 1	Level 2	Level 3	TMS 602
Prior to construction, verification of compliance of submittals.	R	R	R	Art. 1.5
Prior to construction, verification of $f_m$ and $f_{AAC}$ , except where specifically exempted by the Code.	NR	R	R	Art. 1.4 B
During construction, verification of Slump flow and Visual Stability Index (VSI) when self-consolidating grout is delivered to the project site.	NR	R	R	Art. 1.5 & 1.6.3
During construction, verification of $f_m$ and $f_{AAC}$ for every 5,000 sq. ft. (465 sq. m).	NR	NR	R	Art. 1.4 B
During construction, verification of proportions of materials as delivered to the project site for premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout.	NR	NR	R	Art. 1.4 B

<sup>(a)</sup> R=Required, NR=Not Required



15

# STRUCTURAL MASONRY SPECIAL INSPECTIONS

## ◆ TMS 602-16 Chapter 3, Table 4 –Special Inspection Projects

Table 4 Minimum Special Inspection Requirements

MINIMUM SPECIAL INSPECTION									
Inspection Task	Frequency <sup>(a)</sup>			Reference for Criteria					
	Level 1	Level 2	Level 3	TMS 402		TMS 602			
1. As masonry construction begins, verify that the following are in compliance:									
a. Proportions of site prepared mortar	NR	P	P			Art. 2.1.2.6 A, 2.6 C			
b. Grade and size of prestressing tendons and anchorages	NR	P	P						
c. Grade, type and size of reinforcement, connectors, anchor bolts, and prestressing tendons and anchorages	NR	P	P						Art. 1.5
d. Prestressing technique	NR	P	P						Art. 3.3B
e. Properties of thin bed mortar for AAC masonry	NR	C(b)/P(c)	C						Art. 3.3F
f. Sample panel construction	NR	P	C						
2. Prior to grouting, verify that the following are in compliance:									
a. Grout space	NR	P	C						
b. Placement of prestressing tendons and anchorages	NR	P	P						Sec. 6.1
c. Placement of reinforcement, connectors, and anchor bolts	NR	P	C						
d. Proportions of site prepared grout and prestressing grout for bonded tendons	NR	P	P						
3. Verify compliance of the following during construction:									
a. Materials and procedures with the approved submittals	NR	P	P						Art. 1.5
b. Placement of masonry units and mortar joint construction	NR	P	P						Art. 3.3B
c. Size and location of structural members	NR	P	P						Art. 3.3F
d. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction	NR	P	C						Sec. 1.2.1(e), 6.2.1, & 6.3.1
e. Welding of reinforcement	NR	C	C						Sec. 6.1.6.1.2
f. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F (4.4°C)) or hot weather (temperature above 90°F (32.2°C))	NR	P	P						Art. 1.8 C & 1.8 D
g. Application and measurement of prestressing force	NR	C	C						Art. 3.6B
h. Placement of grout and prestressing grout for bonded tendons is in compliance	NR	C	C						Art. 3.5 & 3.6 C
i. Placement of AAC masonry units and construction of thin-bed mortar joints	NR	C(b)/P(c)	C						Art. 3.3B.9 & 3.3F.1b
4. Observe preparation of grout specimens, mortar specimens, and/or prisms	NR	P	C						Art. 1.4B.2 a, 3, 1.4B.2b.3, 1.4 B.2 c, 3, 1.4B.3, & 1.4B.4

<sup>(a)</sup> Frequency refers to the frequency of inspection, which may be continuous during the listed task or periodically during the listed task, as defined in the table. NR=Not Required, P=Periodic, C=Continuous

<sup>(b)</sup> Required for the first 5000 square feet (465 square meters) of AAC masonry.

<sup>(c)</sup> Required after the first 5000 square feet (465 square meters) of AAC masonry.

