
A Deep Dive Into the Concrete Testing Adherence Collaboration (CTAC) Program

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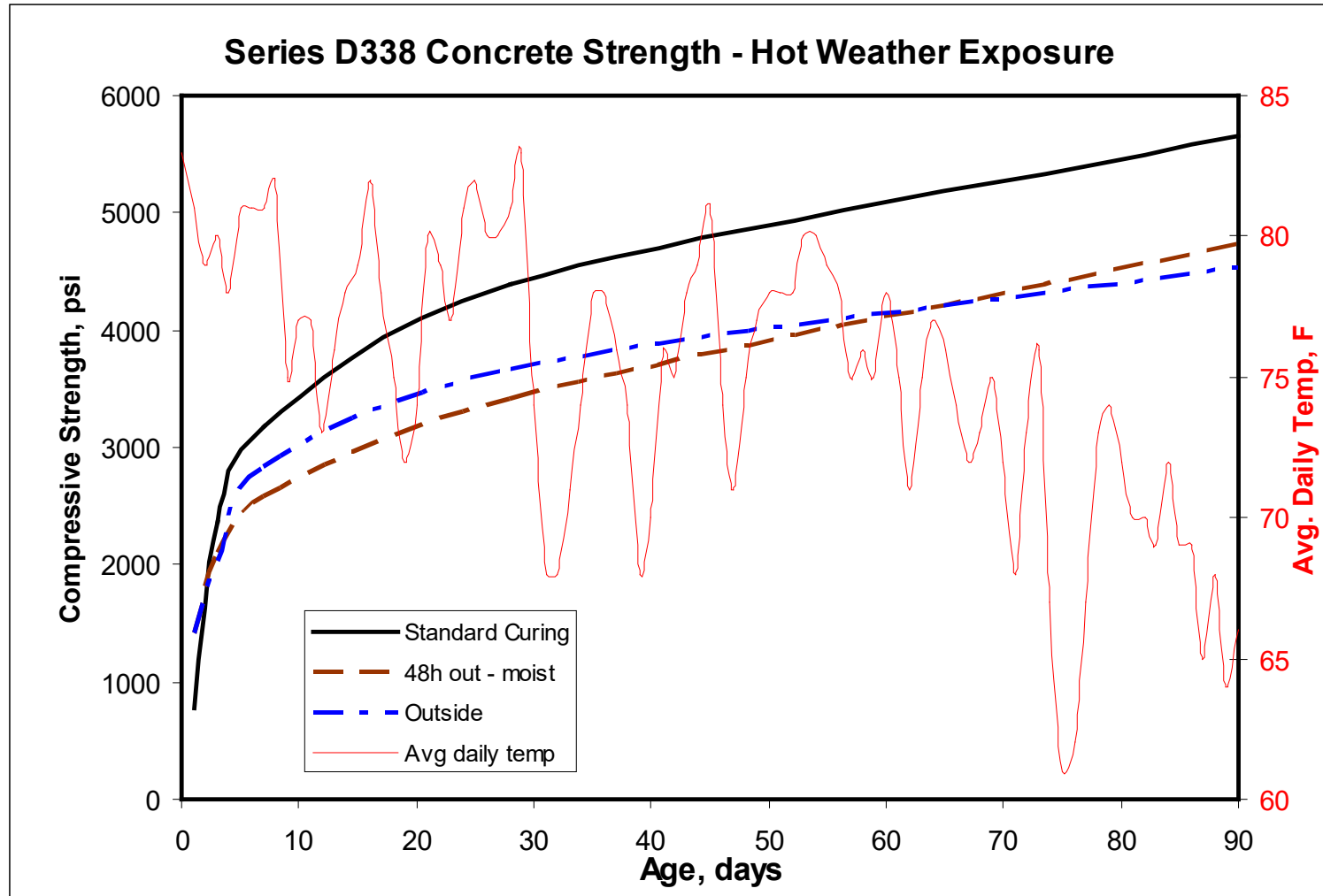
Purpose of Acceptance Testing

- Concrete supplied complies with specification
- Track Quality

Issues with Acceptance Testing

- Don't get test reports
- Non-standard initial curing of cylinders

Poor Initial Curing Cost Money!

