

DSA Code Amendment development

## TRACKING

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## APPLICABLE CODE

Applicable Code Section(s): Title 24, Part 11 CALGreen, Chapter 5 Nonresidential Mandatory Measures

Topic: Embodied Carbon Limits Reduction

## CURRENT CODE LANGUAGE

**SECTION 5.105**

**DECONSTRUCTION AND REUSE**

**OF EXISTING STRUCTURES**

**5.105.1 Scope.**

**[BSC-CG]** Effective July 1, 2024, alteration(s) to existing building(s) where the combined altered floor area is 100,000 square feet or greater shall comply with either Section 5.105.2, 5.409.2, or 5.409.3. Addition(s) to existing building(s) where the total floor area combined with the existing building(s) is 100,000 square feet or greater shall comply with either Section 5.105.2, Section 5.409.2, or Section 5.409.3. Effective January 1, 2026, the combined floor area shall be 50,000 square feet or greater.

**[DSA-SS]** Alteration(s) to existing building(s) where the combined altered floor area is 50,000 square feet or greater shall comply with either Section 5.105.2, 5.409.2, or 5.409.3. Addition(s) to existing building(s) where the total floor area combined with the existing building(s) is 50,000 square feet or greater shall comply with either Section 5.105.2, Section 5.409.2, or Section 5.409.3.

**Exception [BSC-CG, DSA-SS]:** Combined addition(s) to existing building(s) of two times the area or more of the existing building(s) is not eligible to meet compliance with Section 5.105.2.

**5.105.2 Reuse of existing building.** An alteration or addition to an existing building shall maintain at a minimum 45 percent combined of the existing building’s primary structural elements (foundations; columns, beams, walls, and floors; and lateral elements) and existing building enclosure (roof framing, wall framing and exterior finishes). Window assemblies, insulation, portions of buildings deemed structurally unsound or hazardous, and hazardous materials that are remediated as part of the project shall not be included in the calculation.

**5.105.2.1 Verification of compliance**. Documentation shall be provided in the construction documents to demonstrate compliance with Section 5.105.2.

**Note:** Sample Worksheet WS-3 in Chapter 8 may be used to assist in documenting compliance with this section.

**5.105.3 Deconstruction (Reserved).**

**SECTION 5.409**

**LIFE CYCLE ASSESSMENT**

**5.409.1 Scope.**

**[BSC-CG]** Effective July 1, 2024, projects consisting of newly constructed building(s) with a combined floor area of 100,000 square feet or greater shall comply with either Section 5.409.2 or Section 5.409.3. Alteration(s) to existing building(s) where the combined altered floor area is 100,000 square feet or greater shall comply with either Section 5.105.2, 5.409.2, or 5.409.3. Addition(s) to existing building(s) where the total floor area combined with the existing building(s) is 100,000 square feet or greater shall comply with either Section 5.105.2, Section 5.409.2, or Section 5.409.3. Effective January 1, 2026, the combined floor area shall be 50,000 square feet or greater.

**[DSA-SS]** Projects consisting of newly constructed building(s) with a combined floor area of 50,000 square feet or greater shall comply with either Section 5.409.2 or Section 5.409.3. Alteration(s) to existing building(s) where the combined altered floor area is 50,000 square feet or greater shall comply with either Section 5.105.2, 5.409.2, or 5.409.3. Addition(s) to existing building(s) where the total floor area combined with the existing building(s) is 50,000 square feet or greater shall comply with either Section 5.105.2, Section 5.409.2, or Section 5.409.3.

**5.409.2 Whole building life cycle assessment.** Projects shall conduct a cradle-to-grave whole building life cycle assessment performed in accordance with ISO 14040 and ISO 14044, excluding operating energy, and demonstrating a minimum 10-percent reduction in global warming potential (GWP) as compared to a reference baseline building of similar size, function, complexity, type of construction, material specification, and location that meets the requirements of the *California Energy Code* currently in effect. Software used to conduct the whole building life cycle assessment, including reference baseline building, shall have a data set compliant with ISO 14044, and ISO 21930 or EN 15804, and the software shall conform to ISO 21931 and/or EN 15978. The software tools and data sets shall be the same for evaluation of both the baseline building and the proposed building.

**Notes:**

1. Software for calculating whole building life cycle assessment is available for free at Athena Sustainable Materials Institute (https://calculatelca.com/software/impact-estimator/) and OneClick LCA-Planetary (www.oneclicklca.com/planetary). Paid versions include, but are not limited to, Sphera GaBi Solutions (gabi.sphera.com), SimaPro (simapro.com), One-Click LCA (www.oneclicklca.com) and Tally for Revit (apps.autodesk.com).

2. ASTM E2921-22 “Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes, Standards, and Rating Systems” may be consulted for the assessment.

3. In addition to the required documentation specified in Section 5.409.2.3, Worksheet WS-9 may be required by the enforcing entity to demonstrate compliance with the requirements.

**5.409.2.1 Building components**. Building enclosure components included in the assessment shall be limited to glazing assemblies, insulation, and exterior finishes. Primary and secondary structural members included in the assessment shall be limited to footings and foundations, and structural columns, beams, walls, roofs, and floors.

