

Chapter 19.07 is added to Marin County Code, as follows:

19.07 - Reduced Carbon Concrete Requirements

Express finding: Pursuant to Section 17958.2(a) of the California Health and Safety Code, the Marin County Board of Supervisors hereby finds the following modifications to the 2019 California Building Standards Code, as shown in Section 19.07.050 regulating allowable mix design and materials for plain and reinforced concrete, are reasonably necessary. This is because Marin County experiences climatic seasonal reduction in vegetative moisture content, combined with our heavily populated steep terrain, which presents increased wildfire risk to our residents from carbon-induced global warming; and is also bordered by sea water on three sides and subject to direct adverse local impact from sea-level rise as the result of construction-related contributions to climate change, including significant carbon emissions from cement production.

19.07.010 – Purpose

The purpose of this chapter is to provide practical standards and requirements for the composition of concrete, as defined herein, that maintains adequate strength and durability for the intended application and at the same time reduces greenhouse gas emissions associated with concrete composition. This code includes pathways for compliance with either reduced cement levels or lower-emission supplementary cementitious materials.

19.07.020 – Definitions

For the application of this chapter the following definitions shall apply:

Concrete: Concrete is any approved combination of mineral aggregates bound together into a hardened conglomerate in accordance with the requirements of this code.

Upfront Embodied Carbon (*Embodied Carbon*): The greenhouse gasses emitted in material extraction, transportation and manufacturing of a material corresponding to life cycle stages A1 (extraction and upstream production), A2 (transportation), and A3 (manufacturing). Definition is as noted in ISO 21930 and as defined in the Product Category Rule for Concrete by NSF dated February 22nd, 2019. https://www.nsf.org/newsroom_pdf/concrete_pcr_2019.pdf

Environmental Product Declaration (EPD): EPDs present quantified environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function. EPDs must conform to ISO 14025, and EN 15804 or ISO 21930, and have at least a “cradle to gate” scope (which covers product life cycle from resource extraction to the factory).

19.07.030 – Scope

The requirements of this chapter shall apply to all plain and reinforced concrete installed within the unincorporated areas of Marin County.

19.07.040 – California Building Standards Code amendments

Section 1901.2 of the 2019 California Building Code is hereby amended as underlined:

1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code and Chapter 19.07 of Marin County Code.

Section R402.2.1 of the 2019 California Residential Code is hereby amended as underlined:

R402.2.1 Materials for concrete. Materials for concrete shall comply with the requirements of Section R608.5.1, as amended by Chapter 19.07 of Marin County Code.

Section R404.1.3 of the 2019 California Residential Code is hereby amended as underlined:

R404.1.3 Concrete foundation walls. Concrete foundation walls that support light-frame walls shall be designed and constructed in accordance with the provisions of this section, ACI 318, ACI 332, or PCA 100, as amended by Chapter 19.07 of Marin County Code. Concrete foundation walls that support above-grade concrete walls that are within the applicability limits of Section R608.2 shall be designed and constructed in accordance with the provisions of this section, ACI 318, ACI 332, or PCA 100, as amended by Chapter 19.07 of Marin County Code. Concrete foundation walls that support above-grade concrete walls that are not within the applicability limits of Section R608.2 shall be designed and constructed in accordance with the provisions of ACI 318, ACI 332, or PCA 100, as amended by Chapter 19.07 of Marin County Code. When ACI 318, ACI 332, PCA 100 or the provisions of this section, as amended by Chapter 19.07 of Marin County Code, are used to design concrete foundation walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.”

Section R506.1 of the 2019 California Residential Code is hereby amended as underlined:

R506.1 General. Concrete slab-on-ground floors shall be designed and constructed in accordance with the provisions of this section of ACI 332, as amended by Chapter 19.07 of Marin County Code. Floors shall be a minimum 3 1/2 inches (89mm) thick (for expansive soils, see Section R403.1.8). The specified compressive strength of concrete shall be as set forth in Section R402.2.

