



***Our Responsibility to Improve
Testing, Constructability, Durability,
and the Success of Lower Carbon
Construction.***
***Some things we can do today to
address this!***

**Jim Casilio, P.E. - Director of Technical Services
and Codes & Standards Policy**

www.pacaweb.org

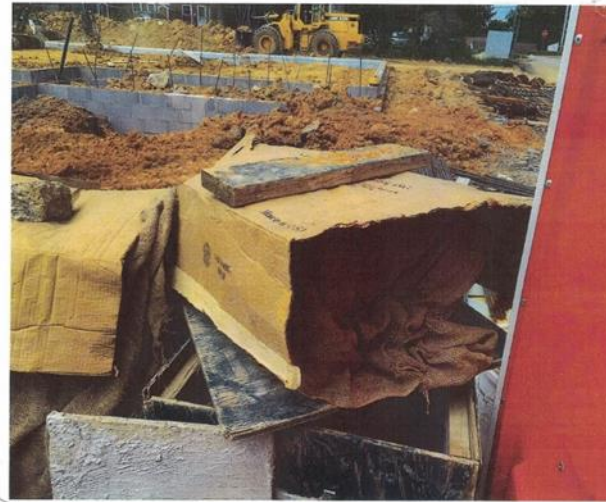


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So what's the issue with field testing? – *What we expect \ What we see!*



So what's the issue with field testing? - *What we expect \ What we see!*



So how widespread is this issue ?

August & September of 2020!

| Projects Observed | Projects Meeting Requirements | Projects Violating Standards ASTM C31, & 172, & etc) |
|-------------------|-------------------------------|--|
| 103 | 15 | 88 |



So how does this effect our efforts at carbon reduction?

ACI MATERIALS JOURNAL

TECHNICAL PAPER

21-470

Role of Mixture Overdesign in the Sustainability of Concrete: Current State and Future Perspective

by Julie K. Buffenbarger, James M. Casilio, Hessam AzariJafari, and Stephen S. Szoke

So how does this effect our efforts at carbon reduction?

Survey of Pennsylvania Producers – 4000 psi

| f'cr, psi | Compressive Strength, psi | Overdesign, psi | CM Content, lbs/yd | Percentage of SCMs | CM Content of Overdesign, lbs/yd | Portland Cement Content of Overdesign, lbs/yd |
|-----------|---------------------------|-----------------|--------------------|--------------------|----------------------------------|---|
| 4747 | 5030 | 283 | 597.8 | 14.8 | 33.7 | 28.7 |

↑
5.6% OPC overdesign

So how does this effect our efforts at carbon reduction?

Table 5—Quality survey results

| Data collected for two concrete mixtures below 5000 psi (35 MPa)* | Weighted average | | | | | |
|---|------------------|-------------|-------------|-------------|-------------|-------------|
| | 2020 | 2019 | 2018 | 2017 | 2014 | 2012 |
| Standard deviation S , psi (MPa) | 432 (3.0) | 435 (3.0) | 464 (3.2) | 465 (3.2) | 551 (3.8) | 491 (3.4) |
| Specified strength, psi (MPa) | 3632 (25.0) | 3590 (24.8) | 3840 (26.5) | 3970 (27.4) | 3427 (23.6) | 3856 (26.6) |
| Overdesign, % | 33 | 36 | 32 | 34 | 30 | 26 |
| Air-entrained mixtures, % | 38 | 38 | 56 | 52 | 75 | 50 |

*This did not include concrete mixtures that had a maximum w/cm or a minimum cementitious factor or fixed over-design value such as 1200 psi (8.3 MPa) or early-age strengths.

Table 6—Prescriptive overdesign of portland cement

| $f'_c + 1200$ psi (8.3 MPa), psi (MPa) | f'_{cr} with field history*, psi (MPa) | Additional strength required, psi (MPa) | CM efficiency*, psi/CM (MPa/CM) | Additional CM, lb/yd ³ (kg/m ³) | Percentage of SCM | Excess portland cement, lb/yd ³ (kg/m ³) |
|--|--|---|---------------------------------|--|-------------------|---|
| 5200 (35.9) | 4747 (32.7) | 453 (3.1) | 8.4 (0.098) | 53.9 (32.0) | 14.8 | 45.9 (27.2) |

* f'_{cr} survey value and CM efficiency and percentage of SCM value taken from Pennsylvania producer survey.