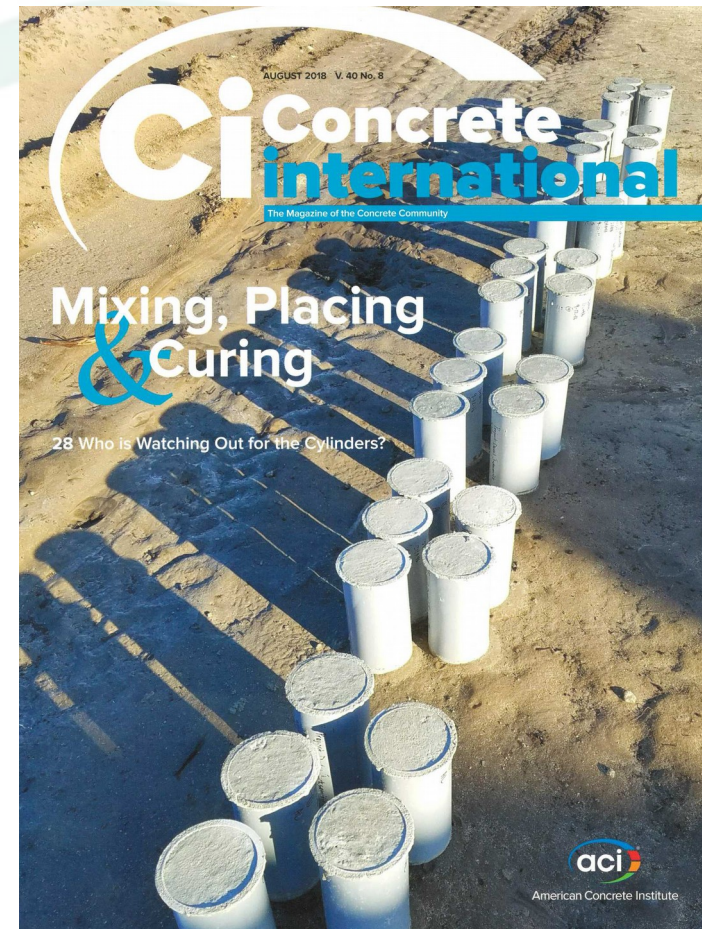


Responsibility for Curing Container

Who is Watching Out for the Cylinders? CI magazine, August 2018

Testing agency responsible for curing container

- Certified technicians
- Responsible to verify, and report on initial curing
- Most knowledgeable about test
- Clear chain of custody



MasterSpec December 2018 Version

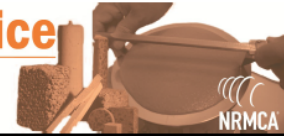
- Test lab provides **curing container** for acceptance testing and verify compliance with ASTM C31
- Test lab to report results to Owner, Architect, Contractor and concrete manufacturer **within 48 hours**.
- Test reports to include curing method and **maximum and minimum temperatures** during initial curing period.
- **Testing Agency qualified** in accordance with ASTM C1077, ASTM E329
- Field tests - **ACI Concrete Field Testing** Technician, Grade I.
- Laboratory tests - **ACI Concrete Strength Testing Technician** and Concrete Laboratory Testing Technician, Grade I. Laboratory supervisor – ACI Concrete Laboratory Testing Technician, Grade II.
- Contractor provides **daily access, secure space for storage**, initial curing, and field curing of test samples, **source of water** and continuous **electrical power** at project site
- **Pre-installation conference** requires review of curing

Evaluating Test Results

- What do Standards Say
- Responsibilities
- Reporting
- Data evaluation
 - Precision
 - Rating test results

Technology in Practice

What, Why & How?



TIP 16 - Evaluating Strength Test Results

This TIP provides guidance on evaluating strength test results used for acceptance of concrete to determine whether the testing procedures and test results indicate deficiencies in testing practices.

WHAT is the Purpose of Strength Testing?