16

## STRUCTURAL MASONRY SPECIAL INSPECTIONS

- ◆ **Duties and Responsibilities of the Inspection Agency**
  - ❖ Provide inspection and material testing reports to the Owner/Architect/Engineer/Contractor
  - ❖ Promptly notify the contractor of items of non-conformance
    - ❖ Monitor non-conforming items and escalate if necessary
  - ❖ Provide a final signed report indicating the work requiring special inspection was performed in accordance with the approved documents and that any non-conforming items have been resolved to the satisfaction of the design professional.
- ◆ **Duties and Responsibilities of the Contractor**
  - ❖ Provide safe access for the special inspection agency
    - ❖ Provide adequate notification of when work is going to take place and when items requiring special inspections will be available for review
    - ❖ Furnish labor to assist the special inspection agency with the handling of materials while on the project site
    - ❖ Provide masonry materials for testing
  - ❖ "The use of testing and inspection services does not relieve the Contractor of the responsibility to furnish materials and construction in full compliance."
  - ❖ Provide submittals that show the provided masonry materials meet or exceed the project specifications.



17

## STRUCTURAL MASONRY SPECIAL INSPECTIONS

- ◆ **Typical Inspection Items**
  - ❖ Preparation of Mortar and Grout
    - ❖ Check proportions
    - ❖ Measuring amount of water?
  - ❖ Thickness of Bed and Head Joints
  - ❖ Typical Details at Corners and T-Intersections
  - ❖ Vertical Reinforcing Steel Placement and Lap Splice
  - ❖ Horizontal Joint Reinforcement and Bond Beams
  - ❖ Grout Space clear of mortar
  - ❖ During Grouting
    - ❖ Maximum grout lift – Clean Outs needed?
    - ❖ Keep grout down a couple inches for key
  - ❖ Hot/Cold Weather Placement/Protection Plan



18

## STRUCTURAL MASONRY SPECIAL INSPECTIONS

- ◆ **Typical Field Testing and Sampling**
  - ❖ **During Grouting**
    - ❖ Slump (ASTM C143) and Temperature (ASTM C1064)
    - ❖ Compressive Strength Prisms (ASTM C1019)
      - › Difficult and requires coordination
  - ❖ **Mortar Sampling**
    - ❖ 2x2 cubes
    - ❖ Do NOT have to meet ASTM C270 strength requirements
    - ❖ Best to use to establish consistency
  - ❖ **Assembly Strength  $f'_m$  – CMU Prisms (ASTM C1314)**
  - ❖ **Individual Unit Sampling – (ASTM C90/C140)**



19

## REINFORCED CONCRETE SPECIAL INSPECTIONS

### Chapter 17 – Section 1705.3

#### 1705.3 Concrete construction. INSIGHTS

*Special inspections* and tests of concrete construction shall be performed in accordance with this section and Table 1705.3.

**Exceptions:** *Special inspections* and tests shall not be required for:

1. Isolated spread concrete footings of buildings three stories or less above *grade plane* that are fully supported on earth or rock.
2. Continuous concrete footings supporting walls of buildings three stories or less above *grade plane* that are fully supported on earth or rock where:
  - 2.1. The footings support walls of *light-frame construction*.
  - 2.2. The footings are designed in accordance with Table 1809.7.
  - 2.3. The structural design of the footing is based on a specified compressive strength,  $f'_c$ , not more than 2,500 pounds per square inch (psi) (17.2 MPa), regardless of the compressive strength specified in the *approved construction documents* or used in the footing construction.
3. *Nonstructural concrete* slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (1.03 MPa).
4. Concrete foundation walls constructed in accordance with Table 1807.1.6.2.
5. Concrete patios, driveways and sidewalks, on grade.