Section R608.5 of the 2019 California Residential Code is hereby amended as underlined

R608.5 Materials. Materials used in the construction of concrete walls shall comply with this section, as amended by Chapter 19.07 of Marin County Code.

Section 301 of the 2019 California Green Building Standards Code is hereby amended as underlined:

301.6 Reduced-carbon concrete requirements for all projects. Plain and reinforced concrete installed as part of any project subject to the application of this code shall demonstrate compliance with the requirements of Chapter 19.07 of Marin County Code, the full text of which is herein added to this code by reference.

Section A4.403.2 of the 2019 California Green Building Standards Code is hereby amended as struck through and underlined:

A4.403.2 Reduction in cement use. As allowed by the enforcing agency, cement use in foundation mix design is reduced by ~~not less than 20 percent~~ as outlined in the requirements of Chapter 19.07 of Marin County Code.

Section A5.405.5 of the 2019 California Green Building Standards Code is hereby amended as underlined:

A5.405.5 Cement and concrete. Use cement and concrete made with recycled products and complying with the following sections and the requirements of Chapter 19.07 of Marin County.

19.07.050 – Compliance

Compliance with the requirements of this chapter shall be demonstrated through any of the compliance options in Sections 19.07.050.2 through 19.07.050.5.

Table 19.07.050 Cement and Embodied Carbon Limit Pathways

	Cement limits for use with any compliance method 19.07.050.2 through 19.07.050.5	Embodied Carbon limits for use with any compliance method 19.07.050.2 through 19.07.050.5
Minimum specified compressive strength f _c , psi (1)	Maximum ordinary Portland cement content, lbs/yd ³ (2)	Maximum embodied carbon kg CO _{2e} /m ³ , per EPD
up to 2500	362	260
3000	410	289
4000	456	313
5000	503	338
6000	531	356
7000	594	394
7001 and higher	657	433
up to 3000 light weight	512	578
4000 light weight	571	626
5000 light weight	629	675
Notes		
(1) For concrete strengths between the stated values, use linear interpolation to determine cement and/or embodied carbon limits.		
(2) Portland cement of any type per ASTM C150.		

19.07.050.1 Allowable Increases

- (1) *Cement and Embodied Carbon Limit Allowances.* Cement or Embodied Carbon limits shown in Table 19.07.050 can be increased by 30% for concretes demonstrated to the Building Official as requiring high early strength. Such concretes could include, but are not limited to, precast, prestressed concrete; beams and slabs above grade; and shotcrete
- (2) *Approved Cements* The maximum cement content may be increased proportionately above the tabulated value when using an approved cement, or blended cement, demonstrated by approved EPD to have a *plant-specific EPD* lower than 1040 kg CO₂e/metric ton. The increase in allowable cement content would be (1040 / plant-specific EPD) %.

19.07.050.2 Cement Limit Method - Mix

Cement content of a concrete mix using this method shall not exceed the value shown in the Table 19.07.050. Use of this method is limited to concrete with specified compressive strength not exceeding 5,000 psi.

19.07.050.3 Cement Limit Method - Project

Total cement content shall be based on total cement usage of all concrete mix designs within the same project. Total cement content for a project shall not exceed the value calculated according to Equation 19.07.050.3.

Equation 19.07.050.3:

$$Cem_{proj} < Cem_{allowed}$$

where

$$Cem_{proj} = \sum Cem_n V_n \text{ and } Cem_{allowed} = \sum Cem_{lim} V_n$$

and

n = the total number of concrete mixtures for the project

Cem_n = the cement content for mixture n , kg/m³ or lb/yd³

Cem_{lim} = the maximum cement content for mixture n per Table 19.07.050, kg/m³ or lb/yd³

V_n = the volume of mixture n concrete to be placed, yd³ or m³

Applicant can use yd³ or m³ for calculation, but must keep same units throughout

19.07.050.4 Embodied Carbon Method - Mix

Embodied carbon of a concrete mix, based on an approved environmental product declaration (EPD), shall not exceed the value given in Table 19.07.050

19.07.050.5 Embodied Carbon Method - Project

Total embodied carbon (EC_{proj}) of all concrete mix designs within the same project shall not exceed the project limit ($EC_{allowed}$) determined using Table 19.07.050 and Equation 19.07.050.5.