One of the primary specified requirements for concrete is the compressive strength. Strength tests are typically performed by a third-party testing agency. It is imperative that the procedures for making and testing strength specimens conform to the standards. Improper testing can result in acceptable concrete being rejected, considerable cost for evaluation, and delay project schedules.

Strength tests are primarily performed to evaluate the quality of concrete supplied by a ready mixed concrete producer when strength requirements are stated in orders or specifications for ready mixed concrete. The strength test results are evaluated for compliance with the strength acceptance criteria. For this purpose cylindrical test specimens are cast from representative samples of concrete as delivered. The standard size of cylindrical strength test specimens is either 4 x 8 in. or 6 x 12 in. (100 x 200 mm or 150 x 300 mm). Strength test specimens for acceptance of concrete are subjected to standard curing, as defined in ASTM C31.

A common concern is whether strength of standard-cured cylinders represent the strength of concrete in the structure. This is not the purpose of these strength tests. Concrete structural design procedures are based on strength of standard-cured specimens with appropriate safety factors for structural capacity. Field-cured cylinders are sometimes used to estimate the in-place strength of concrete in the structure for post tensioning, formwork removal, determining adequacy of curing and protection, and for other reasons during construction. This TIP does not address results of field-cured cylinders.

WHAT are the Requirements for Testing Agencies (Laboratories)?

A testing agency for quality assurance testing is hired by the owner of the structure or by the contractor when required in the contract. The testing agency should conform to the requirements of ASTM C1077, *Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation*. This standard establishes a quality system for testing agencies and requires that technicians performing tests maintain certification for the tests that they perform. Certification requirements apply to field and laboratory technicians. The laboratory should be third-party inspected periodically and participate in proficiency sample testing programs. In some cases testing agencies maintain accreditation that assures compliance with this standard. The entity contracting for testing services should ensure that the agency selected has the required credentials and that they will provide reliable testing services. ACI 311.6, *Specification for Ready Mixed Concrete Testing Services*, is a good basis for this contract.

WHAT are the Requirements for Strength Testing?

Concrete samples should be obtained in accordance with ASTM C172. The sample should be obtained after all adjustments are made to the load. The sample should not be obtained from the initial discharge. From a truck mixer, ASTM C172 requires obtaining the sample from at least two portions of the discharge stream from the middle portion of the load. The sample should be thoroughly mixed and tests should be started within specific time limits. Molding cylinders should start within 15 minutes of obtaining the sample. ASTM C94 and ACI 301

Preconstruction checklist for Testing

Pre-Construction Checklist Concrete Acceptance Testing

Project Information

Project Name: _____ Location: _____

Project Representatives:

Owner: _____ Architect: _____

Structural Engineer: _____ Construction Manager: _____

General Contractor: _____ Concrete Supplier: _____

Testing Agency: _____ Other: _____

Concrete Mixture Design Submittals

Application / Placement location	Mix Code	Special Attributes (See codes)	Specification Requirements for Mixtures				Approved Y/N
			Strength / age	Max w/cm	Slump/Slump flow	Air (%)	

Concrete Quality Control/ Assurance (NOTE 1)

(Circle Yes or No)

Does Owner's testing/laboratory comply with ASTM C1077?

yes no*

If not, explain (is owner aware?): _____

Code and Standards Requirements For Acceptance Testing

<https://www.nrmca.org/quality/index.htm#acceptance>



Logger Info & Examples

Producers can request permission to use them in projects

- Prices from \$25 to \$200 +
- 1 channel to 4+ channels
- Memory – length of recording
- Waterproof
- USB, Bluetooth, Wi-Fi



CTAC Development Background and Long-term Problem

1

Improper concrete testing procedures in the field have a huge impact on construction projects:

- Timelines
- Project owner satisfaction

2

Producers are “Guilty, ‘til proven innocent” if breaks are low.

- Sometimes this is from problems with the concrete
- However, many times these breaks are the result of improper field sampling and cylinder care

3

Labs may be accredited and technicians certified, but doesn't mean ALL criteria is followed.

