1

About AET

- Established in 1971
- Employee Owned
- Staff By Discipline:
  - Engineers, Geologists, Hydrogeologists, Technicians, Drilling, Environmental, NDT, Administrative, etc.
  - Total of 409 employees, which includes our branch offices in MN, ND, SD, WI, WY, (FL and IN for NDT Only)

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Special Inspections Applicable Code

Minnesota Building Code 2020 (Chapter 17)
International Building Code 2018 (In the Minnesota Code)
Other Manuals – Listed in Chapter 35 – Reference Standards
- American Concrete Institute 2014
- American Welding Society 2011
- American Society for Testing and Materials (Multiple Years)
  - Listed in Chapter 35 – Reference Standards

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Inspector Qualifications

1704.2.1 Special Inspector Qualifications

The special inspector shall provide written documentation to the building official demonstrating his or her competence and relevant experience or training. Experience or training shall be considered relevant when the documented experience or training is related in complexity to the same type of *special inspection* activities for projects of similar complexity and material qualities. These qualifications are in addition to qualifications specified in other sections of this code.

Minnesota Building Code (2015)

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Inspector Qualifications - Continued

In order to become an ICC (International Code Council) Inspector, there are experience and qualification requirements, continuing education requirements, and the need to pass an exam specific to the different areas of inspection.

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Inspector Qualifications - Continued

The following categories of certifications are presently available from ICC:

- Reinforced Concrete
- Prestressed Concrete
- Structural Masonry
- Structural Welding
- Structural Steel and Bolting
- Spray-Applied Fireproofing
- Soils

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Special Inspector – Technical

2. Definitions
   a) Refer to PART 1 of standard definitions.
   b) Cast-in-Place Concrete
      1) Technical I
         ACI Certified Grade I Inspector. Inspector shall be employed by a testing laboratory, under the direct supervision of a Technical III.
      2) Technical II
         ACI Certified Grade II Inspector. Inspector shall be employed by a testing laboratory, under the direct supervision of a Technical III.
      3) Technical III
         A civil/structural engineer regularly engaged in this type of work, with a minimum of 4 years experience and licensed in the State in which the project is located and is an employee of a qualified and approved testing laboratory. The licensed engineer shall review and approved all reports.
      4) Testing laboratory shall have C.C.R.L. certification at the National Bureau of Standards.

Reproduced from page 21 MNSCA/MN

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Inspection Frequency

The SER specifies at the beginning of the project the frequency of inspections required. The two frequencies given in IBC Chapter 17 (2006) are as follows:

"Special Inspections" – Continuous

The full-time observation of work requiring "Special Inspections" by an approved "SI" who is present in the area where the work is being performed.

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Inspection Frequency - Continued

"Special Inspection" – Periodic

The part-time or intermittent observation of work requiring "Special Inspections" by an approved "SI" who is present in the area where the work has been or is being performed, and at the completion of the work.

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Reporting

In IBC, Chapter 17, Section 1704.2.4, *"Report Requirements,"* the reporting requirements are given. The "SI" should keep records of inspections and reports of their observations should be furnished to the Building Official and registered design professional in responsible charge.

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Final Report

In IBC, Chapter 17 (1704.2.4), the requirements of this report

are given as follows:

"A final report documenting required "Special Inspections" and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the Building Official prior to the start of the work."

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Reinforced Concrete

- Table 1705.3 – "Required Verification and Inspection of Concrete Construction

TABLE 1705.3
REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD[a]	IBC REFERENCE
1. Inspection of reinforcing steel, including prestressing tendons, and placement.	—	X	ACI 318: 3.5, 7.1-7.7	1910.4
2. Inspection of reinforcing steel welding in accordance with Table 1705.2.2, Item 2b.	—	—	AWS D1.4 ACI 318: 3.5.2	—
3. Inspection of anchors cast in concrete where allowable loads have been increased or where strength design is used	—	X	ACI 318: 8.1.3, 21.2.8	1908.5, 1909.1
4. Inspection of anchors post-installed in hardened concrete members[b]	—	X	ACI 318: 3.8.6, 8.1.3, 21.2.8	1909.1
5. Verifying use of required design mix.	—	X	ACI 318: Ch. 4, 5.2-5.4	1904.2, 1910.2, 1910.3
6. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C172 ASTM C31 ACI 318: 5.6, 5.8	1910.10
7. Inspection of concrete and shotcrete placement for proper application techniques.	X	X[c]	ACI 318: 5.9, 5.10	1910.6, 1910.7, 1910.8
8. Inspection for maintenance of specified curing temperature and techniques.	—	X	ACI 318: 5.11-5.13	1910.9
9. Inspection of prestressed concrete: a. Application of prestressing forces b. Grouting of bonded prestressing tendons in the seismic force-resisting system.	X X	— —	ACI 318: 18.20 ACI 318: 18.18.4	— —
10. Erection of precast concrete members.	—	X	ACI 318: Ch. 16	—
11. Verification of 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: 6.2	—
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 6.1.1	—

