28 Day Concrete Strength -Proactive vs. Reactive PRESENTED TO: MN CONCRETE FORUM

JOHN HAUPT - NOVEMBER 8, 2017

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Low 28 Day Compression Strength

NOW WHAT?

Preparing for the Concrete **Placement**

- Preconstruction Meeting
 Discuss placement, testing, and other issues
- Mix Designs
- Submitted for approval by the design team prior to placement.

 ID Number, size of aggregate, cementous material, water cement ratio.

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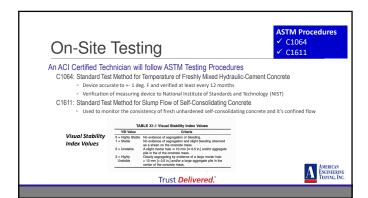
- Weather Issues

- Logistics
 How it is placed on site after it leaves the truck
- Sampling Location
 From truck or end of placement



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On	-Site Testing	ASTM Procedures ✓ C31 ✓ C231/173 ✓ C143
C31:	Certified Technician will follow ASTM Testing Procedures Standard Practice for Making and Curing Test Specimens in the Field Standard Test Method for Air Content of Freshly Mixed Concrete by the Press Most commonly used Calibration not to exceed three months	ure Method
C173:	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volum Used lightweight aggregate mixes	netric Method
C143:	Standard Test Method for Slump of Hydraulic-Cement Concrete - Considered applicable to plastic concrete having coarse aggregate up to 1-1/2 inch ir - Condition of mold may influence test results, calibration at least annually	n size
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Site Storage and Transportation of Test Samples MnDOT Safe Initial Curing Intermediate Transportation of **Curing Period** Test Specimens Transport 8 hours after initial set Protect samples Transportation time less than 4 hours Store immediately after casting Temperature 60-80 deg. F < 6000 psi 68-78 deg. F > 6000 psi Time on-site up to 48 hrs. Specification 2461.3.G.5 Time period: less than 7 days A AMERICAN ENGINEERING TESTING, INC. Trust Delivered."



Laboratory Testing

- Certified Lab / Calibrated Equipment
- Final Curing ASTM C31
- Testing C39 or C78
- Capping / Pad Caps
 Alignment
- Size measurements
- Load rate; 35 +- 7psi per second

Diameter (in)	Low Rate (lb/m)	High Rate (lb/m)	Average Rate (lb/m	
4	21,120	31,680	26,400	
6	47,480	71,220	59,350	

Review of Strength Test Results

- To Day Test Results
 Indicator test: typically a 7day strength test will achieve between 67% to 75% of the 28 day test. Depends on amount and types cementous material content.
- 28 Day Average Strength
 ACI 318-14: average of two 6x12in or three 4x8in cylinders of the same sample tested at 28 days, or test age designed for f'_c
- Break Types
 ASTM C39 list six types of fracture types.
- Possible Reasons for Low Strength
- Reviewing of Field Test Results
 Air content, concrete temperature, slump



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Extended Tests

- 56 Day Tests
- If 28 day test is low, the Hold Cylinder is tested.
- Slow Strength Gaining Concrete
- · Used in mass concrete applications.
- Compressive strength for acceptance is usually tested at 56 or 90 days.

ACI 318-14 Chapter 26 - Construction Documents and Inspection

- Qualified Testing Staff
 ACI Grade 1 Certified concrete field testing technician per ASTMC1077, or equivalent program.
- 26.12.3.1 (b)
- Strength of concrete is satisfactory if both requirements are met:
 every arithmetic average of any three consecutive tests equals or exceeds I'c.
- on strength test falls below f_c by more than 500psi when f_c is 5000psi or less; or by more than 0.10 f_c if f_c exceeds 5000 psi

Set Number	28 Day Lab Cure	28 Day Lab Cure	28 Day Average	Running Average
2	5630	5650	5640	
3	4760	4810	4790	
4	3870	3890	3880	4770
6	4020	4100	4060	4240
	4060	4020	4040	2000

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ACI 318-14 Chapter 26 – Construction Documents and Inspection

- Chapter 27.4 Load Testing
- Not used much for new concrete
- Can determine the capacity of a structure with questionable strength
 New or additional loading

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	Concrete Strength (ACI 214.4R) • Core Location: bottom of the structure is stronger than top • Core Orientation: lower strength when measured parallel to the casting plane
ASTM C42 – Testing Concrete	Core Size Use 4 in. core bit with a diameter at least 3.70 in., or at least 2X nominal size of course aggregate which ever is larger.
Concrete Cores and Beams	Direction of Drilling Report should state the direction of the load on the specimen with respect to the horizontalicasting plane of the concrete as placed.
	Storage
	 After coring, wipe off surface. Place and keep in plastic bags or nonabsorbent containers at all times except during preparation for a maximum time of 2 hours to permit capping before testing.

Length (ASTM C174)

If the core is used to determine the thickness of pavements, slabs wall or other structural elements, use ASTM C174 procedures.

Density

Concrete
Cores and
Beams
(continued)

Length to Diameter

If the ratio of length to diameter (L/D) of the specimen is 1.75 or less, correct the result by multiplying it by the appropriate factor given in the table in Section 7.9.1. Lengths less than its diameter after capping shall not be tested.

Capping

Perpendicularly and planerees of the ends of the core needs to neet the speciment of ASTM C1231.

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ASTM C42 —
Testing
Concrete
Cores and
Beams
(continued)

Petrographic Analysis		
Petrograhics is the microscopic analysis of concrete and its aggregate mixes.		
ASTM C457 Air Void Determines the air content of hardened concrete, void frequency, spacing factor, and paste-air ratio of the air-void system in hardened concrete.		
Other Tests Carbonation Aggregate Types		
Water Cement Ratio Blead Water Tracks Cracking	AMERICAN	
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Thombread		
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