- QA and QC technicians performing testing differently

4

Therefore, Project and Work Plan created

- Assessors are most critical component for success

Strength
in Numbers

CTAC Development Confidence in the Field

- Technicians *should* be certified
- Technicians *should* know procedures
- Technicians *should* know WHY testing is needed and meaning of tests
- Managers *should* know who continuously tests correctly/consistently
- Managers *should* know if training is working
- Producers *should* know their results are not due to “poor” testing
- Owners *should* feel at ease with testing and results
- How do we assure this all happens...?

Strength
in Numbers



CTAC Development Adherence to Standards

- Purpose: **Minimize/eliminate the effects of false negative/positive concrete tests on producers, and the concrete construction industry.**
 - Meant to assist concrete producers, testing agencies, municipality agents, project owner representatives, and contractors.
- Goal: **Fair and Consistent Assessment of Ready Mixed Concrete**

Find faults in the system | Improve testing & training to validate results
...Then everyone gets the same page

- ASTM and ACI have established standards and guidelines to evaluate the performance of concrete, but not consistently followed or monitored:
 - RM Producer's Role (QC)
 - Testing Laboratory's Role (QA)
 - Owner/Third-party Inspectors (QA/QC)

CTAC Program Observation Input

NOT a “finger pointing” device!

- Website, iOS, and Android work identically
 - Input by ACI Certified and experience individuals
- Example as if we were in the field...