**5.409.2.2 Reference study period.** The reference study period of the proposed building shall be equal to the reference baseline building and shall be 60 years.

**5.409.2.3 Verification of compliance.** A summary of the GWP analysis produced by the software and Worksheet WS-4 signed by the design professional of record shall be provided in the construction documents as documentation of compliance. A copy of the whole building life cycle assessment which includes the GWP analysis produced by the software, in addition to maintenance and training information, shall be included in the operation and maintenance manual and shall be provided to the owner at the close of construction. The enforcing agency may require inspection and inspection reports in accordance with Sections 702.2 and 703.1 during and at completion of construction to demonstrate substantial conformance. Inspection shall be performed by the design professional of record or third party acceptable to the enforcing agency.

**5.409.3 Product GWP compliance—prescriptive path.** Each product that is permanently installed and listed in Table 5.409.3 shall have a Type III environmental product declaration (EPD), either product-specific or factory-specific.

**5.409.3.1** Products shall not exceed the maximum GWP value specified in Table 5.409.3.

**Exception:** Concrete may be considered one product category to meet compliance with this section. A weighted average of the maximum GWP for all concrete mixes installed in the project shall be less than the weighted average maximum GWP allowed per Table 5.409.3 using Exception Equation 5.409.3.1. Calculations shall be performed with consistent units of measurement for the material quantity and the GWP value. For the purposes of this exception, industry-wide EPDs are acceptable.

**Exception EQUATION 5.409.3.1**

GWP*n* < GWP*allowed*

where

GWP*n* = Σ (GWPn)(vn)

and

GWPallowed = Σ (GWP*allowed*)(v*n*)

and

*n* = each concrete mix installed in the project

GWP*n* = the GWP for concrete mix *n* per concrete mix EPD, in kg CO2e/m3

GWP*allowed* = the GWP potential allowed for concrete mix *n* per Table 5.409.3

v*n* = the volume of concrete mix *n* installed in the project, in m3

**5.409.3.2 Verification of compliance.** Calculations to demonstrate compliance, Type III EPDs for products required to comply, if included in the project, and Worksheet WS-5 signed by the design professional of record shall be provided on the construction documents. Updated EPDs for products used in construction shall be provided to the owner at the close of construction and to the enforcement entity upon request. The enforcing agency may require inspection and inspection reports in accordance with Sections 702.2 and 703.1 during and at completion of construction to demonstrate substantial conformance. Inspection shall be performed by the design professional of record or third party acceptable to the enforcing agency.



**Note:** A sample ordinance for use by local agencies may be found in Appendix A of the document at the CalRecycle’s web site.

**WORKSHEET (WS-4)**

**Section 5.409.2 WHOLE BUILDING LIFE CYCLE ASSESSMENT**

Responsible Designer’s Declaration Statement:

I attest that the Whole Building Life Cycle Analysis has been performed according to the

requirements of Section 5.409.2 and has met the minimum 10 percent reduction in global warming potential as compared to a reference baseline building of similar size, function, complexity, type of construction, material specification, and location that meets the requirements of the California Energy Code currently in effect. Furthermore, I will ensure during construction that the material specifications will be reviewed for substantial conformance with the life cycle assessment indicated on the approved plans so at the close of construction the minimum 10 percent reduction in global warming potential is thereby secured.

(…)

**WORKSHEET (WS-5)**

**Section 5.409.3 PRODUCT GWP COMPLIANCE—PRESCRIPTIVE PATH**

Responsible Designer’s Declaration Statement:

I attest that prescriptive compliance has been performed according to the requirements of Section 5.409.3 and products have met the minimum 10 percent reduction in global warming potential as specified in Table 5.409.3. Furthermore, I will ensure during construction that the material specifications will be reviewed for substantial conformance with the global warming potential limits indicated on the approved plans so at the close of construction the minimum 10 percent reduction in global warming potential is thereby secured.

(…)

**WORKSHEET (WS-9)**

**Section 5.409.2 and Section A5.409.2 WHOLE BUILDING LIFE CYCLE ASSESSMENT**



## SUGGESTED TEXT OF PROPOSED AMENDMENT

**SECTION 202**

**DEFINITIONS**

**BIOGENIC CARBON.** The carbon dioxide absorbed from the atmosphere by plants as they grow and then released back into the atmosphere through processes such as decomposition.

**EMBODIED CARBON BUDGET (ECB).** An embodied carbon intensity (ECI) value used as a maximum acceptable limit for determining a project's compliance with embodied carbon reduction requirements and expressed in kgCO2e/m2.

**EMBODIED CARBON INTENSITY (ECI).** The total global warming potential (GWP) of a building per gross floor area and expressed in kgCO2e/m2.

**SALVAGED MATERIAL AND PRODUCT.** A construction component recovered from existing buildings or construction sites and reused without substantial alteration of its form. Salvaged materials are minimally processed only, such as cleaning, repairing, resurfacing and resizing. Common salvaged materials include structural beams and posts, flooring, doors, cabinetry, brick, and decorative items.

