



# Sustainability and the ACI Building Code: Plans for the 2025 Edition of ACI 318

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Chair, ACI 318 Building Code Committee

ACI Spring Convention, San Francisco, CA

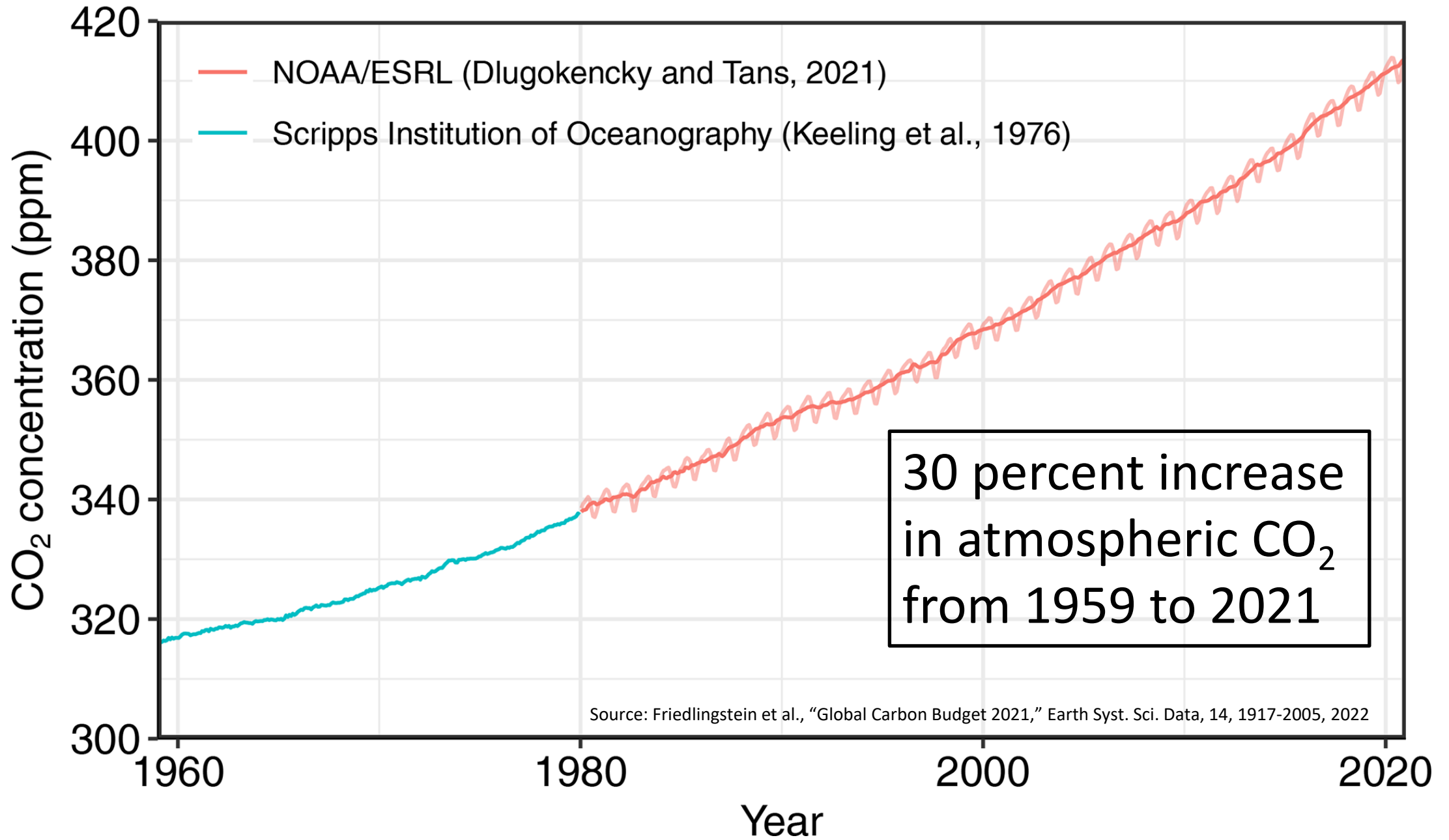
4 April 2023



## Sustainability and the ACI 318 Building Code

- Environmental impacts of concrete construction
- Sustainability initiatives at ACI
- What difference can structural engineers make?
- New sustainability provisions in ACI 318-19
- The future of sustainability in ACI 318-25

