

Code Development – Overview and Opportunities

NEU Session on Low Carbon Cement and Concrete

Wednesday, November 1, 2023

Boston, MA

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American Concrete Institute



Code Development

■ Building Code

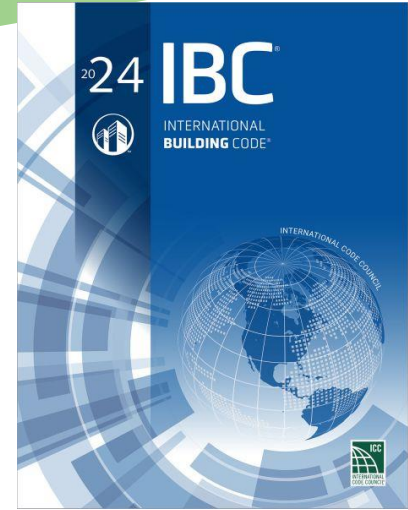
- Authority Having Jurisdiction
- Typically, 3 or 6-year cycle

■ Model Code

- International Building Code
- 3-year cycle

■ Referenced Standards

- ACI, ASCE, ASTM, etc.
- Typically, 3 to 6-year cycle



Code Development - Examples

Cycle	Building Code	Model Code	Ref. Std.
3-yr	2021	2018	318-14
	2024	2021	318-19
	2027	2024	318-19
	2030	2027	318-25
6-yr	2021	2018	318-14
	2027	2024	318-19
	2033	2030	318-25

Model Code

- International Green Construction Code
- ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1
 - American National Standards Institute
 - ASHRAE
 - International Code Council
 - US Green Building Council
 - Illuminating Engineers Society
 - American Institute of Architects



Referenceable Documents



International Code Council

International Green Construction Code

- Administrative Content



ASHRAE

Standard for the Design of High Performance Green Buildings Except Low-Rise Residential Buildings

- Technical Content



ASHRAE 189.1 Chapter 9

Materials and Resources

- 9.1 Scope
- 9.2 Compliance (Section 9.4 or 9.5)
- 9.3 Mandatory Provisions
 - Construction and Demolition Waste Management
 - Extraction, Harvesting, and/or Manufacturing
 - Refrigerants
 - Areas for Storage and Collection of Recyclables
 - Mercury Content Levels of Lamps

ASHRAE 189.1 Chapter 9: Materials and Resources

- 9.4 Prescriptive Option
 - Reduced Impact Materials
 - Recycled/Salvaged Material Content
 - Regional Materials
 - Biobased Products
 - Multiple-Attribute Declaration
 - Industry-wide Product Declaration (Type III)

ASHRAE 189.1 Chapter 9: Materials and Resources

- Multiple-Attribute Product Declaration
 - Industry-wide Product Declaration (Type III)
 - Product Specific Declaration
 - Third Party Multi-attribute Declaration
 - Product Life Cycle

ASHRAE 189.1 Chapter 9: Materials and Resources

- 9.5 Performance Option
 - Life Cycle Assessment
 - Metrics
 - 10% less in 2 categories (1 = GWP)
 - 5% less in 3 categories (1= GWP)
 - Procedure – ASTM E2921
 - Reporting

EPD – Primary Impact Categories

- Global Warming Potential CO₂e
- Stratospheric Ozone Depletion CFC-11e
- Acidification H+ or SO₂e
- Eutrophication N or [PO₄]³⁻
- Tropospheric Ozone Formation NO_x, O₃e, or C₂H₄
- Abiotic Depletion (Fossil) NCV
- Abiotic Depletion (Elements) Sbe
- Nonrenewable Energy Resource Depletion, MJ

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EPD – Other Impact Categories

- Ecotoxicity
- Land Use
- Particulate Matter
- Human Toxicity
- Ionizing radiation

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ASHRAE 189.3 Design, Construction, and Operation of Sustainable High-Performance Health Care Facilities