**SECTION 5.105**

**DECONSTRUCTION AND REUSE**

**OF EXISTING STRUCTURES**

**5.105.1 ~~Scope.~~ Reserved.**

**~~[BSC-CG]~~** ~~Effective July 1, 2024, alteration(s) to existing building(s) where the combined altered floor area is 100,000 square feet or greater shall comply with either Section 5.105.2, 5.409.2, or 5.409.3. Addition(s) to existing building(s) where the total floor area combined with the existing building(s) is 100,000 square feet or greater shall comply with either Section 5.105.2, Section 5.409.2, or Section 5.409.3. Effective January 1, 2026, the combined floor area shall be 50,000 square feet or greater.~~

**~~[DSA-SS]~~** ~~Alteration(s) to existing building(s) where the combined altered floor area is 50,000 square feet or greater shall comply with either Section 5.105.2, 5.409.2, or 5.409.3. Addition(s) to an existing building(s) where the total floor area combined with the existing building(s) is 50,000 square feet or greater shall comply with either Section 5.105.2, Section 5.409.2, or Section 5.409.3.~~

**~~Exception [BSC-CG, DSA-SS]:~~** ~~Combined addition(s) to an existing building(s) of two times the area or more of the existing building(s) is not eligible to meet compliance with Section 5.105.2.~~

**5.105.2 Reuse of existing building.** For reuse of existing buildings embodied carbon reduction requirements see Section 5.409.~~An alteration or addition to an existing building shall maintain at a minimum 45 percent combined of the existing building’s primary structural elements (foundations; columns, beams, walls, and floors; and lateral elements) and existing building enclosure (roof framing, wall framing and exterior finishes). Window assemblies, insulation, portions of buildings deemed structurally unsound or hazardous, and hazardous materials that are remediated as part of the project shall not be included in the calculation.~~

**~~5.105.2.1 Verification of compliance~~**~~. Documentation shall be provided in the construction documents to demonstrate compliance with Section 5.105.2.~~

**~~Note:~~** ~~Sample Worksheet WS-3 in Chapter 8 may be used to assist in documenting compliance with this section.~~

**5.105.3 Deconstruction (Reserved).**

**SECTION 5.409**

**~~LIFE CYCLE ASSESSMENT~~ EMBODIED CARBON REDUCTION**

**5.409.1 Scope.** Provisions of this section define the scope and options for embodied carbon reduction compliance.

**[BSC-CG]** (…)

**[DSA-SS]** ~~Projects consisting of newly constructed building(s) with a combined floor area of 50,000 square feet or greater shall comply with either Section 5.409.2 or Section 5.409.3. Alteration(s) to existing building(s) where the combined altered floor area is 50,000 square feet or greater shall comply with either Section 5.105.2, 5.409.2, or 5.409.3. Addition(s) to existing building(s) where the total floor area combined with the existing building(s) is 50,000 square feet or greater shall comply with either Section 5.105.2, Section 5.409.2, or Section 5.409.3.~~Projects with a combined new and/or altered building floor area of 25,000 square feet or greater shall comply with one of the following:

1. Reuse of existing building option in Section 5.409.2.

2. Product GWP – prescriptive option in Section 5.409.3.

3. Whole building life cycle assessment – performance option in Section 5.409.4.

**Exception [BSC-CG, DSA-SS]:** Newly constructed buildings, and combined addition(s) to existing building(s) of two times the area or more of the existing building(s), are not eligible to meet compliance with Section 5.409.2.

**5.409.1.1 [DSA-SS] Site paving.** Projects with a combined new site concrete area of 5,000 square feet or greater shall comply with Section 5.409.3 for all new site concrete and reinforcing steel.

[The following language is moved from Section 5.105.2 with minor modifications]**5.409.2 Reuse of existing building option.** An alteration or addition to an existing building shall maintain at a minimum 45 percent combined of the existing building’s primary structural elements (foundations; columns, beams, walls, and floors; and lateral elements) and existing building enclosure (roof framing, wall framing and exterior finishes). Window assemblies, insulation, portions of buildings deemed structurally unsound or hazardous, and hazardous materials that are remediated as part of the project shall not be included in the calculation.

**5.409.2.1 Verification of compliance**. Documentation shall be provided in the construction documents to demonstrate compliance with Section 5.~~105~~409.2.

**Note:** Sample Worksheet WS-3 in Chapter 8 may be used to assist in documenting compliance with this section.

**5.409.3 Product GWP ~~compliance~~ - prescriptive ~~path~~ option.** Each product that is permanently installed and listed in Table 5.409.3 shall not exceed the maximum GWP value specified in Table 5.409.3 and shall have a Type III environmental product declaration (EPD), either product-specific or factory-specific.

**~~5.409. 3.1~~** ~~Products shall not exceed the maximum GWP value specified in Table 5.409. 3.~~

**Exceptions:**

**1:** Salvaged materials and products are not required to have a Type III EPD and shall have a GWP of zero.

**~~Exception~~2:** ~~Concrete may be considered one product category to meet compliance with this section.~~ Concrete mixes may be considered individually, or as a~~A~~ weighted average of the maximum GWP for all concrete mixes installed in the project. The weighted average maximum GWP shall be less than the weighted average maximum GWP allowed per Table 5.409.3 using Exception Equation 5.409.3~~.1~~. Calculations shall be performed with consistent units of measurement for the material quantity and the GWP value. For the purposes of this exception, industry-wide EPDs are acceptable.