# Atmospheric CO<sub>2</sub> Concentration



# Environmental Impacts

Cement production accounts for about  
8% of global CO<sub>2</sub> emissions  
(5% production process, 3% energy use)

Source: Andrew, R., "Global CO<sub>2</sub> Emissions From Cement Production, 1928-2018," Earth Syst. Sci. Data, 11, 1675-1710, 2019

# ACI Sustainability Initiatives

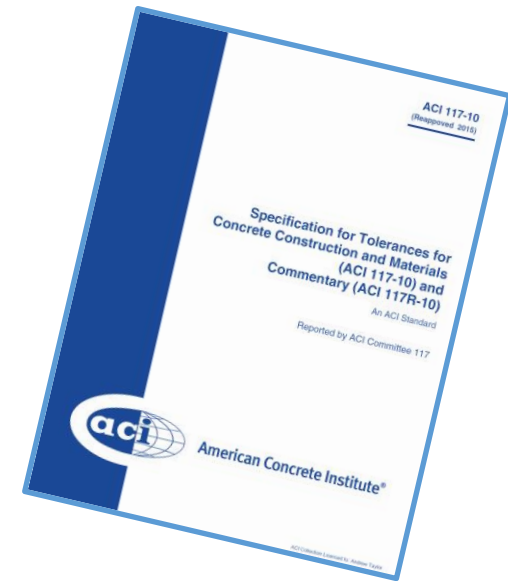
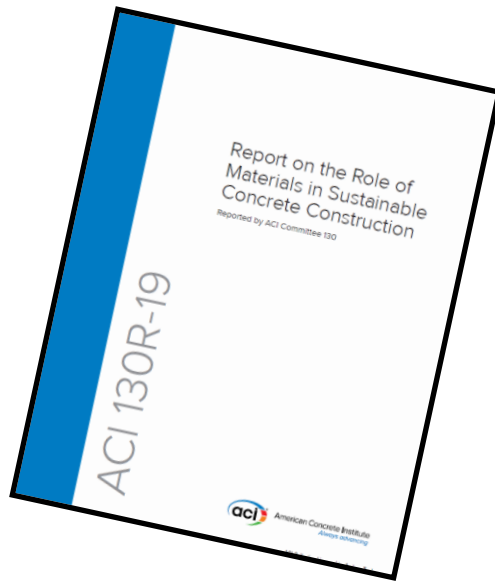
- Publications
- Education
- Technical Committees
- NEU Center of Excellence for Carbon Neutral Concrete
- Certification
- Standards



American Concrete Institute  
*Always advancing*

# ACI Sustainability Initiatives - Publications

- Standards and guides > 40
- Journal articles > 60
- Practice-oriented papers and articles > 200



# ACI Sustainability Initiatives - Education

- Online learning programs > 100
- Sponsored or co-sponsored events > 30
- Technical sessions at ACI conventions
- ACI Ambassador speakers



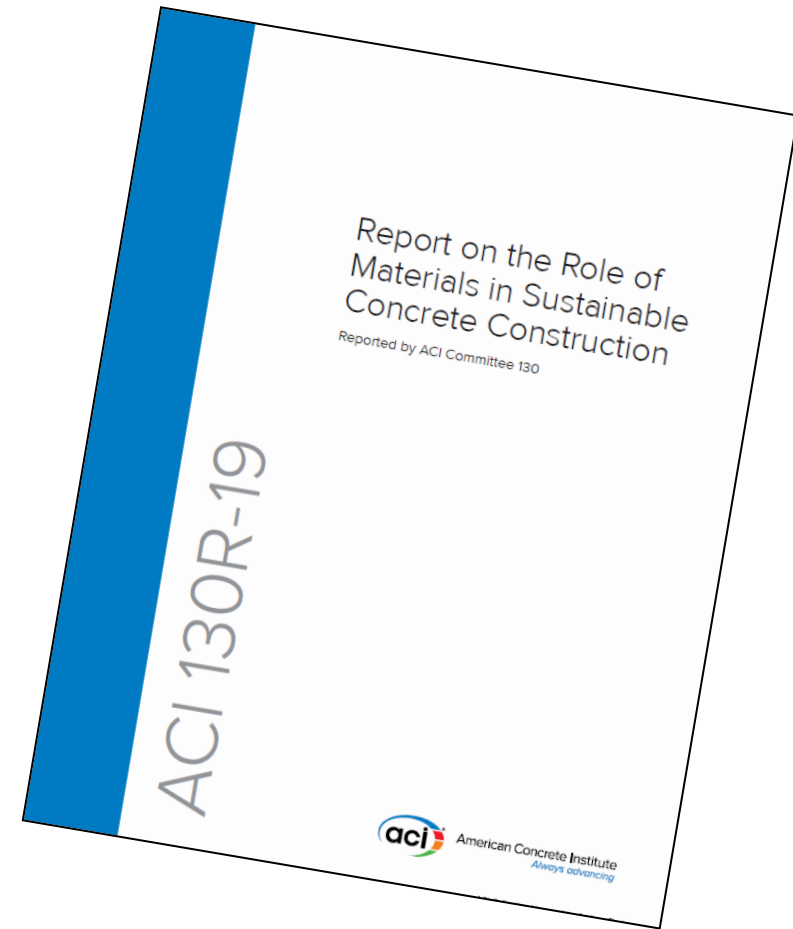
American Concrete Institute  
*Always advancing*