Equation 19.07.050.5:

$$EC_{proj} < EC_{allowed}$$

where

$$EC_{proj} = \sum EC_n v_n \text{ and } EC_{allowed} = \sum EC_{lim} v_n$$

and

n = the total number of concrete mixtures for the project

EC_n = the embodied carbon potential for mixture n per mixture EPD, kg/m³

EC_{lim} = the embodied carbon potential limit for mixture n per table 19.07.050, kg/m³

v_n = the volume of mixture n concrete to be placed, yd³ or m³

Applicant can use yd³ or m³ for calculation, but must keep same units throughout

19.07.060 – Verification and Enforcement

As a condition prior to the issuance of every building permit involving placement of concrete, the permit applicant shall be required to submit a completed Low-Carbon Concrete Plan Review Compliance Form that shall be provided by and reviewed for compliance by the building department prior to issuing the permit.

As a condition of such building permits, and prior to approving construction inspections following placement of concrete, the permit applicant shall be required to submit batch certificates and/or EPDs provided by the concrete provider that demonstrate compliance with the Low-Carbon Concrete Plan Review Compliance Form on file with the building permit. The batch certificates and/or EPDs shall be reviewed for compliance by the building department prior to approving any further inspections.

When deviations from compliance with this section occur the chief building official is authorized to require evidence of equivalent carbon reductions from the portions of remaining construction of the project to demonstrate alternative compliance with the intent of this chapter.

For projects involving placement of concrete by, or on behalf of, a public works, parks, or similar department the director of such department, or his/her assignee, shall maintain accurate records of the total volume (in cubic yards) of all concrete placed, as well as the total compliant volume (in cubic yards) of all concrete placed, and shall report this data annually to the governing body in a form expressing an annual compliance percentage derived from the quotient of total compliant concrete volume placed divided by total concrete volume placed.

19.07.70 – Exemptions

- (1) *Hardship or infeasibility exemption.* If an applicant for a project subject to this chapter believes that circumstances exist that make it a hardship or infeasible to meet the requirements of this chapter, the applicant may request an exemption as set forth below. In applying for an exemption, the burden is on the applicant to show hardship or infeasibility. The applicant shall identify in writing the specific requirements of the standards for compliance that the project is unable to achieve and the circumstances that make it a hardship or infeasible for the project to comply with this chapter. Circumstances that constitute hardship or infeasibility may include, but are not limited to the following:
 - a. There is a lack of commercially available material necessary to comply with this chapter;

- b. The cost of achieving compliance is disproportionate to the overall cost of the project;
 - c. Compliance with certain requirements would impair the historic integrity of buildings listed on a local, state or federal list or register of historic structures as regulated by the California Historic Building Code (Title 24, Part 8).
- (2) *Granting of exemption.* If the chief building official determines that it is a hardship or infeasible for the applicant to fully meet the requirements of this chapter and that granting the requested exemption will not cause the building to fail to comply with the California Building Standards Code, the chief building official shall determine the maximum feasible threshold of compliance reasonably achievable for the project. In making this determination, the chief building official shall consider whether alternate, practical means of achieving the objectives of this chapter can be satisfied. If an exemption is granted, the applicant shall be required to comply with this chapter in all other respects and shall be required to achieve the threshold of compliance determined to be achievable by the chief building official.
- (3) *Denial of exception.* If the chief building official determines that it is reasonably possible for the applicant to fully meet the requirements of this chapter, the request shall be denied and the applicant shall be notified of the decision in writing. The project and compliance documentation shall be modified to comply with the standards for compliance.
- (4) *Appeal.* Any aggrieved applicant or person may appeal the determination of the chief building official regarding the granting or denial of an exemption or compliance with any other provision of this chapter. An appeal of a determination of the chief building official shall be filed in writing and processed in accordance with the provisions of Section 19.04.028 of this code.