So how does this effect our efforts at carbon reduction?

Yearly excess USA cement consumption and CO² output due to excessive overdesign

@ 28.7 lbs/yd³ **4.4 million metric tonnes** – (Pennsylvania Producers Survey)

@ 45.9 lbs.yd³ **7.0 million metric tonnes** – (at 1200 psi above f'c)

Using the value of .6 tonnes of CO₂ per tonne of cement = 2.64 million metric tonnes of CO₂

Or – The total output of three US cement plants each year



So What can we do?

Proper Molding, Care, and Testing of Concrete Cylinders

Designation: C31/C31M – 21
Standard Practice for
Making and Curing Concrete Test Specimens in
the Field

10.1.2 *Initial Curing*—Store standard-cured specimens for a period up to 48 h after molding to maintain the specified temperature and moisture conditions described in 10.1.2.1 and 10.1.2.2.

NOTE 9—Generally, just covering the specimens is not sufficient to maintain the environment required for initial standard curing.

10.1.2.1 For concrete mixtures with a specified strength less than 40 MPa [6000 psi], maintain the initial curing temperature between 16 °C and 27 °C [60 °F and 80 °F]. For concrete mixtures with a specified strength of 40 MPa [6000 psi] or greater, maintain the initial curing temperature between 20 °C and 26 °C [68 °F and 78 °F]. Shield specimens from direct exposure to sunlight and, if used, radiant heating devices.

Record the minimum temperature and maximum temperatures achieved for each set of specimens during the initial curing period.

If You Wish To See It - Specify It!!

Automated *Curing* & *Monitoring* of Initial Cyl. Curing



*Heat and Cools
Less than \$2000*



*Waterproof
Bluetooth*

If You Wish To See It - Specify It!!

Automated *Curing* & *Monitoring* of Initial Cyl. Curing

PennDOT PTM 611

A temperature record of the specimens shall be maintained by means of ~~high-low thermometers or other appropriate temperature recording devices~~ of a digital system that records temperature at least every hour, within the range of 30 to 120 °F and to an accuracy of 1°F and provide software to access the stored data. The output from the automated temperature measuring device shall be made available in real time to the Departments representative. The output from the automated temperature device will be used to report the minimum and maximum temperature on the “Report of Compressive Strength of Portland Cement Concrete Form” (CS-458A).



***Waterproof
Bluetooth***

A tool to help get what is required for your project



2040 Linglestown Road
Suite 204
Harrisburg, PA 17110
Tel 717-234-2603
Fax 717-234-7030

Checklist of Requirements for Proper Acceptance Testing of Concrete.

In accordance with requirements of PA Building Codes PA IBC, ACI 318, and ASTM C31, also ACI 301

1. Owners testing agency meets the requirements of ASTM C1077: Yes _____ No _____
2. Field testing will be conducted by ACI certified Technicians: Yes _____ No _____

Technician Name

ACI Certification No.

Technician Name

ACI Certification No.

Technician Name

ACI Certification No.

Technician Name

ACI Certification No.

If a technician certification program other than ACI's is proposed, submit details including documentation of independent written and performance technician proficiency.

3. Contractor will provide secure space, water, and electricity for initial curing of concrete test specimens.
The designated space allocated for this is _____.

~~Require This~~ – Specify This

3. Contractor will provide secure space, water, and electricity for initial curing of concrete test specimens.
The designated space allocated for this is _____.
4. Owners testing agency will provide an apparatus to ensure proper initial curing of test cylinders. Apparatus to keep samples between 60F and 80F degrees concrete 6000 PSI or less, 67F to 78F degrees for concrete greater than 6000 PSI.

Owners testing agency will provide proper curing apparatus Yes _____ No _____.

Is the curing apparatus automatically heated _____ automatically controlled for heating and curing _____.