**Exception 2 EQUATION 5.409.3~~.1~~**

GWP*n* < GWP*allowed*

where

GWP*n* = Σ (GWPn)(vn)

and

GWPallowed = Σ (GWP*allowed*)(v*n*)

and

*n* = each concrete mix installed in the project

GWP*n* = the GWP for concrete mix *n* per concrete mix EPD, in kg CO2e/m3

GWP*allowed* = the GWP potential allowed for concrete mix *n* per Table 5.409.3

v*n* = the volume of concrete mix *n* installed in the project, in m3

**5.409.3.~~2~~1 Verification of compliance.** Calculations to demonstrate compliance, Type III EPDs for products required to comply, if included in the project, and Worksheet WS-5 signed by the design professional of record shall be provided on the construction documents. Updated EPDs for products used in construction shall be provided to the owner at the close of construction and to the enforcement entity upon request. The enforcing agency may require inspection and inspection reports in accordance with Sections 702.2 and 703.1 during and at completion of construction to demonstrate substantial conformance. Inspection shall be performed by the design professional of record or third party acceptable to the enforcing agency.

**TABLE 5.409.3**

**PRODUCT GWP LIMITS**

|  |  |  |
| --- | --- | --- |
| **Buy Clean California** **Materials Product Category 1** | **Maximum acceptable GWP value (unfabricated)(GWP allowed)** | **Unit of Measurement** |
| Hot-rolled structural steel sections | ~~1.77~~1.26 | MT CO2e/MT |
| Hollow structural sections | ~~3.00~~2.14 | MT CO2e/MT |
| Steel plate | ~~2.61~~1.86 | MT CO2e/MT |
| Concrete reinforcing steel | ~~1.56~~0.94 | MT CO2e/MT |
| Flat glass | ~~2.50~~1.79 | kg CO2e/MT |
| Light-density mineral wool board insulation | ~~5.83~~3.35 | kg CO2e/1 m2 |
| Heavy-density mineral wool board insulation | ~~14.28~~8.53 | kg CO2e/1 m2 |

**Concrete, Ready-Mixed 2, 3**

|  |  |  |
| --- | --- | --- |
| **Concrete Product Category** | **Maximum GWP allowed value(GWP allowed)** | **Unit of Measurement** |
| up to 2499 psi  | ~~450~~321 | kg CO2e/m3 |
| 2500-3499 psi  | ~~489~~349 | kg CO2e/m3 |
| 3500-4499 psi | ~~566~~404 | kg CO2e/m3 |
| 4500-5499 psi | ~~661~~472  | kg CO2e/m3 |
| 5500-6499 psi | ~~701~~501  | kg CO2e/m3 |
| 6500 psi and greater | ~~799~~571 | kg CO2e/m3 |

**Concrete, Lightweight Ready-Mixed 2**

|  |  |  |
| --- | --- | --- |
| **Concrete Product Category** | **Maximum GWP allowed value (GWP allowed)** | **Unit of Measurement** |
| up to 2499 psi  | ~~875~~625 | kg CO2e/m3 |
| 2500-3499 psi | ~~956~~683 | kg CO2e/m3 |
| 3500-4499 psi | ~~1,039~~742 | kg CO2e/m3 |

1. The GWP values of the products listed in Table 5.409.3 are based on ~~175~~125 percent of Buy Clean California Act (BCCA) GWP values effective January 1, 2025, except for concrete products which are not included in BCCA.
2. For concrete, ~~175~~125 percent of the National Ready Mix Concrete Association (NRMCA) 2022 version 3 Pacific Southwest regional benchmark values are used for the GWP allowed, except for High Early strength.
3. Concrete High Early Strength ready-mixed shall be calculated at 130 percent of the Ready mixed concrete GWP allowed values for each product category.

**~~Note:~~** ~~A sample ordinance for use by local agencies may be found in Appendix A of the document at the CalRecycle’s web site.~~

[The following language is moved from Section 5.409.2 with modifications]**5.409.4~~2~~ Whole building life cycle assessment – performance option.** Projects shall conduct a cradle-to-grave whole building life cycle assessment performed in accordance with ISO 14040 and ISO 14044, excluding operating energy, and shall demonstrate compliance with Section 5.409.4.1 carbon budget method, or Section 5.409.4.2 base building method. [The following language is moved to Section 5.409.4.2 with minor modifications]~~, demonstrating a minimum 10-percent reduction in global warming potential (GWP) as compared to a reference baseline building of similar size, function, complexity, type of construction, material specification, and location that meets the requirements of the~~ *~~California Energy Code~~* ~~currently in effect~~ Software used to conduct the whole building life cycle assessment, including reference baseline building if applicable, shall have a data set compliant with ISO 14044, and ISO 21930 or EN 15804, and the software shall conform to ISO 21931 and/or EN 15978. [The following language is moved to Section 5.409.4.2]~~The software tools and data sets shall be the same for evaluation of both the baseline building and the proposed building.~~

**Exception:** Biogenic carbon shall be excluded from the whole building life cycle assessment calculations.

**Notes:**

1. Software for calculating whole building life cycle assessment is available for free at Athena Sustainable Materials Institute (https://calculatelca.com/software/impact-estimator/) and OneClick LCA-Planetary (www.oneclicklca.com/planetary). Paid versions include, but are not limited to, Sphera GaBi Solutions (gabi.sphera.com), SimaPro (simapro.com), One-Click LCA (www.oneclicklca.com), Tangible Materials (www.tangiblematerials.com), and Tally for Revit (apps.autodesk.com).