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Referenced Standards

Refer to: ACI 318, ASTM C31, C172, and Chapter 19 IBC

Part 3 – 318 – Chapter 3-7 (Cross Reference 117 Tolerances)

Part 1 – 117 – Section 1-4 – 46 pg

- Section 1 – General
- Section 2 – Materials
- Section 3 – Foundations
- Section 4 – Cast-in-Place Concrete For Buildings

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Reinforced Concrete

Review Project Drawings – (Beam Schedule)

15

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Reinforced Concrete

Check Current Drawings – "For Construction"

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Reinforced Concrete

Periodic Basis – Check Formwork Dimensions

17

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Reinforced Concrete

Periodic Basis – Forms Adequately Braced

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Reinforced Concrete

Observing Reinforcing Bars – Free of dirt, excessive rust, damage – Check bar grade

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Reinforced Concrete

Surface Rust
ACI 318 – 7.4

20

20

Reinforced Concrete

Measuring Reinforcing Bar Thickness – Size Check

21

21

Reinforcement Cover

ACI 318 7.5 "d" Design Value

Not for construction (ACI 117 is referenced for placement in commentary)

d = distance from extreme compression fibers to centroid of longitudinal compression reinforcement

22

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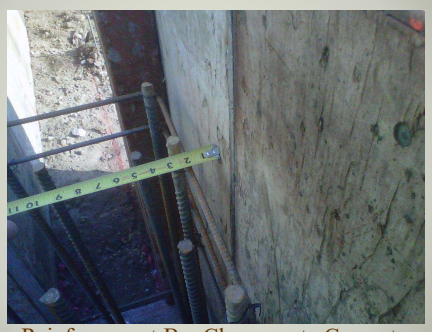
Reinforced Concrete



Reinforcement Bar Clearance to Concrete Surface (Chair/Spacer needed)

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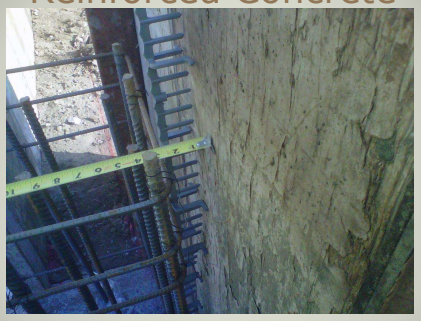
Reinforced Concrete



Observe Proper Clear Distances between Reinforcing Bars and Concrete Surface (Chair used)

24

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Reinforced Concrete

Observe Reinforcing Bar Laps for Length and Stagger

25

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Required Information

On Drawings
ACI 318, Chapter 12
Class A 1.0 L_d
Class B 1.3 L_d
L_d = Tensile Development Length
318 – Chapter 1, Paragraph 1.2 Contract Documents
"Location and Length of Lap Splices"
Tolerance 3-11 = -1 inch
14 & 18 = -2 inch

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Reinforced Concrete

Observe Reinforcing Bar Heights and Clearances

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Reinforced Concrete

Observe for Proper Reinforcing Bar Lengths

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Reinforced Concrete

Observe that Reinforcing Bar is adequately chaired, tied and does not shift/move during concrete placement.

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Reinforced Concrete

Check Reinforcing Bar Spacing

ACI 117 – 2.2.5

30

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Reinforced Concrete

Horizontal/Vertical Spacing and Corner Bars

31

31

Reinforced Concrete

Check Vertical Dowel Lap Lengths

ACI 318 – 7.5
Accurately placed and adequately supported before concrete is placed

32

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Reinforced Concrete

Hooked Dowels – "Wet Stuck"

33

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Reinforced Concrete

Vertical Bars – Outside Column Stirrups
Fix: Remove Stirrup and replace with the correct size.

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Reinforced Concrete

Cut Reinforcing Bars

35

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Reinforced Concrete

Grade beam for structural slab – Cut reinforcing bars.
Contacted SER
Fix: Add straight bars at an angle.