cricket [notification icons] 50% 4:24 PM



COLORADO READY MIXED
CONCRETE ASSOCIATION

Username

Password

Sign In



**Update to CTAC program logo
and name in apps in progress.*



Strength
in Numbers

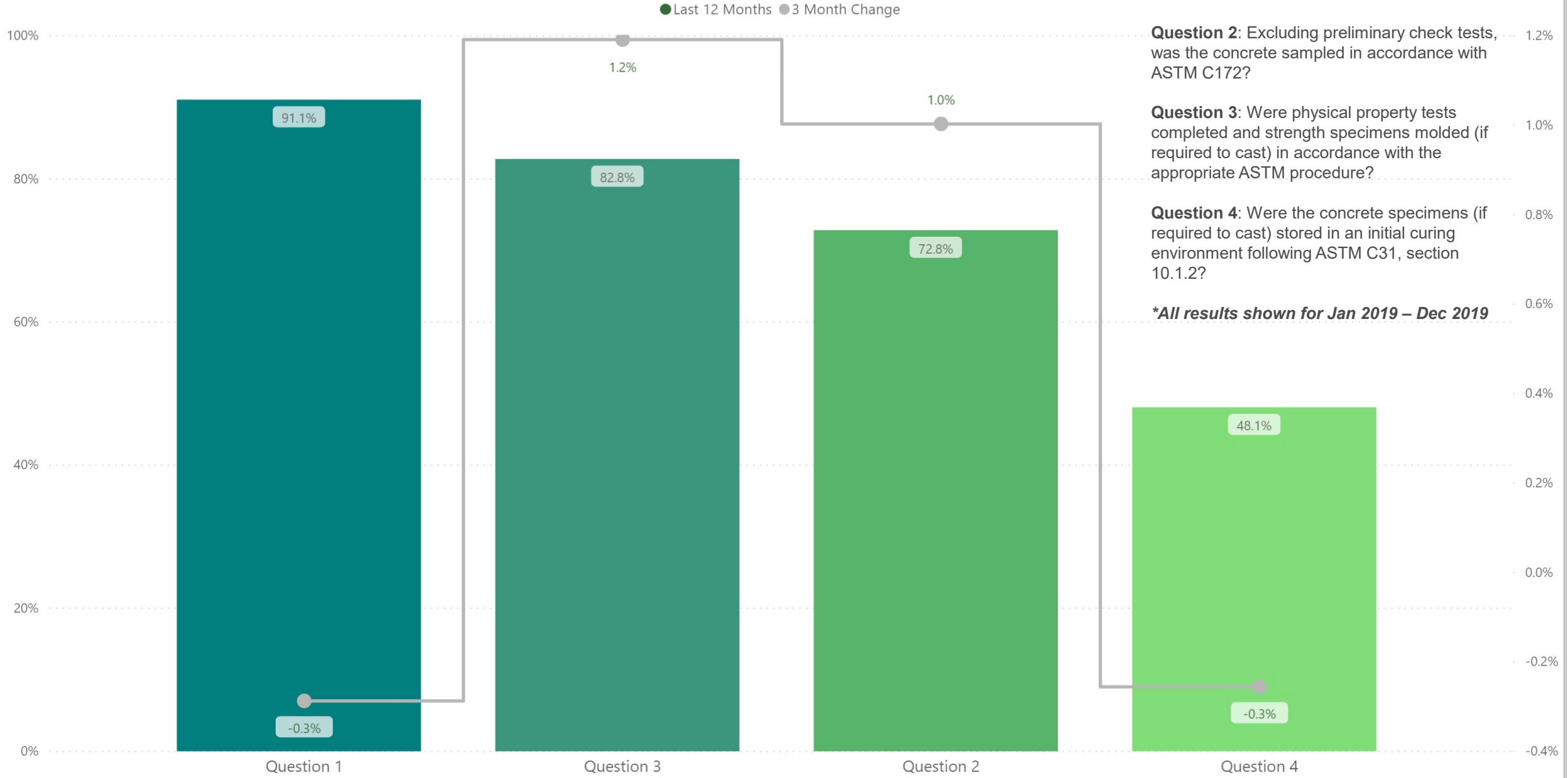
CTAC Program

Example on Andriod

Four Main Questions

- **Question 1:** Is the testing technician currently ACI Field I certified to test concrete?
 - **Sub-question:** What type of project?
- **Question 2:** Excluding preliminary check tests, was the concrete sampled in accordance with ASTM C172?
 - **Sub-question:** Where was sample taken?
 - **Sub-question:** If no, what sampling procedure was not followed?
- **Question 3:** Were physical property tests completed and strength specimens molded (if required to cast) in accordance with the appropriate ASTM procedure?
 - **Sub-question:** If no, what procedures were completed incorrectly and explanation of observation
- **Question 4:** Were the concrete specimens (if required to cast) stored in an initial curing environment following ASTM C31, section 10.1.2, including temperature monitoring?
 - **Sub-question:** What initial curing procedures were used, if any?
 - **Sub-question:** What temperature monitoring devices were used, if any?

PERCENTAGE OF EACH QUESTION MEETING REQUIREMENTS IN LAST 12 MONTHS



Question 1: Is the testing technician currently ACI Field I certified to test concrete?

Question 2: Excluding preliminary check tests, was the concrete sampled in accordance with ASTM C172?