If no provide details what the owners testing agency will do to achieve the initial curing conditions required under ASTM C31. _____.

~~Require This~~ – Specify This

6. The Min/Max temperature results from the initial curing will be reported on the ASTM 31 and C39 reports.

Yes _____ No _____.

7. Name and signature of the responsible licensed professional engineer of the owner's testing agency.

8. Construction supervision personnel onsite assigned to ensure compliance with above requirements (GC, CM, or Owners Rep). _____.

Some Additional Tools – Warranty Language

WARRANTY

Producer warrants that, at the point of discharge, its Product(s) will conform to applicable specifications for compressive strength, durability and workability in the current American Society for Testing and Materials (“ASTM”) C94/C94M Standard Specification for Ready-Mixed Concrete (“ASTM Standards”) or other alternative specifications that are agreed upon in writing when tested in accordance with applicable ASTM procedures, and evaluated in accordance with all applicable American Concrete Institute (“ACI”) standards and guidelines.

To ensure that proper acceptance testing is performed on the Product, Producer’s warranty is also expressly conditioned upon completion of the attached **Checklist For Requirements for Proper Acceptance Testing of Concrete** by the Buyer’s and/or Owner’s testing agency. If Producer determines, in its sole discretion, that the proper sampling and testing procedures were not followed by any testing agency, if the Checklist is not completed in its entirety or if the testing agency fails to provide test reports bearing an engineer’s signature, Producer reserves the right to refuse further delivery of the Product until such time as Buyer and/or Owner is compliant with these terms and/or to terminate its Purchase Order or other agreement with Buyer, all without penalty to Producer. Any cost for additional testing, repairs, replacement Product or delays due to improper sampling, testing or inspection procedures shall be the responsibility of Buyer and/or Owner.

Some Additional Tools – Notice of Improper Testing

[COMPANY LETTERHEAD]

[Date]

VIA [Insert Delivery Method]

[recipient name]

RE: Notice of Improper Testing Procedures
[Insert Name of Project]
[Insert PO Number or other Contract Reference]

Dear _____:

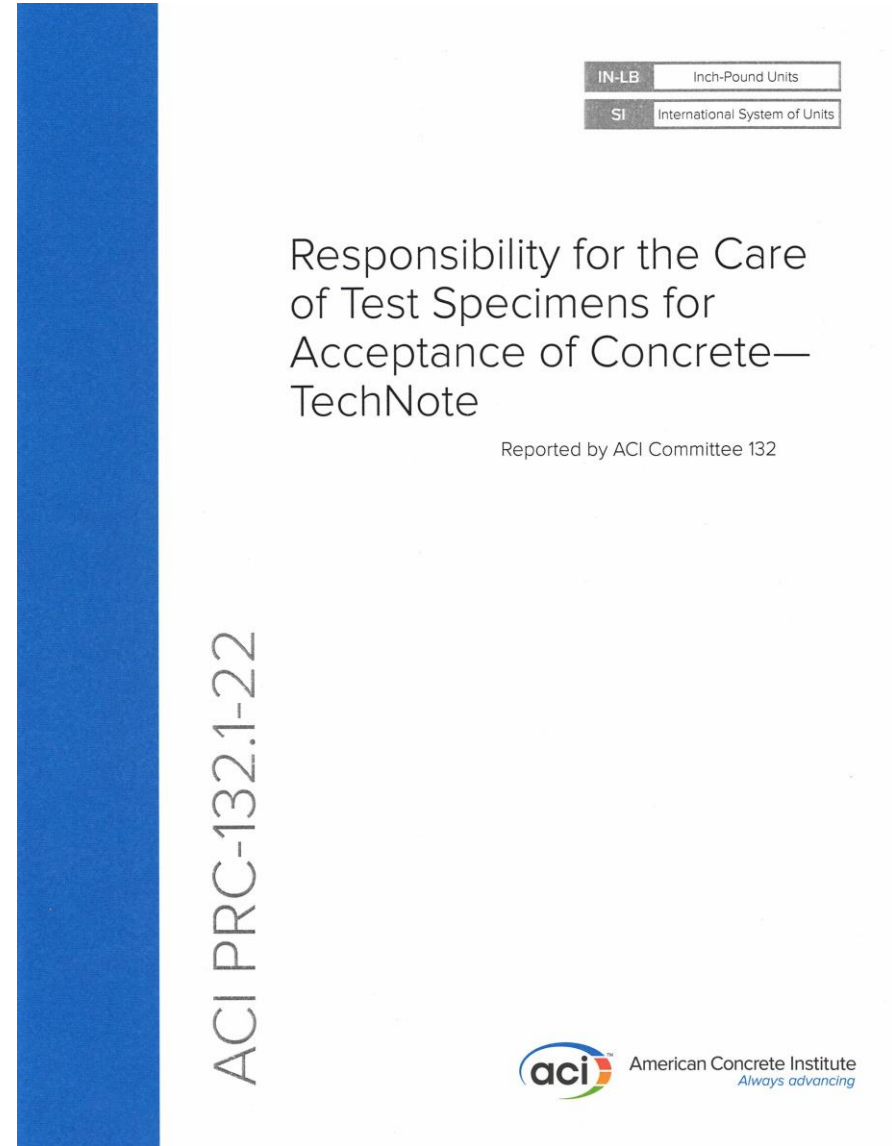
This letter is to put you on notice that the testing procedures conducted by _____ (the “Testing Agency”) on the above-referenced Project have not been done in accordance with the Project Specifications and/or Pennsylvania Building Code. Specifically, the testing is not in conformance in the following material respects:

- ☐ Improper initial curing per ASTM C31
- ☐ Testing has not be performed by a certified concrete field technician
- ☐ Other: _____

As a result of the above failure(s) by the Testing Agency, the test results received are not a valid

Some Guidance from ACI Committee 132

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*OK But Who and How ?
First – A Lesson learned the hard way!*

Responsibility for
Constructability,
Durability, and Maybe
Even the Success of
Lower Carbon
Construction



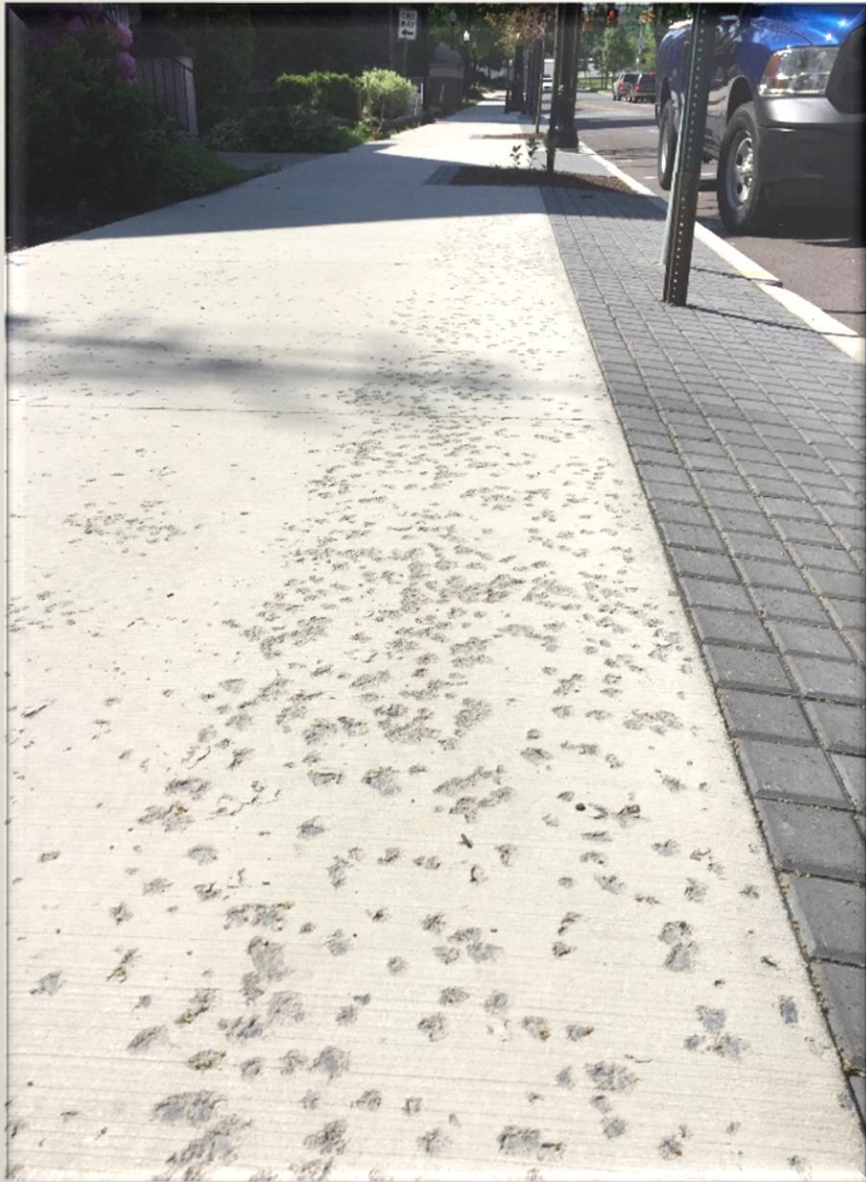
CONCRETE PROOF

You were tailgating.

VERY DEMOTIVATIONAL .com



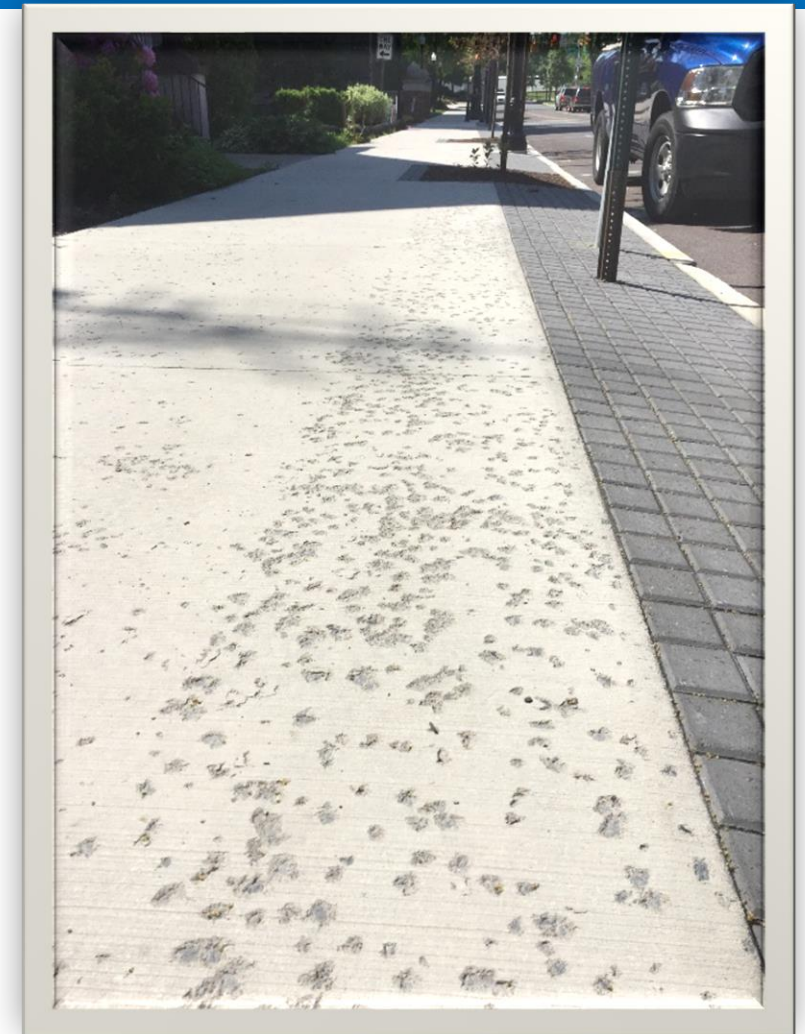
**Spring
of 2017**





Spring of 2017 Scaling

- A great quote:
- This is not a finisher problem.
- This is not a producer problem.
- This is not a specifier problem.
- *This is an industry problem!*



Reducing Scaling of Concrete Surfaces

A Pennsylvania STIC Initiative

State Transportation Innovation Council

Construction and Materials TAG

1. Finisher certification: 60% of All Finishers

ACI Flat Work Finisher or

NRMCA exterior concrete finisher

2. A Training Module for Construction Insp.



Classes Across PA: Over 1900 PA Finishers Certified



Why not add this improvement to your projects? *Specify it*



Responsibility for Constructability, Durability, and Maybe Even the Success of Lower Carbon Construction – OK But Who?