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Reinforced Concrete

Short Bars
Embedment Plate Placement

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Reinforced Concrete

Bars Being Moved

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Reinforced Concrete

Beam Steel Too Short

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39

Reinforced Concrete

Beam Steel Placed Correctly

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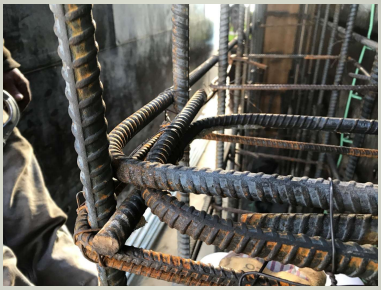
Reinforced Concrete



Clearance and Bend Diameter Conflict

41

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Reinforced Concrete

Spacing/Clearance – The Greater of One Bar Diameter or 1 Inch

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Reinforced Concrete

Solution; Vertical Staggering

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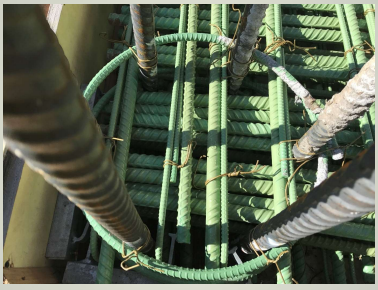
Reinforced Concrete



Bar Clearance

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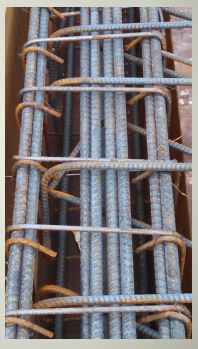
Reinforced Concrete

4 Horizontal Bars Too Close

Bundled Bars OK if Approved by Designer



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Reinforced Concrete

Difficult Stirrup Placement

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Reinforced Concrete

Replacement Embedment Plate

47

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Reinforced Concrete

Holes Drilled in Column

48

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Reinforced Concrete

Hole is Oversized for the Reinforcement

49

49

Reinforced Concrete

Solution; High Strength Grout and/or Redrilling

50

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Reinforced Concrete

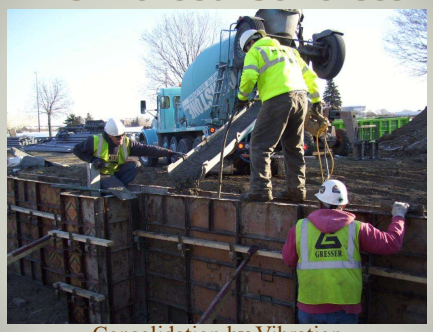
Observe placement of concrete for segregation and consolidation.

ACI 318 – 5.10 "Deposit as nearly as practical in its final position"

51

51

Reinforced Concrete



Consolidation by Vibration

52

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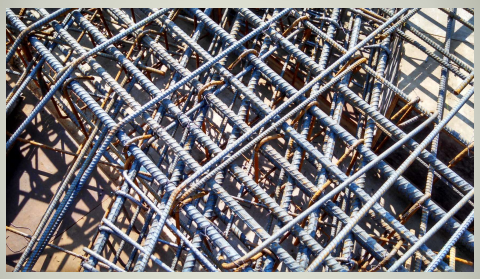
Reinforced Concrete



Congested Reinforcement

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Reinforced Concrete

Congested Reinforcement

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Reinforced Concrete

Pumping concrete with a vibratory screed.
Chaired reinforcing mats.

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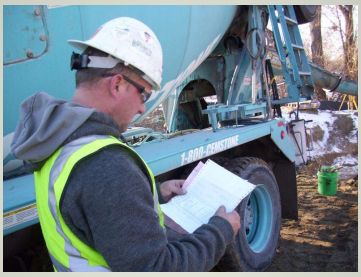
Reinforced Concrete



Check that the specified mix placed for placement location/structural element. Also review batch ticket information such as batch time, amount of water available to add, etc.

ACI 318 – 5.10

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56

Reinforced Concrete

Concrete temperature – Each set of cylinders, hourly during hot/cold weather placement.

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Reinforced Concrete

Slump Test (ASTM C143)
Measuring Slump

58

58

Reinforced Concrete

Air Entrainment Test (ASTM C143)
First Batch, then every cylinder set.

59

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Reinforced Concrete

Observe that proper curing and hot/cold weather practices are being followed.

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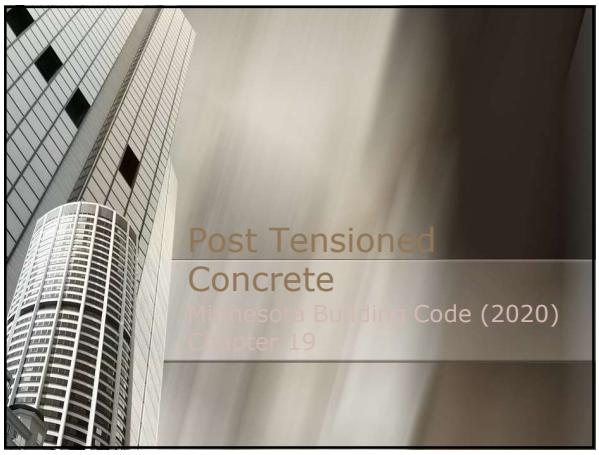