New Building Institute - IBC

- S178-22 -Revised definitions and added table

CO₂e Limits, kg/m³			
f'_c, psi	Max.	High Early Strength	Lightweight
Up to 2499	302	408	578
2500-3499	382	516	578
3500-4499	432	583	626
4500-5499	481	649	675
5500-6499	505	682	N/A
6500 and up	518	680	N/A

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DISAPPROVED

ICC 700

National Green Building Standard

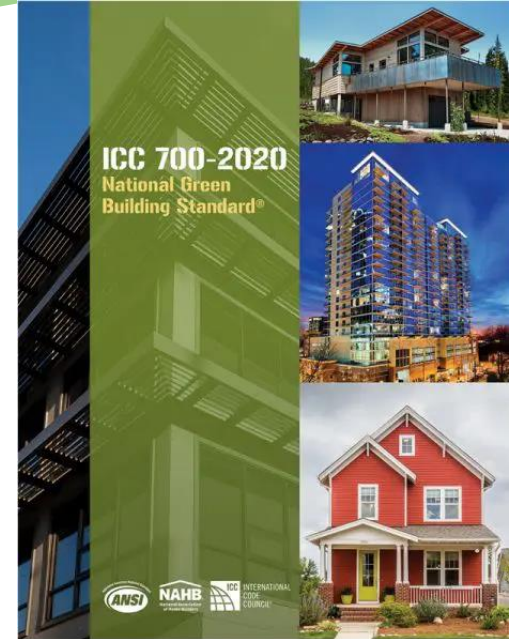
Ch 5 – Lot Design and Development

Ch 6 – Resource Efficiency

Ch 7 – Energy Efficiency

Ch 8 – Water Efficiency

Ch 9 – Indoor Environmental Quality



California Green Building Standards Code 2022

- Mandatory Requirements – None
- Voluntary Requirements:
 - A5.405.5.2.1 supplementary cementitious materials
Use concrete with one or more SCM...
 - Fly Ash
 - Slag Cement
 - Natural Pozzolan
 - Blended Cementitious

County of Marin

Min. Compressive Strength, psi	Cement Limits, lb/cu.yd.	Max. Embodied Carbon, kg CO₂e/m³
≤ 2,500	362	260
3,000	410	289
4,000	456	313
5,000	503	338
6,000	531	356
7,000	594	394
> 7,000	657	433

Separate requirements for lightweight concrete

Washington 2022 NBI Proposal Modifications

1901.8 Embodied CO₂e in concrete materials. All concrete mixes used in the building project's primary structural frame, lateral force-resisting system, and foundations shall comply with Section 1901.8.1

Exceptions:

1. Precast, shotcrete, or auger cast concrete.
2. Projects under 50,000 square feet.
3. Projects where the total volume of concrete is less than 50 cu. yds.
4. Concrete with product strengths for which the nearest supplier with a cradle to gate Type III product specific EPD is located more than 100 miles from the project site.

Washington 2022 NBI Proposal Modifications

1901.8.1 Documentation of CO₂e. Confirmation of a product's EPDs for **75% of products used in the building's primary structural frame, lateral force-resisting system, and foundations**, based on product cost. Confirmation of the product's EPDs shall be provided to the AHJ prior to certificate of occupancy.

1901.8.1 Requirements for EPD. 75% of the concrete mixes must have a product-specific cradle-to-gate Type III EPD complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930 and be available in a publicly accessible database.

Denver Building Code



DENVER AMENDMENT PROPOSAL FORM FOR PROPOSALS TO THE 2019 DENVER BUILDING CODE AMENDMENTS AND THE 2021 INTERNATIONAL CODES

DENVER[®]
THE MILE HIGH CITY

2021 CODE DEVELOPMENT CYCLE

1) **Name:** Rebecca Esau (RMI) **Date:** May 19, 2021
Webly Bowles (NBI) *Revised November 22, 2021*
Email: resau@rmi.org **Representing (organization or self):** RMI & NBI
webly@newbuildings.org

2) One proposal per this document is to be provided with clear and concise information.