2. ASTM E2921-22 “Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes, Standards, and Rating Systems” may be consulted for the assessment.

3. In addition to the required documentation specified in Section 5.409.4.5~~2.3~~, Worksheet WS-9 may be required by the enforcing entity to demonstrate compliance with the requirements.

**5.409.4.1 Carbon budget method.** Demonstrate the building’s embodied carbon intensity (ECI) does not exceed the embodied carbon budget (ECB) specified in Table 5.409.4.1.

**5.409.4.1.1 Embodied Carbon Intensity (ECI) Calculation.** To determine the Embodied Carbon Intensity (ECI), divide the building’s total Global Warming Potential (GWP) by gross floor area (GFA) in meters squared (m2).

**5.109.4.1.1 EQUATION:**

GWP/GFA (m2) = ECI (kgCO2e/m2)

**TABLE 5.409.4.1 – EMBODIED CARBON BUDGET (ECB) LIMITS**

|  |  |
| --- | --- |
| **Primary Occupancy Group** | **Maximum acceptable ECB value (kgCO2e/m2)1** |
| Storage (S) | 480 |
| Education (E) & Business (B) | 660 |
| Other occupancy groups  | 750 |

1. The ECB values are based on the 75th percentile of ECI of buildings included in the Carbon Leadership Forumʼs WBLCA Benchmark Study v2.

[The following language is moved from Section 5.409.4 with minor modifications.] **5.409.4.2 Baseline building method.** Demonstrate ~~and demonstrating~~ a minimum 10 percent reduction in global warming potential (GWP) as compared to a reference baseline building of similar size, function, complexity, type of construction, material specification, and geographic location that meets the requirements of the *California Energy Code* currently in effect. The software tools and data sets shall be the same for evaluation of both the baseline building and the proposed building.

**5.409.4~~2~~.3 Building components**. Building enclosure components included in the assessment shall be limited to glazing assemblies, insulation, and exterior finishes. Primary and secondary structural members included in the assessment shall be limited to footings and foundations, ~~and~~ structural columns, beams, walls, roofs, and floors.

**5.409.4.3.1** Salvaged materials and products are not required to have a Type III EPD and shall have a GWP of zero.

**5.409.4~~2~~.4~~2~~ Reference study period.** The reference study period of the proposed building shall be equal to the reference baseline building if applicable and shall be 60 years.

**5.409.4~~2~~.5~~3~~ Verification of compliance.** A summary of the GWP analysis produced by the software and Worksheet WS-4 signed by the design professional of record shall be provided in the construction documents as documentation of compliance. A copy of the whole building life cycle assessment which includes the GWP analysis produced by the software, in addition to maintenance and training information, shall be included in the operation and maintenance manual and shall be provided to the owner at the close of construction. The enforcing agency may require inspection and inspection reports in accordance with Sections 702.2 and 703.1 during and at completion of construction to demonstrate substantial conformance. Inspection shall be performed by the design professional of record or third party acceptable to the enforcing agency.

(…)

**WORKSHEET (WS-4)**

**Section 5.409.4~~2~~ WHOLE BUILDING LIFE CYCLE ASSESSMENT – PERFORMANCE OPTION**

Responsible Designer’s Declaration Statement:

I attest that the Whole Building Life Cycle Analysis has been performed according to the

requirements of Section 5.409.4~~2~~ and has complied with one of the following options:

1. The building’s embodied carbon intensity (ECI) does not exceed the embodied carbon budget (ECB) specified in Table 5.409.4.1.
2. The building has met the minimum 10 percent reduction in global warming potential as compared to a reference baseline building of similar size, function, complexity, type of construction, material specification, and geographic location that meets the requirements of the California Energy Code currently in effect.

Furthermore, I will ensure during construction that the material specifications will be reviewed for substantial conformance with the life cycle assessment indicated on the approved plans so at the close of construction the project’s carbon budget compliance or minimum 10 percentreduction in global warming potential (GWP) is thereby secured.

(…)

**WORKSHEET (WS-5)**

**Section 5.409.3 PRODUCT GWP ~~COMPLIANCE~~—PRESCRIPTIVE OPTION~~PATH~~**

Responsible Designer’s Declaration Statement:

I attest that each product listed in Table 5.409.3 and intended to be permanently installed complies with ~~prescriptive compliance has been performed according to~~ the requirements of Section 5.409.3 and does not exceed the maximum ~~products have met the minimum 10 percent reduction in~~ global warming potential (GWP) value ~~as~~ specified in Table 5.409.3.