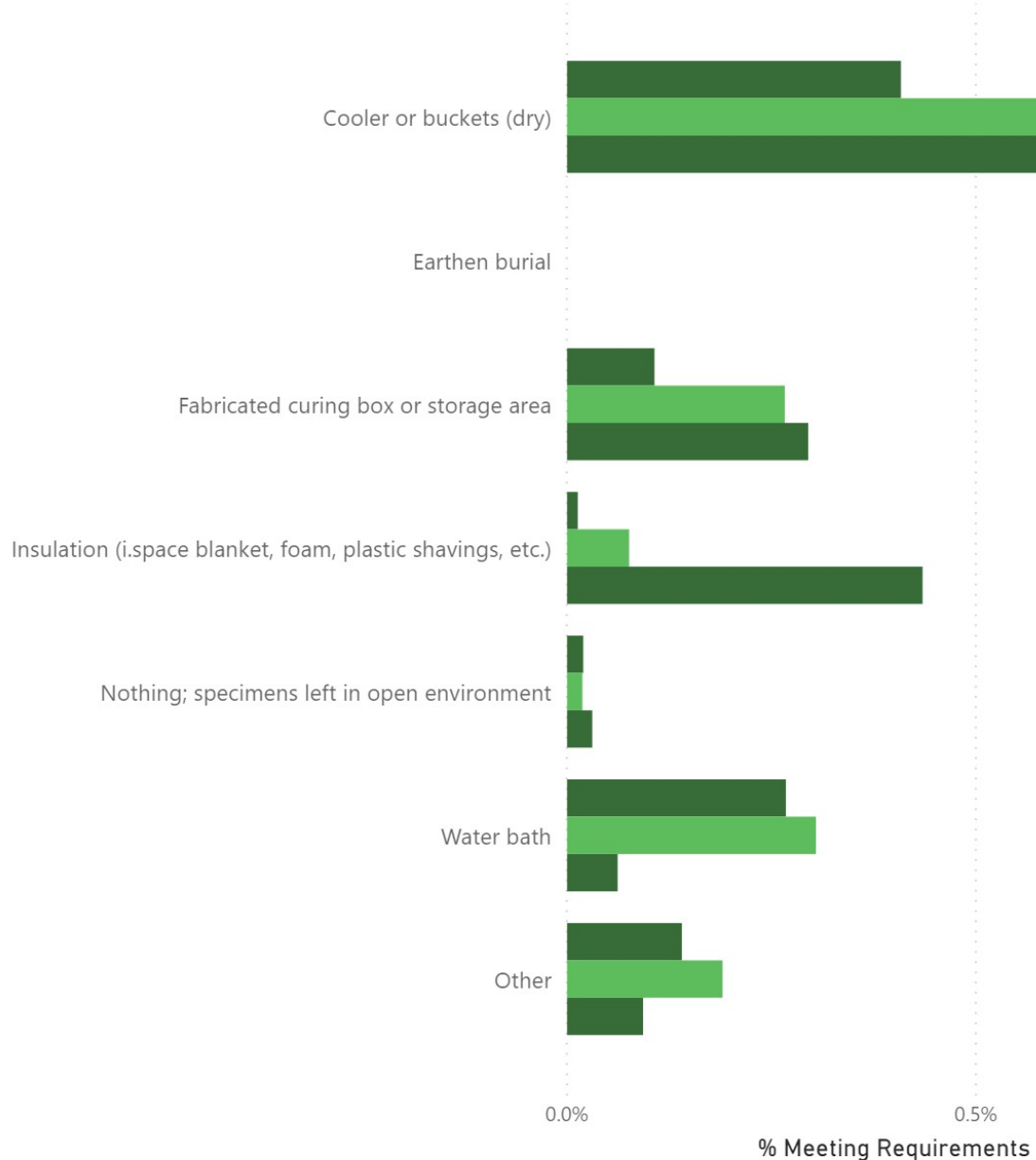
Question 3: Were physical property tests completed and strength specimens molded (if required to cast) in accordance with the appropriate ASTM procedure?

Question 4: Were the concrete specimens (if required to cast) stored in an initial curing environment following ASTM C31, section 10.1.2?