Is a separate graphic file provided ("X" to answer): ___ Yes or X No

3) Highlight the code and acronym that applies to the proposal

<u>Acronym</u>	<u>Code Name</u>	<u>Acronym</u>	<u>Code Name</u>
DBC-AP	Denver Building Code–Administrative Provisions	IPC	International Plumbing Code
IBC	International Building Code	IRC	International Residential Code
IECC	International Energy Conservation Code	IFGC	International Fuel Gas Code

Colorado Legislation



First Regular Session | 74th General Assembly

Colorado General Assembly

HB21-1303 Global Warming Potential for Public Project Materials

...the contractor that is awarded the contract is required to submit **a current environmental product declaration** for each eligible material proposed to be used in the public project

Oregon

An official website of the State of Oregon [How you know »](#)

Language



- [Air Quality](#) ▾
- [Land Quality](#) ▾
- [Water Quality](#) ▾
- [Recycling and Waste Prevention](#) ▾
- [Action on Climate Change](#) ▾
- [Resources](#) ▾
- [About DEQ](#) ▾



Production and Design

DEQ's mission is to be a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

[Home](#) > [Materials Management](#) > [Production and Design](#) > [Built Environment](#) > [Concrete](#)

Concrete

BUILT ENVIRONMENT ▾

According to [Oregon's Consumption Based Emissions Inventory](#), concrete generated approximately 887,000 million metric tons of greenhouse gas in 2015—the equivalent emissions from 190,000 passenger vehicles on the road for a year. Cement, a primary component in concrete is a major contributor this this amount, and according to the EPA, the cement sector is the third largest industrial source of pollution, emitting more than 500,000 tons per year of sulfur dioxide, nitrogen oxide, and carbon monoxide.

PACKAGING ▾

Fortunately, there is great potential to lower the impacts of concrete by using low cement mixes. DEQ is working collaboratively with industry to address challenges and develop solutions.



Oregon Concrete EPDs

[EPD Resources & Publications](#)

Participating Oregon Concrete Producers



Any concrete company in Oregon that has a *third-party verified* **Environmental Product Declaration** (EPD), for one or more of their concrete mix designs, may be listed here in the future (*Subject to eligibility and verification criteria*).

Links to company registered EPDs:

- Cadman Materials- Foster Road, Orchards, Port of Portland

U.S. Environmental Protection Agency (EPA)

- Lowest 20% in embodied greenhouse gas emissions
- Lowest 40% in embodied greenhouse gas emissions
- Better than industry average



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an agency must determine both the material/product-specific GWP and estimate the **Top 20 percent (or Top 40 percent)** and the industry average

U.S. Industry Average?

- > 2,000 ready-mixed concrete businesses in the U.S.
 - IBISWorld
- > 7,000 ready-mixed concrete plants (includes Canada)
 - National Ready Mixed Concrete Association
- NRMCA Database
 - 60 companies (< 3.0%)
 - 303 plants (< 4.5%)

Regionality of Plants Reporting

NE – 46	SE – 47	NC – 43	SC – 34	NW – 40	SW – 92
CT – 11	AL – 4	IL – 5	CO – 28	OR – 20	AZ – 12
DC – 2	FL – 9	IN – 1	MO – 9	WA – 20	CA – 77
MA – 4	NC – 1	OH – 6	OK – 1		NM – 3
MD – 10	SC – 8	WI – 3	TX – 24		
NY – 5	VA – 23				
PA – 14					

Data from less than 50% of states

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Data from less than 50% of states
63% of Data from 6 States

Max GWP CO₂e kg/m³

Specified f'_c	Standard Mix	High Early Strength Mix	Lightweight
Up to 2499	242	314	462
2500-3499	306	398	462
3500-4499	346	450	501
4500-5499	385	500	540
5500-6499	404	526	N/A
6500 and up	414	524	N/A

> 10 cubic yards
Waivers permissible

Inflation Reduction Act (IRA)

Under the Inflation Reduction Act Sections 60503 and 60506, the **Department of Transportation Federal Highway Administration** and the **General Services Administration** are appropriated funds to spend on materials and products “that have substantially lower levels of embodied greenhouse-gas emissions associated with all relevant stages of production, use and disposal as compared to estimated industry averages of similar materials or products, as determined by the Administrator of the U.S. Environmental Protection Agency.