**IBC 2021 References ACI 318-19**



20



# REINFORCED CONCRETE SPECIAL INSPECTIONS

TABLE 1705.3

REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD*	IBC REFERENCE
1. Inspect reinforcement, including prestressing tendons, and verify placement.	—	X	ACI 318: Ch. 20, 25.2, 26.3, 26.6.1-26.6.3	—
2. Reinforcing bar welding: a. Verify weldability of reinforcing bars other than ASTM A796; b. Inspect single-pass fillet welds, maximum $r_{1/4}$ ; and c. Inspect all other welds.	— — X	X X —	AWS D1.4 ACI 318: 26.6.4	—
3. Inspect anchors cast in concrete.	—	X	ACI 318: 17.8.2	—
4. Inspect anchors post-installed in hardened concrete members: <sup>†</sup> a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads. b. Mechanical anchors and adhesive anchors not defined in 4.a.	X —	— X	ACI 318: 17.8.2.4 ACI 318: 17.8.2	—
5. Verify use of required design mix.	—	X	ACI 318: Ch. 19, 26.4.3, 26.4.4	1904.1, 1904.2
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C31 ASTM C172	—
7. Inspect concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 26.5, 26.12 ACI 318: 26.5	—
8. Verify maintenance of specified curing temperature and techniques.	—	X	ACI 318: 26.5.3-26.5.5	—
9. Inspect prestressed concrete for: a. Application of prestressing forces; and b. Grouting of bonded prestressing tendons.	X X	— —	ACI 318: 26.10	—
10. Inspect erection of precast concrete members.	—	X	ACI 318: 26.9	—
11. For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category C, D, E or F, inspect such connections and reinforcement in the field for: a. Installation of the embedded parts b. Completion of the continuity of reinforcement across joints. c. Completion of connections in the field.	X X X	— — —	ACI 318: 26.13.1.3 ACI 550.5	—
12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5.	—	X	ACI 318: 26.13.1.3	—
13. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 26.11.2	—
14. Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 26.11.1.2(b)	—

For SI: 1 inch = 25.4 mm.  
 a. Where applicable, see Section 1705.13.  
 b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.



21

# REINFORCED CONCRETE SPECIAL INSPECTIONS

- ◆ Table 1705.3 identifies Continuous vs. Periodic Inspections
  - ❖ Continuous is full time observations during all phases of the installation of the work.
  - ❖ Periodic is part time observations during the work but present when an area is ready for review.
- ◆ Continuous Inspection Items
  - ❖ Welding of Reinforcing Steel
  - ❖ Post Installed Concrete Anchors
    - › Adhesive – sustained tension
  - ❖ Concrete Placement
  - ❖ Prestressing/Post Tensioning

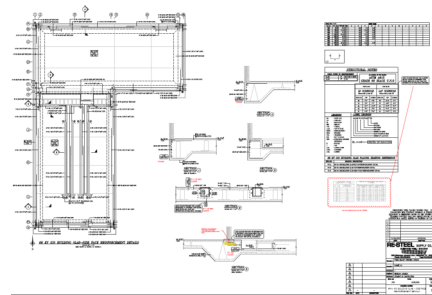


22

## REINFORCED CONCRETE SPECIAL INSPECTIONS

### • Approved Documents

- Approved Concrete Mix Design(s)
- Structural Drawings – Latest Revision
- Approved Reinforcing Steel Placement Drawings
- Project Specifications
- Anchor Bolt and Embedment Drawings
- Manufacturer's Printed Installation Instructions



### • Preconstruction Meeting

- Review available documents
- Establish inspection schedule
- Review curing locations
- Review hot/cold weather plans
- Report Distribution List

23

## REINFORCED CONCRETE SPECIAL INSPECTIONS

### ♦ Typical Inspection Items

- ♦ Placement of Reinforcing Steel
  - ♦ Quantity, size, grade, spacing, clearance
- ♦ Formwork Dimensions
- ♦ Lap Splice lengths and locations
- ♦ Embedded items
  - ♦ Anchor Bolts
  - ♦ Bearing Plates
- ♦ Post Installed Adhesive and Mechanical Anchors
- ♦ Placement and Consolidation of Concrete
- ♦ Protection and Curing (Hot/Cold Weather)
- ♦ Sampling and Field Testing



24

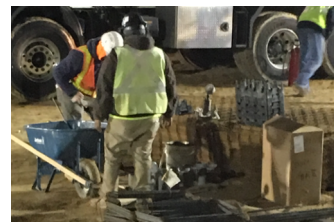
## REINFORCED CONCRETE SPECIAL INSPECTIONS

### Material Testing and Inspection

- ❖ Critical component to concreting in all weather but most important in the extremes
- ❖ Provides data that is representative of the material placed for both compliance with the project specifications and entry into service.