**All results shown for Jan 2019 – Dec 2019*

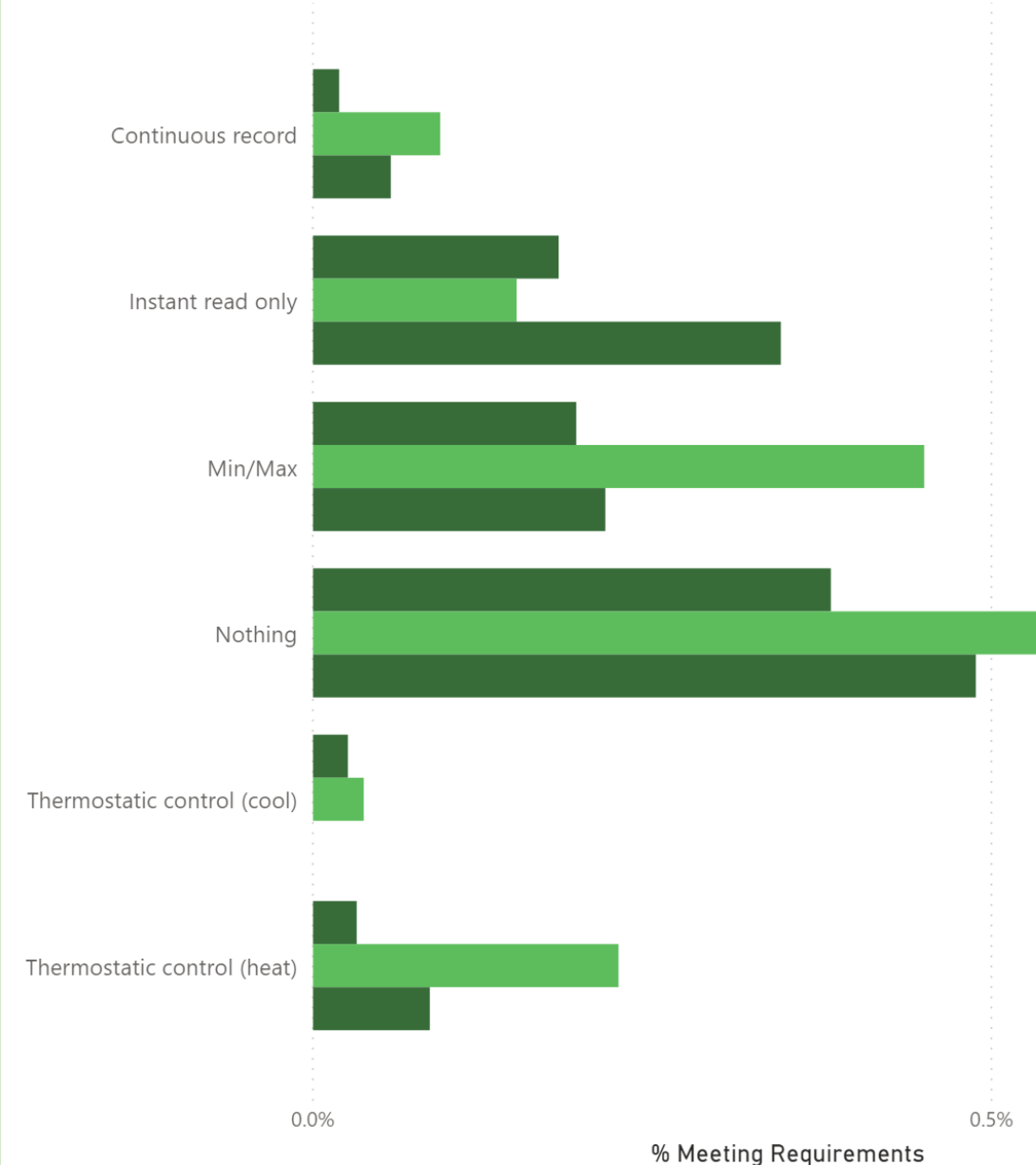
OBSERVATION OF INITIAL CURING ENVIRONMENT

● August 2019 ● October 2019 ● December 2019



TEMPERATURE MONITORING DEVICE USED

● August 2019 ● October 2019 ● December 2019



1 Is the testing technician currently ACI Field I certified to test concrete? **93.2%** **90.7%** **2.5%**

What type of project/site is concrete testing observed at?	Selected Company	Other Companies	Variance
Commercial/Industrial	67%	42%	25.2%
Federal/State	5%	22%	-16.3%
Local/Municipality	13%	24%	-10.5%
Other		0%	-0.1%
Private	4%	1%	3.4%
Residential	10%	11%	-1.7%

2 Excluding preliminary check tests, was the concrete sampled in accordance with ASTM C172? **66.0%** **74.1%** **-8.1%**

Where was the sample(s) collected from?	Selected Company	Other Companies	Variance
At end of mixer truck discharge; prior to pump/belt (if used)	75%	63%	11.8%
At point of placement; end of mixer truck discharge	22%	33%	-10.7%
At point of placement; end of pump/belt (if used)	2%	4%	-2.2%
Other	0%	0%	0.3%