GSA



ACI 323 – Low Carbon Concrete



Committee Mission: ***Develop and maintain code requirements for low-carbon concrete.***

Referenceable in:

- IgCC/ASHRAE 189.1
- State and Local Codes
- Rules and Regulations

Internal Coordination



ACI 318 – Structural Concrete Building Code

ACI 318-2N – Sustainability

ACI 321 Committee – Concrete Durability Code

C601-0E – Concrete Construction Sustainability

Assessor

Etc.

ASCE/SEI – Low Carbon Concrete



STRUCTURAL
ENGINEERING
INSTITUTE

Sustainability Committee

Advancing sustainability in the structural engineering community.



**Standard Practice for
Sustainable Infrastructure
(ASCE 73-23)**

Potential Venues

Rules and Regulations

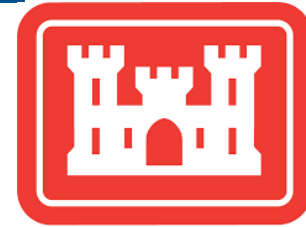
- Federal Agencies
 - EPA, GSA, FHWA, Etc

- State Agencies

- DOT, DPW, Building Codes, Etc.

- Local Agencies

- DPW, Building Codes, Etc.



DEPARTMENT OF
TRANSPORTATION



DENVER
PUBLIC WORKS

aci CONCRETE
CONVENTION
October 29-November 2, 2023 | Boston, MA, USA

neu
An ACI Center of Excellence
for Carbon Neutral Concrete

Potential Venues

- Federal Legislation
- Presidential Executive Orders
- State Legislations
- Gubernatorial Orders
- Local Ordinances
- Mayoral Orders



Potential Venues

■ Standards Developers

- AASHTO
- ACI
- ASCE
- ASHRAE 189.1 and 189.3
- ASTM E60
- SEI
- Etc.



Potential Venues

■ Voluntary Programs

- LEED
- Green Globes
- Individual Companies
 - Amazon
 - Breakthrough Energy
 - Meta
 - Walmart
 - Etc.



Codes and Standards Advocacy and Outreach

- **Model Building Codes (Primary)**
- **Referenced Standards (Secondary)**
- **National Building Codes (Secondary)**
- **State and Local Codes (Secondary)**
 - Targeting early adopters
 - Leverage influence in model codes
- **Federal Rules (Tertiary)**
- **Voluntary Programs (Tertiary)**

Collaboration Groups



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Committee Home

SCG - State Initiatives Collaboration Group

[Modify Committee Home](#)

Committee Mission: Implement initiatives modifying the statewide codes, legislation, and regulations: 1) reference ACI standards and programs; 2) remove criteria addressed in ACI Standards; 3) align language with the criteria in ACI Standards.

Chair: Kerry Sutton

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[Committee Roster »](#)

OPEN WEB BALLOTS

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C00SIC00 SUBCOMMITTEES (18)

[SCG-AZ Arizona Initiatives Collaboration Group](#)

[SCG-CA California Initiatives Collaboration Group](#)

[SCG-CT Connecticut Initiatives Collaboration Group](#)

[SCG-DC Washington DC Initiatives Collaboration Group](#)

[SCG-FL Florida Initiatives Collaboration Group](#)

[SCG-IN Indiana Initiatives Collaboration Group](#)

[SCG-KS Kansas Initiative Collaboration Group](#)

Low Carbon Concrete Requirements

Thank you!

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