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Sustainability and the ACI 318 Building Code

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We will discuss current provisions of the ACI 318-19 building code that support principles of sustainability and possible future modifications to the ACI 318 code that would further promote sustainable uses of concrete.

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Topics

Sustainability and the ACI 318 Building Code

- Environmental impacts of concrete construction
- Sustainability initiatives at ACI
- What difference can structural engineers make?
- Existing sustainability provisions in ACI 318-14
- New sustainability provisions in ACI 318-19
- The future of sustainability in ACI 318-25

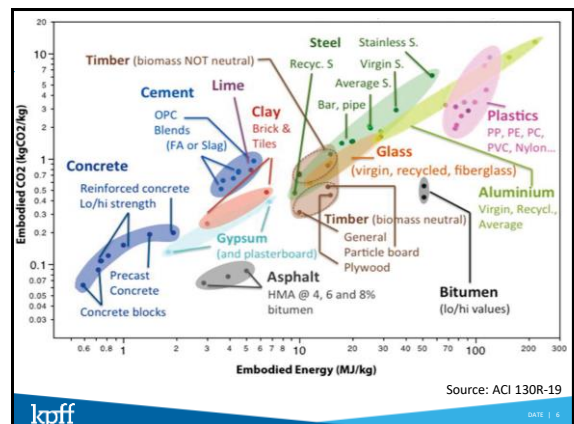
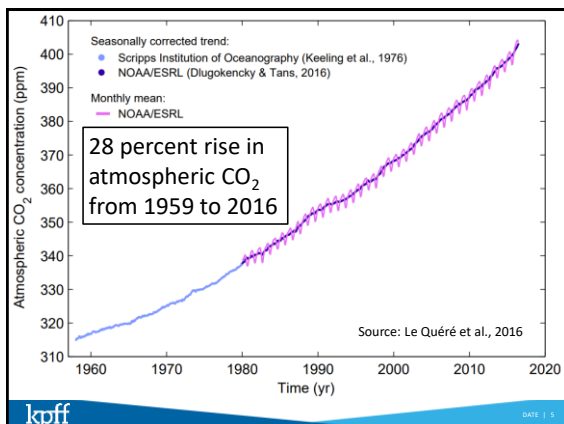
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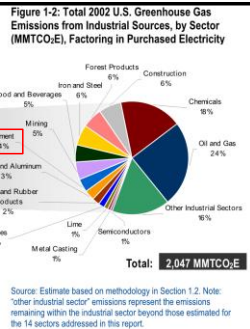
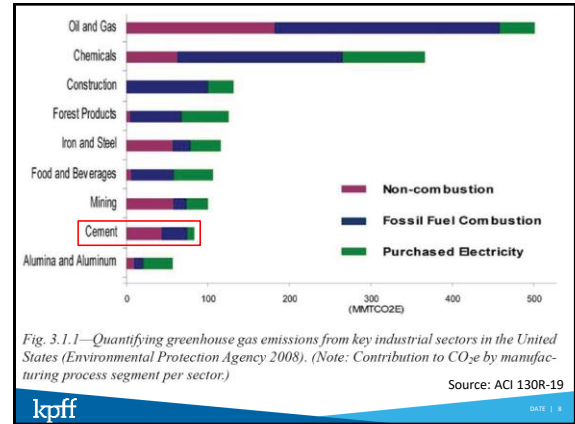
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Environmental impacts of concrete construction

Environmental impacts of concrete construction

Topics

ACI Sustainability Initiatives

- Standards and guides > 40
- Journal articles > 60
- Practice-oriented papers and articles > 200
- Online learning > 100
- Sponsored or co-sponsored events > 25



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ACI Sustainability Initiatives

ACI Innovation Task Group ITG-10

- “Report on Alternative Cements”
- “Practitioner’s Guide for Alternative Cements”
- These two reports provide guidance on the characteristics and implementation of alternative cements.
- ACI 318-19 26.4.1.1.1



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ACI Sustainability Initiatives

ACI Technical Committee 130

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



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ACI Sustainability Initiatives

ACI Technical Committee 130 Subcommittees:

- Materials
- Production/Transportation/Construction
- Structures in Service
- Rating Systems/Sustainability Tools
- Design/Specifications/Codes/Regulations
- Education
- Climate Change Impacts on the Sustainability of Concrete
- Liaison Subcommittee

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ACI Sustainability Initiatives

ACI 318 Structural Building Code

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



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What Difference can structural engineers make?

We are, after all,

- Not environmental scientists
- Not environmental regulators
- Not project architects
- Not project owners



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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

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."



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New sustainability provisions in ACI 318-19

- "Approval shall be based upon test data documenting that the proposed concrete mixture made with the alternative cement meets the performance requirements for the application including structural, fire, and durability.."



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New sustainability provisions in ACI 318-19

aggregate—The use of recycled aggregate is addressed in the Code in 2019. The definition of recycled materials in **ASTM C33** is very broad and is likely to include materials that would not be expected to meet the intent of the provisions of this Code for use in structural concrete. Use of recycled aggregates including crushed hydraulic-cement concrete in structural concrete requires additional precautions. See 26.4.1.2.1(c).



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New sustainability provisions in ACI 318-19

26.4.1.2.1(c):

(c) Crushed hydraulic-cement concrete or recycled aggregate shall be permitted if approved by the licensed design professional and the building official based on documentation that demonstrates compliance with (1) and (2).



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New sustainability provisions in ACI 318-19

26.4.1.2.1(c)(1)&(2):

- (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.

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The future of sustainability in ACI 318-25

Besides the provisions already in ACI 318-19, the 2025 edition of the code may also address

- Additional provisions related to alternative cements
- Provisions encouraging the design of compact structural members (minimum concrete volume)
- Guidelines for voluntary reporting of the Environmental Product Declaration (EPD) or Global Warming Potential (GWP) of a concrete mixture



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The future of sustainability in ACI 318-25

Besides the provisions already in ACI 318-19, the 2025 edition of the code may also address

- Provisions that encourage consideration of a period of time longer than 28 days to establish the acceptability of in-situ concrete strength (e.g. 42 or 56 days)
- Provisions supporting the use of recycled and non-traditional aggregates
- Reviewing existing durability requirements that specify a minimum concrete strength based on environmental exposure category



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