Which of the following was observed?	Selected Company	Other Companies	Variance
Did not combine and remix	11%	10%	0.7%
Exceeding sample time allowance		0%	-0.1%
Incorrect location (outside middle 1/3rd of truck discharge)	6%	6%	0.2%
Incorrect portions/intervals sampled	7%	7%	0.5%
Incorrect sample size taken	10%	9%	1.7%
Other	7%	4%	2.4%

3 Were physical property tests completed and strength specimens molded (if required to cast) in accordance with the appropriate ASTM procedure? **79.9%** **83.3%** **-3.4%**

Which procedure was not followed?	Selected Company	Other Companies	Variance
Air Content	95%	97%	-2.0%
Casting concrete strength specimens	97%	99%	-1.7%
Density (unit weight)	94%	89%	5.4%
Slump	87%	96%	-8.9%
Temperature	99%	99%	0.0%
Tests completed within time requirement	98%	99%	-1.1%

4 Were the concrete specimens (if required to cast) stored in an initial curing environment following ASTM C31, section 10.1.2? **49.1%** **47.9%** **1.3%**

Which of the following was utilized?	Selected Company	Other Companies	Variance
Cooler or buckets (dry)	34%	53%	-19.2%
Earthen burial	0%	0%	0.3%
Fabricated curing box or storage area	38%	18%	19.9%
Insulation (i.space blanket, foam, plastic shavings, etc.)	8%	11%	-3.0%
Nothing; specimens left in open environment	4%	2%	2.5%
Water bath	12%	12%	0.3%
Other	9%	13%	-3.8%

Which type of temperature monitoring device was utilized in the curing environment?	Selected Company	Other Companies	Variance
Continuous record	11%	6%	5.2%
Instant read only	8%	11%	-3.2%
Min/Max	25%	27%	-1.9%
Nothing	42%	45%	-2.6%
Thermostatic control (cool)	6%	3%	2.8%
Thermostatic control (heat)	18%	13%	4.6%

Assessor Employee	Total Assessments	Assessment Questions				Which procedure was not followed? <i>(percentage meeting requirements)</i>					
		Question 1	Question 2	Question 3	Question 4	Temperature	Slump	Air Content	Density (unit weight)	Casting specimens	Time requirement
JT Mesite	12	66.7%	91.7%	58.3%	41.7%	91.6%	58.3%	100.0%	100.0%	100.0%	100.0%
Ned Ryerson	9	66.7%	88.9%	77.8%	77.8%	88.8%	77.7%	100.0%	100.0%	100.0%	100.0%
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Laboratory Employee	Total Assessments	Assessment Questions				Which procedure was not followed? <i>(percentage meeting requirements)</i>					
		Question 1	Question 2	Question 3	Question 4	Temperature	Slump	Air Content	Density (unit weight)	Casting specimens	Time requirement
Abe Lincoln	1	100.0%	100.0%	100.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Cosmo Kramer	7	0.0%	71.4%	14.3%	14.3%	71.4%	14.2%	100.0%	100.0%	100.0%	100.0%
Joe Schmoe	6	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Mike Wazowski	7	100.0%	100.0%	85.7%	71.4%	100.0%	85.7%	100.0%	100.0%	100.0%	100.0%
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Strength
in Numbers



CTAC Program Long-term Plan

Bene

- Assist employee training
- Company comparisons with program average
- Specific placement information (i.e. dispatch ticket, add'l notes)
- Testing "failure" notifications and photo log of field testing observations

- Develop industry training & education
- Established and promoted through Technical Committee
- Continue to promote use of program through membership
- Assist in disputes through observation results

Long-term development

- ASTM & ACI action items to develop better procedures
- Committee correspondence between CRMCA and ASTM/ACI
- AIA MasterSpec Changes complete-Testing agency shall provide the curing container

Strength
in Numbers



Next Steps

- If CTAC is available nationally is there sufficient interest within state associations?
- If so we will form a task group to define:
 - Changes, updates to CTAC and costs
 - Role of NRMCA, state associations, companies
- Present plan to the board
- If approved update CTAC, implement program
- Task group to oversee effective use

Thank you

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