# ACI Sustainability Initiatives – Technical Committees

## ACI Technical Committee 130

- Over 100 Members
- 8 subcommittees
- “Report on the Role of Materials in Sustainable Concrete Construction”





# ACI Sustainability Initiatives – Technical Committees

## New ACI Technical Committee 321

- “Concrete Durability Code”
- 15 voting members
- Established in October 2020

# ACI Sustainability Initiatives - NEU

Launched Spring 2022



# ACI Sustainability Initiatives – NEU Vision

The Center envisions a concrete industry where all stakeholders have access to technologies and the knowledge needed to effectively and safely produce and place carbon-neutral concrete and concrete products in the built environment.



# ACI Sustainability Initiatives – NEU Mission

Collaborate globally to drive research, education, awareness, and adoption of the use of carbon-neutral materials and technologies in the built environment.

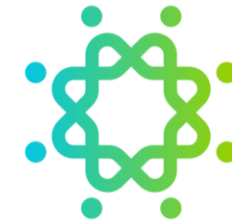


# ACI Sustainability Initiatives – Current Partners

**Sustaining Members**

**Supporting Members**

**Affiliate Members**



**Breakthrough Energy**



# ACI Sustainability Initiatives – Certification

## ACI Certification Programs



Testing, Inspection, Construction/Specialist



# 31 Certification Programs... and Growing



## TESTING

- Field Testing (4)
- Strength Testing
- Laboratory Testing (2)
- Aggregate & Soils/Base Testing (3)
- Cement Physical Tester
- Masonry Testing (2)
- Self-Consolidating Concrete

## INSPECTION

- Construction Special Inspector (2)
- Transportation Inspector
- Post-Installed Concrete Anchor (2)
- Concrete Quality/Materials
- Shotcrete
- Nondestructive Testing
- **Concrete Construction Sustainability and Resilience Assessor**

## CONSTRUCTION

- Adhesive Anchor Installer
- Flatwork Finisher
- Decorative Concrete Flatwork
- Specialty Commercial-Industrial Flatwork
- Tilt-Up
- Shotcrete Nozzleman (2)
- Residential Concrete Foundation

## DESIGN

- **ACI 318 Design Professional**

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# The Challenge for Structural Design Codes

How can structural engineers reduce the environmental impacts of concrete construction through innovations in the structural design process?

# What Difference Can Structural Engineers Make?

Encourage sustainable design practices:

- Specify concrete mixtures that make use of alternative cementitious materials
- Specify recycled aggregates when possible
- Specify time periods longer than 28 days to achieve design strength
- Design with minimum concrete volume
- Promote sustainability provisions in structural codes and standards

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# New Sustainability Provisions in ACI 318-19

- Until the 2014 edition, no sustainability provisions
- In ACI 318-14, Section 4.9 “Sustainability”
  - Minimal introduction of sustainability concepts – but a start!
  - Allows (but does not require) the engineer to consider sustainability in design
  - Strength, serviceability, and durability must take precedence over sustainability considerations

# New Sustainability Provisions in ACI 318-19

In addition to Section 4.9, “Sustainability”,

- Section 26.4.1.1.1 allows, within limits, the use of “alternative cements”
- “Alternative cements shall be permitted if approved by the licensed design professional and the building official.”