Responsibility for Constructability, Durability, and Maybe Even the Success of Lower Carbon Construction

Responsibility – Guidance from ACI

PRC 132-14 Guide for Responsibility in Concrete Construction

PRC 132-24 Revised and Reapproved – Available Soon



Strengthen your People, Company, & Association

Five Reasons Why You or Someone From Your Company Should Be a Part of PELA

- ✓ 1. For personal growth and development
- ✓ 2. To acquire tools for career success
- ✓ 3. To build relationships through networking
- ✓ 4. To develop talent with the goal of retention
- ✓ 5. To challenge oneself and move outside your personal box



2024 ACADEMY CALENDAR

INSTRUCTOR & FACILITATOR:
Greg Coker, Greg Coker Development
ibuildcathedrals@gmail.com

STAFF LIAISON:
Kallie Kline, Pennsylvania Aggregates &
Concrete Association
kallie@pacaweb.org



| FEBRUARY 22 | MARCH 13 & 14 | APRIL 24 & 25 | MAY 15 & 16 | JUNE 5 & 6 |
|--|---|---|---|---|
| SETTING THE STAGE FOR LEADERSHIP EXCELLENCE | A BLUEPRINT FOR LEADERSHIP EXCELLENCE | EMOTIONAL INTELLIGENCE | LEADERSHIP & MANAGEMENT | ORGANIZATIONAL TRACTION / DISCIPLINE OF EXECUTION / TEAM EFFECTIVENESS |
| Program overview, participant introductions, expectations, Capstone project overview | Zoom link will be sent via calendar appointment | | | Zoom link will be sent via calendar appointment |
| IN PERSON - STATE COLLEGE, PA | ONLINE - VIA ZOOM | IN PERSON - LOCATION TBD | IN PERSON - LOCATION TBD | ONLINE - VIA ZOOM |
| 9:30 AM to 12:30 PM | 13 - 8:30 AM to 12:30 PM 14 - 12:30 PM to 4:00 PM | 24 - 9:00 AM to 4:00 PM 25 - 8:30 AM to Noon | 15 - 9:00 AM to 4:00 PM 16 - 8:30 AM to Noon | 5 - 8:30 AM to 12:30 PM 6 - 12:30 PM to 4:00 PM |
| JULY 18 | AUGUST 12 & 13 | SEPTEMBER 18 & 19 | OCTOBER 9 & 10 | NOVEMBER 18 & 19 |
| SUMMER CALIBRATION / CAPSTONE PROJECT ASSISTANCE | DAY AT THE PA CAPITAL & COMMUNICATION TRAINING | CAPSTONE PROJECT PRESENTATION PREP | PROGRAM REVIEW, DEBRIEF, CAPSTONE PROJECT FINAL PREP, PARTICIPANT FEEDBACK | GRADUATION  |
| Zoom link will be sent via calendar appointment | Meet and greet with leaders in the world of Pennsylvania politics, education on the process of politics in Harrisburg, includes tour of the Pennsylvania Capitol Building | | | Being held in conjunction with PACA's Annual Meeting & Honors Program, all must attend the Annual Meeting. Discount rate provided to PELA graduates |
| ONLINE - VIA ZOOM | IN PERSON - HARRISBURG, PA | IN PERSON - LOCATION TBD | IN PERSON - LOCATION TBD | IN PERSON - HERSHEY, PA |

Pennsylvania Aggregate and Concrete Association



www.pacaweb.org | www.specifyconcrete.org

Building and Connecting Communities

Jim Casilio, P.E.

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