Furthermore, I will ensure during construction that all~~the~~ material specifications and substitutions will be reviewed for substantial conformance with the requirements of Section 5.409.3 ~~global warming potential limits indicated on the approved plans~~ so at the close of construction compliance with the maximum GWP values ~~the minimum 10 percent reduction in global warming potential~~ is thereby secured.

(…)

**WORKSHEET (WS-9)**

**Section 5.409.4~~2~~ and Section A5.409.4~~2~~ WHOLE BUILDING LIFE CYCLE ASSESSMENT – PERFORMANCE OPTION**



## CODE TEXT IF ADOPTED

**SECTION 202**

**DEFINITIONS**

**BIOGENIC CARBON.** The carbon dioxide absorbed from the atmosphere by plants as they grow and then released back into the atmosphere through processes such as decomposition.

**EMBODIED CARBON BUDGET (ECB).** An embodied carbon intensity (ECI) value used as a maximum acceptable limit for determining a project's compliance with embodied carbon reduction requirements and expressed in kgCO2e/m2.

**EMBODIED CARBON INTENSITY (ECI).** The total global warming potential (GWP) of a building per gross floor area and expressed in kgCO2e/m2.

**SALVAGED MATERIAL AND PRODUCT.** A construction component recovered from existing buildings or construction sites and reused without substantial alteration of its form. Salvaged materials are minimally processed only, such as cleaning, repairing, resurfacing and resizing. Common salvaged materials include structural beams and posts, flooring, doors, cabinetry, brick, and decorative items.

**SECTION 5.105**

**DECONSTRUCTION AND REUSE**

**OF EXISTING STRUCTURES**

**5.105.1 Reserved.**

**5.105.2 Reuse of existing building.** For reuse of existing buildings embodied carbon reduction requirements see Section 5.409.

**5.105.3 Deconstruction (Reserved).**

**SECTION 5.409**

**EMBODIED CARBON REDUCTION**

**5.409.1 Scope.** Provisions of this section define the scope and options for embodied carbon reduction compliance.

**[BSC-CG]** (…)

**[DSA-SS]** Projects with a combined new and/or altered building floor area of 25,000 square feet or greater shall comply with one of the following:

1. Reuse of existing building option in Section 5.409.2.

2. Product GWP – prescriptive option in Section 5.409.3.

3. Whole building life cycle assessment – performance option in Section 5.409.4.

**Exception [BSC-CG, DSA-SS]:** Newly constructed buildings, and combined addition(s) to existing building(s) of two times the area or more of the existing building(s), are not eligible to meet compliance with Section 5.409.2.

**5.409.1.1 [DSA-SS] Site paving.** Projects with a combined new site concrete area of 5,000 square feet or greater shall comply with Section 5.409.3 for all new site concrete and reinforcing steel.

**5.409.2 Reuse of existing building option.** An alteration or addition to an existing building shall maintain at a minimum 45 percent combined of the existing building’s primary structural elements (foundations; columns, beams, walls, and floors; and lateral elements) and existing building enclosure (roof framing, wall framing and exterior finishes). Window assemblies, insulation, portions of buildings deemed structurally unsound or hazardous, and hazardous materials that are remediated as part of the project shall not be included in the calculation.

**5.409.2.1 Verification of compliance**. Documentation shall be provided in the construction documents to demonstrate compliance with Section 5.409.2.

**Note:** Sample Worksheet WS-3 in Chapter 8 may be used to assist in documenting compliance with this section.

**5.409.3 Product GWP - prescriptive option.** Each product that is permanently installed and listed in Table 5.409.3 shall not exceed the maximum GWP value specified in Table 5.409.3 and shall have a Type III environmental product declaration (EPD), either product-specific or factory-specific.

**Exception:** Salvaged materials and products are not required to have a Type III EPD and shall have a GWP of zero.

**5.409.3.1 Concrete GWP.** Concrete mixes may be considered individually, or as a weighted average of the maximum GWP for all concrete mixes installed in the project. The weighted average maximum GWP shall be less than the weighted average maximum GWP allowed per Table 5.409.3 using Exception Equation 5.409.3.1. Calculations shall be performed with consistent units of measurement for the material quantity and the GWP value. For the purposes of this exception, industry-wide EPDs are acceptable.

**Exception EQUATION 5.409.3.1**

GWP*n* < GWP*allowed*

where

GWP*n* = Σ (GWPn)(vn)

and

GWPallowed = Σ (GWP*allowed*)(v*n*)

and

*n* = each concrete mix installed in the project

GWP*n* = the GWP for concrete mix *n* per concrete mix EPD, in kg CO2e/m3

GWP*allowed* = the GWP potential allowed for concrete mix *n* per Table 5.409.3

v*n* = the volume of concrete mix *n* installed in the project, in m3

**5.409.3.1 Verification of compliance.** Calculations to demonstrate compliance, Type III EPDs for products required to comply, if included in the project, and Worksheet WS-5 signed by the design professional of record shall be provided on the construction documents. Updated EPDs for products used in construction shall be provided to the owner at the close of construction and to the enforcement entity upon request. The enforcing agency may require inspection and inspection reports in accordance with Sections 702.2 and 703.1 during and at completion of construction to demonstrate substantial conformance. Inspection shall be performed by the design professional of record or third party acceptable to the enforcing agency.