- ❖ American Concrete Institute Certifications
  - ❖ ACI Flatwork Finisher
  - ❖ ACI Concrete Field Technician Grade 1
  - ❖ ACI Concrete Construction Special Inspector
  - ❖ Post Installed Concrete Anchor Installation



25

## REINFORCED CONCRETE SPECIAL INSPECTIONS

- ❖ Sampling of Concrete: ASTM C172
  - ❖ After addition of ALL water and admixtures
  - ❖ Representative sample from the middle of the batch
  - ❖ Frequency of sampling is determined by specifications
- ❖ Plastic Testing
  - ❖ Air Entrainment: ASTM C231 or ASTM C173
  - ❖ Slump: ASTM C143
  - ❖ Temperature: ASTM C1064
  - ❖ Unit Weight: ASTM C138
- ❖ Cylinders for Compression (ASTM C31)
- ❖ Beams for Flexural (ASTM C31)
- ❖ Tracking of truck times
- ❖ Temperature Monitoring
  - ❖ Hot Weather
  - ❖ Cold Weather
  - ❖ Mass Concrete



26



## REINFORCED CONCRETE SPECIAL INSPECTIONS

### ASTM C31

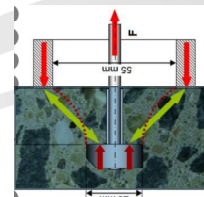
- ◆ **Standard Initial Field Curing**
  - ❖ Environment that is between 60-80F and can retain moisture
  - ❖ Cold Weather – Insulated Cooler with the lid closed
  - ❖ Hot Weather – Submerged in water
  - ❖ Shielded from direct sunlight
  - ❖ Minimum of 8 hours after final set
  - ❖ Maximum of 48-hours from date cast
- ◆ **Final Curing**
  - ❖ Saturated lime water bath
  - ❖ Moist room
- ◆ **Compression Testing**
  - ❖ ASTM C39



27

## REINFORCED CONCRETE SPECIAL INSPECTIONS

- ◆ **Evaluation of Compressive Strength**
  - ❖ Average of (3) 4x8 cylinders at 28-days exceeds design strength?
    - ❖ Yes – All Good
    - ❖ No – Might be OK, Might Not be OK
  - ❖ First Step
    - ❖ ACI 318 running average of 3
      - Every mean exceeds  $f'_c$  and no individual strength is below 500 psi (or 10% if  $f'_c$  is > 5000 psi)
      - If Pass – OK
      - If Fail – Core
  - ❖ NDT Testing to determine where to core
    - ❖ Swiss Hammer
    - ❖ Ultrasonic Pulse Velocity
    - ❖ CAPO
    - ❖ Windsor Probe
  - ❖ Core (ASTM C42)
    - ❖ Average of 3 cores exceeds 85% of design strength
    - ❖ No individual strength is below 75% of design strength
    - ❖ If Cores Pass – OK
    - ❖ If Cores Fail – EOR to review (removal is a possibility)



28

# SOIL/FOUNDATIONS SPECIAL INSPECTIONS

## Chapter 17 – Section 1705.6 - Soil

**1705.6 Soils.** INSIGHTS *Special inspections* and tests of existing site soil conditions, fill placement and load-bearing requirements shall be performed in accordance with this section and Table 1705.6. The *approved* geotechnical report and the *construction documents* prepared by the *registered design professionals* shall be used to determine compliance.

**Exception:** Where Section 1803 does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in-place dry density of the compacted fill is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D1557.

## Chapter 17 – Section 1705.7-9– Deep Foundations

### 1705.7 Driven deep foundations. INSIGHTS

*Special inspections* and tests shall be performed during installation of driven *deep foundation* elements as specified in Table 1705.7. The *approved* geotechnical report and the *construction documents* prepared by the *registered design professionals* shall be used to determine compliance.

### 1705.8 Cast-in-place deep foundations. INSIGHTS

*Special inspections* and tests shall be performed during installation of cast-in-place *deep foundation* elements as specified in Table 1705.8. The *approved* geotechnical report and the *construction documents* prepared by the *registered design professionals* shall be used to determine compliance.