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Post Tensioned Tendons

Tendons with conduits

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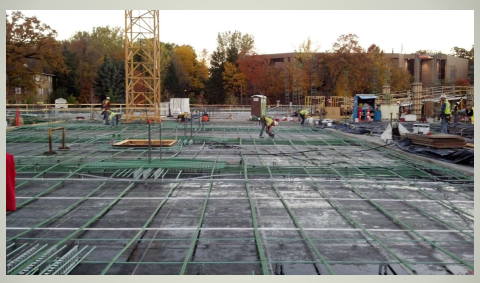
Post Tensioned Tendons

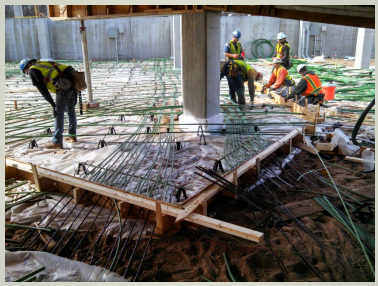


Note drape and added reinforcing over columns and beams

63

63

Post Tensioned Tendons



Note drape, sweep, and bulkheads

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Post Tensioned Tendons

Slab Penetrations blocked out.

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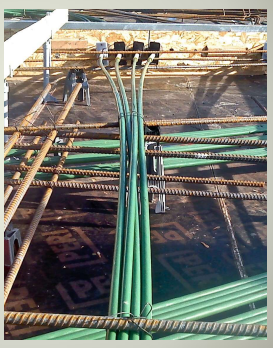
Post Tensioned Tendons

Anchor points. Note the rebar in front of the anchors.



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Post Tensioned Tendons

Damaged Tendon

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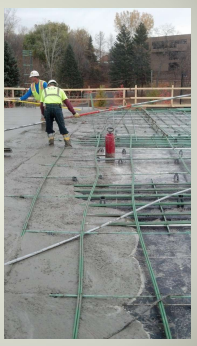
Post Tensioned Tendons

Trying not to displace the tendons during concrete placement



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Post Tensioned Tendons

Temperature probes for maturity are only valid for the specific mix that was tested.

69

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Post Tensioned Tendons

Cast in place punch out cylincores (CIPPOC's). With probe

70

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Post Tensioned Tendons

CIPPOC's after pour

71

71

Post Tensioned Tendons

Marking tendons prior to stressing

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72

Post Tensioned Tendons

Stressing

73

73

Post Tensioned Tendons

PT Blowout due to cold concrete

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Post Tensioned Tendons

PT Blowout due to cold concrete

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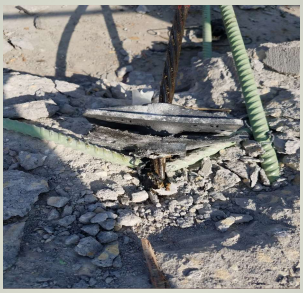
Post Tensioned Tendons



PT Blowout due to cold concrete

76

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Post Tensioned Tendons

Detensioning

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Post Tensioned Tendons

Repair

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Post Tensioned Tendons

Blowout repair

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79

Post Tensioned Tendons

Added bar in repair

80

80

Post Tensioned Tendons

Grease Caps on tendon ends

81

81

Post Tensioned Tendons

Leaking cap, needs replaced

82

82

Post Tensioned Tendons

Note steel puncture in cap

83

83

Post Tensioned Tendons

Repaired caps

84

84

Post Tensioned Tendons

Need to be dried

85

85

86

Hot Weather

ACI 305-R10 Hot Weather

- Problems
- Water Demand
- Slump Loss
- Faster Set
- Shrinkage & Thermal Cracking

Damage can't be fixed

Must adjust to account for RH, wind, and temperature

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87

Cold Weather

ACI 306-R10 Cold Weather

- Problems

- Water Demand

- Freezing leading to strength loss

- Slower Set

- Shrinkage & Thermal Cracking

Damage can't be fixed

Must adjust to account for RH, wind, and temperature

Concrete temperature must not change by more than 20 F in 24 Hours

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Cold Weather

Unless concrete element is more than 6 feet thick, temperature must be above 55 degrees F when placed.

Reinforcing larger than #7 bar must be heated to at least 10 degrees F

Must be protected from freezing until at least 500 psi.

Must attain minimum strengths before load is applied

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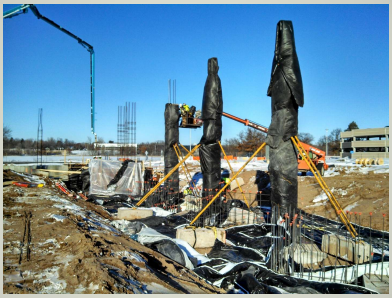
Cold Weather

Wrapped with heat tubes

90

Cold Weather



New column placement with insulation blankets placed

91

91

Cold Weather

Inadequate protection caused blowout

92

92

Cold Weather

Melt ice off before placing

93

93

Cold Weather

Protect Tendons

94

94

Thank you for the opportunity to speak with you today.

Further Questions? Please contact us.

Derek Van Heuveln

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