**TABLE 5.409.3**

**PRODUCT GWP LIMITS**

|  |  |  |
| --- | --- | --- |
| **Buy Clean California** **Materials Product Category 1** | **Maximum acceptable GWP value (unfabricated)(GWP allowed)** | **Unit of Measurement** |
| Hot-rolled structural steel sections | 1.26 | MT CO2e/MT |
| Hollow structural sections | 2.14 | MT CO2e/MT |
| Steel plate | 1.86 | MT CO2e/MT |
| Concrete reinforcing steel | 0.94 | MT CO2e/MT |
| Flat glass | 1.79 | kg CO2e/MT |
| Light-density mineral wool board insulation | 3.35 | kg CO2e/1 m2 |
| Heavy-density mineral wool board insulation | 8.53 | kg CO2e/1 m2 |

**Concrete, Ready-Mixed 2, 3**

|  |  |  |
| --- | --- | --- |
| **Concrete Product Category** | **Maximum GWP allowed value(GWP allowed)** | **Unit of Measurement** |
| up to 2499 psi  | 321 | kg CO2e/m3 |
| 2500-3499 psi  | 349 | kg CO2e/m3 |
| 3500-4499 psi | 404 | kg CO2e/m3 |
| 4500-5499 psi | 472  | kg CO2e/m3 |
| 5500-6499 psi | 501  | kg CO2e/m3 |
| 6500 psi and greater | 571 | kg CO2e/m3 |

**Concrete, Lightweight Ready-Mixed 2**

|  |  |  |
| --- | --- | --- |
| **Concrete Product Category** | **Maximum GWP allowed value (GWP allowed)** | **Unit of Measurement** |
| up to 2499 psi  | 625 | kg CO2e/m3 |
| 2500-3499 psi | 683 | kg CO2e/m3 |
| 3500-4499 psi | 742 | kg CO2e/m3 |

1. The GWP values of the products listed in Table 5.409.3 are based on 125 percent of Buy Clean California Act (BCCA) GWP values effective January 1, 2025, except for concrete products which are not included in BCCA.
2. For concrete, 125 percent of the National Ready Mix Concrete Association (NRMCA) 2022 version 3 Pacific Southwest regional benchmark values are used for the GWP allowed, except for High Early strength.
3. Concrete High Early Strength ready-mixed shall be calculated at 130 percent of the Ready mixed concrete GWP allowed values for each product category.

**5.409.4 Whole building life cycle assessment – performance option.** Projects shall conduct a cradle-to-grave whole building life cycle assessment performed in accordance with ISO 14040 and ISO 14044, excluding operating energy, and shall demonstrate compliance with Section 5.409.4.1 carbon budget method, or Section 5.409.4.2 base building method. Software used to conduct the whole building life cycle assessment, including reference baseline building if applicable, shall have a data set compliant with ISO 14044, and ISO 21930 or EN 15804, and the software shall conform to ISO 21931 and/or EN 15978.

**Exception:** Biogenic carbon shall be excluded from the building’s total global warming potential (GWP).

**Notes:**

1. Software for calculating whole building life cycle assessment is available for free at Athena Sustainable Materials Institute (https://calculatelca.com/software/impact-estimator/) and OneClick LCA-Planetary (www.oneclicklca.com/planetary). Paid versions include, but are not limited to, Sphera GaBi Solutions (gabi.sphera.com), SimaPro (simapro.com), One-Click LCA (www.oneclicklca.com), Tangible Materials (www.tangiblematerials.com), and Tally for Revit (apps.autodesk.com).

2. ASTM E2921-22 “Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes, Standards, and Rating Systems” may be consulted for the assessment.

3. In addition to the required documentation specified in Section 5.409.4.5, Worksheet WS-9 may be required by the enforcing entity to demonstrate compliance with the requirements.

**5.409.4.1 Carbon budget method.** Demonstrate the building’s embodied carbon intensity (ECI) does not exceed the embodied carbon budget (ECB) specified in Table 5.409.4.1.

**5.409.4.1.1 Embodied Carbon Intensity (ECI) Calculation.** To determine the Embodied Carbon Intensity (ECI), divide the building’s total Global Warming Potential (GWP) by gross floor area (GFA) in meters squared (m2).

**5.109.4.1.1 EQUATION:**

GWP/GFA (m2) = ECI (kgCO2e/m2)

**TABLE 5.409.4.1 – EMBODIED CARBON BUDGET (ECB) LIMITS**

|  |  |
| --- | --- |
| **Primary Occupancy Group** | **Maximum acceptable ECB value (kgCO2e/m2)1** |
| Storage (S) | 480 |
| Education (E) & Business (B) | 660 |
| Other occupancy groups  | 750 |

1. The ECB values are based on the 75th percentile of ECI of buildings included in the Carbon Leadership Forumʼs WBLCA Benchmark Study v2.

**5.409.4.2 Baseline building method.** Demonstrate a minimum 10 percent reduction in global warming potential (GWP) as compared to a reference baseline building of similar size, function, complexity, type of construction, material specification, and geographic location that meets the requirements of the *California Energy Code* currently in effect. The software tools, and data sets shall be the same for evaluation of both the baseline building and the proposed building.