### 1705.9 Helical pile foundations.

*Continuous special inspections* shall be performed during installation of *helical pile* foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by the *registered design professional* in responsible charge. The *approved* geotechnical report and the *construction documents* prepared by the *registered design professional* shall be used to determine compliance.



29

# SOIL/FOUNDATIONS SPECIAL INSPECTIONS

TABLE 1705.6 REQUIRED SPECIAL INSPECTIONS AND TESTS OF SOILS

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify materials below <i>shallow foundations</i> are adequate to achieve the design bearing capacity.	—	X
2. Verify excavations are extended to proper depth and have reached proper material.	—	X
3. Perform classification and testing of compacted fill materials.	—	X
4. During fill placement, verify use of proper materials and procedures in accordance with the provisions of the approved geotechnical report. Verify densities and lift thicknesses during placement and compaction of compacted fill.	X	—
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	—	X

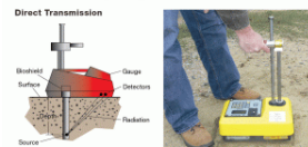


30

## SOIL/FOUNDATIONS SPECIAL INSPECTIONS

- ◆ **Typical Inspection Items**
  - ❖ Preparation of Subgrade
    - ❖ Visually classify soil and confirm consistent with Geotech Report
    - ❖ Proof Roll and look for soft zones
  - ❖ Compaction control verification
    - ❖ Nuclear Density Gauge
    - ❖ Sand Cone
  - ❖ Confirm sizes and depths of foundation excavations

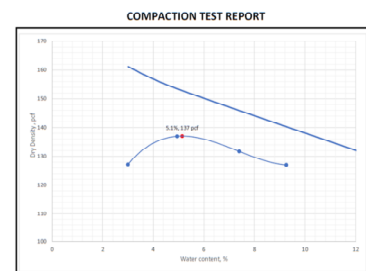
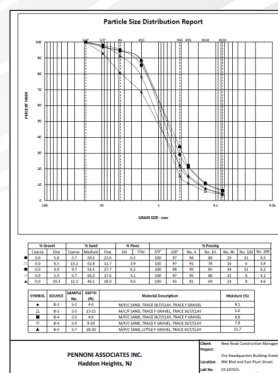
Moisture Density Gauge



31

## SOIL/FOUNDATIONS SPECIAL INSPECTIONS

- ◆ **Soil Laboratory Testing**
  - ❖ Gradation – Particle Size Distribution
  - ❖ Moisture – Density Relationship (Proctor)
  - ❖ Atterberg Limits
  - ❖ Moisture Content



32



## SOIL/FOUNDATIONS SPECIAL INSPECTIONS

### Troubleshooting Techniques

- **Remember, the Nuclear Density Gauge is a Gauge – Use it that way!**
  - Most issues with unstable soils is due to moisture content. The nuclear density gauge provides a moisture content of the soil. It can be used to determine how far from optimum moisture (high or low) the material is even before it is compacted.
  - This can save time when trying to use ambient conditions to dry the material or adding water to moisten.
- **Do I have the right proctor for the material being tested?**
  - Visual classification of the soil is just as important as the compaction test. The technician or geotechnical representative should be able to visually confirm that the material being placed is consistent with the gradation and classifications of the material.
  - Classifications typically consist of wording such as:
    - Brown – Fine/Medium/Coarse Sand, Little Fine Gravel, Trace Silt/Clay
    - 2A Modified
    - Recycled Concrete Aggregate (RCA)
    - Dense Graded Aggregate (DGA)
  - Due to the nature of manufactured imported materials, such as DGA and RCA, additional samples may be required because of variability of the constituents.
    - Proctor family curves – Based on multiple proctors of the same material from the same source



33

## QUESTIONS

Michael Padula, PE  
Chief Engineer

3100 Horizon Drive  
King of Prussia, PA 19046  
Mobile: 215-620-5832  
mpadula@pennoni.com



34