# New Sustainability Provisions in ACI 318-19

## 26.4.1.2.1(c)(1)&(2): recycled aggregate

(1) Concrete incorporating the specific aggregate proposed for the Work has been demonstrated to provide the mechanical properties and durability required in structural design.

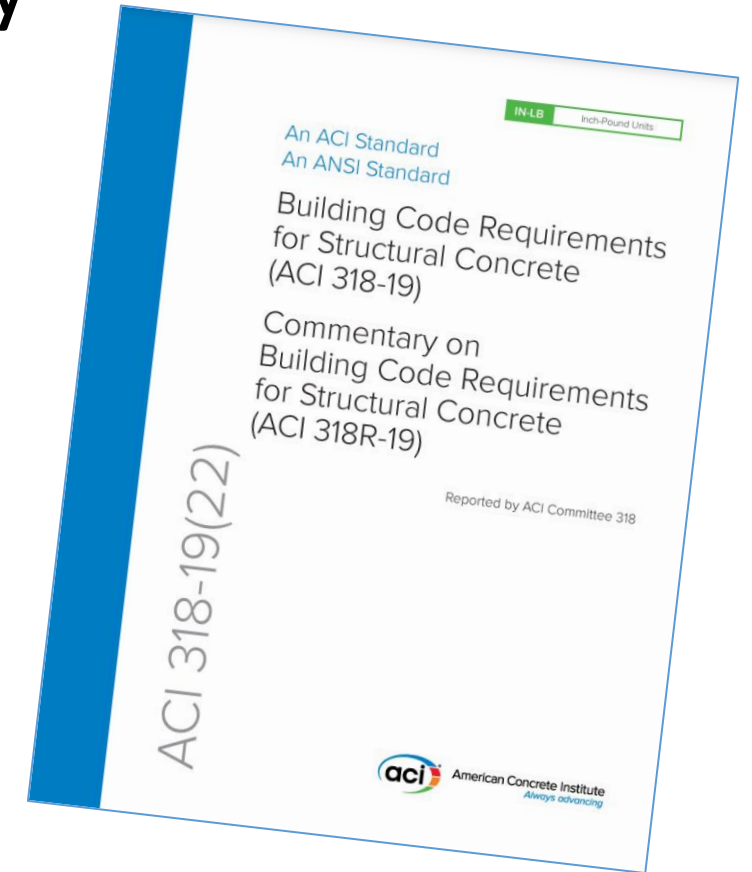
(2) A testing program to verify aggregate consistency and a quality control program to achieve consistency of properties of the concrete are conducted throughout the duration of the project.



# The Future of Sustainability in ACI 318-25

## ACI 318 Subcommittee N, “Sustainability”

- Established in 2019
- Chaired by Shana Kelley, P.E., S.E.
- 12 Voting Members
- 6 Task Groups



# The Future of Sustainability in ACI 318-25

## ACI 318 Subcommittee N

- Writing “Appendix N” for ACI 318-25
- Appendix N will add sustainability provisions to the code that can be followed whenever sustainable design practices are required for a project.



Source: A. Harasimowicz, KPFF

# The Future of Sustainability in ACI 318-25

- Subcommittee N currently has (6) task groups
  - (4) task groups are working on developing the proposed Sustainability Appendix
  - (2) task groups are looking at existing provisions related to alternative cements and recycled aggregates in the code in coordination with Subcommittee A



Source: A. Harasimowicz, KPFF

# ACI 318-25 Appendix N

## Outline of Appendix N

1. Scope
2. Concrete Mixture Sustainability Measurement Metrics  
*How to provide consistency in the way mixtures are evaluated?*
3. Structural System Sustainability – Measurement of Overall Sustainable Impacts  
*How are concrete-specific properties like thermal mass accounted for?*
4. Structural System Sustainability – Resiliency  
*If resiliency is to be considered, how can it be consistently accounted for?*



# The Future of Sustainability in ACI 318-25

- To learn more about sustainable concrete design and construction
  - ACI standards, guides, reports
    - ACI 318, ACI 130, ACI 201, ACI 321
  - ACI web site for information on the NEU Center of Excellence
  - Practice-oriented papers and articles
  - ACI Structural Journal
  - ACI Materials Journal
  - ACI Seminars and Conferences



# *Thank you*

For the most up-to-date information please  
visit the American Concrete Institute at:

[www.concrete.org](http://www.concrete.org)