**5.409.4.3 Building components**. Building enclosure components included in the assessment shall be limited to glazing assemblies, insulation, and exterior finishes. Primary and secondary structural members included in the assessment shall be limited to footings and foundations, structural columns, beams, walls, roofs, and floors.

**5.409.4.3.1** Salvaged materials and products are not required to have a Type III EPD and shall have a GWP of zero.

**5.409.4.4 Reference study period.** The reference study period of the proposed building shall be equal to the reference baseline building if applicable and shall be 60 years.

**5.409.4.5 Verification of compliance.** A summary of the GWP analysis produced by the software and Worksheet WS-4 signed by the design professional of record shall be provided in the construction documents as documentation of compliance. A copy of the whole building life cycle assessment which includes the GWP analysis produced by the software, in addition to maintenance and training information, shall be included in the operation and maintenance manual and shall be provided to the owner at the close of construction. The enforcing agency may require inspection and inspection reports in accordance with Sections 702.2 and 703.1 during and at completion of construction to demonstrate substantial conformance. Inspection shall be performed by the design professional of record or third party acceptable to the enforcing agency.

**WORKSHEET (WS-4)**

**Section 5.409.4~~2~~ WHOLE BUILDING LIFE CYCLE ASSESSMENT**

Responsible Designer’s Declaration Statement:

I attest that the Whole Building Life Cycle Analysis has been performed according to the

requirements of Section 5.409.4 and has complied with one of the following options:

1. The building’s embodied carbon intensity (ECI) does not exceed the embodied carbon budget (ECB) specified in Table 5.409.4.1.
2. The building has met the minimum 10 percent reduction in global warming potential as compared to a reference baseline building of similar size, function, complexity, type of construction, material specification, and geographic location that meets the requirements of the California Energy Code currently in effect.

Furthermore, I will ensure during construction that the material specifications will be reviewed for substantial conformance with the life cycle assessment indicated on the approved plans so at the close of construction the method of compliance for reduction in global warming potential (GWP) is thereby secured.

(…)

**WORKSHEET (WS-5)**

**Section 5.409.3 PRODUCT GWP COMPLIANCE—PRESCRIPTIVE PATH**

Responsible Designer’s Declaration Statement:

I attest that each product listed in Table 5.409.3 and intended to be permanently installed complies with the requirements of Section 5.409.3 and does not exceed the maximum global warming potential (GWP) specified in Table 5.409.3. Furthermore, I will ensure during construction that all material specifications and substitutions will be reviewed for substantial conformance with the requirements of Section 5.409.3 so at the close of construction compliance with the maximum GWP values is thereby secured.

(…)

**WORKSHEET (WS-9)**

**Section 5.409.4 and Section A5.409.4 WHOLE BUILDING LIFE CYCLE ASSESSMENT**



## STATEMENT OF REASONS

DSA proposes to relocate Section 5.105, Deconstruction and Reuse of Existing Structures, to Section 5.409 and rename Section 5.409 to Embodied Carbon Reduction, with subsection 5.409.2, 5.409.3 and 5.409.4 reorganized and renamed to identify them as “options”. This will clarify that there are three options for embodied carbon reduction compliance including reuse of existing structures option, product GWP – prescriptive option, or whole building life cycle assessment – performance option as applicable based on project type and scale. Additional amendments to these sections are for clarification.

DSA proposes to reduce the compliance threshold from projects with a combined new or renovated building area of 50,000 square feet to 25,000 square feet. Building characteristics data from the Commercial Buildings Energy Consumption Survey (CBECS) was analyzed and compared the number of all new buildings in the U.S. built in 2018 by size and by floorspace. A targeted analysis reflects 13% of all buildings are greater than 25,000 sf and account for 62,355,000 sf, which is 65% of the total building floorspace. Thus, targeting buildings greater than 25,000 sf yields the greatest reduction potential via total building area with the lowest number of buildings being targeted. Additionally, the study showed that the average education building size is 31,100 sf. Reducing the threshold to 25,000 sf will capture the average education building while still alleviating the impact on smaller projects.

DSA proposes to add the requirement for projects with combined new site concrete area of 5,000 square feet or greater to comply with the GWP limits in Table 5.409.3 for consistency with the intent of 5.409.3 to target the highest GWP materials for reduction. According to the 2021 Integrated Energy Policy Report Volume I-Building Decarbonization, produced by the California Energy Commission, “In new building projects, on average, up to 50 percent of total GHG emissions, considered over a 30-year building life, are from the embodied carbon associated with the initial construction, and nearly 70 percent of that is from just six materials—concrete and steel (by far the most significant), …”

DSA proposes to amend Life Cycle Assessment – performance option Section 5.409.4 (formerly Section 5.409.2) to allow a carbon budget as a secondary option to the baseline building model. The carbon budget was proposed by the AIA sponsored stakeholder group Carbon Leadership Forum.

DSA proposes to reduce maximum GWP levels in the Product GWP Limits Table 5.409.3 to 125% of BCCA 2025 levels and NRMCA 2022 Benchmark levels to achieve California’s decarbonization goals, as required by executive orders and legislation.

**Executive Orders, Legislation and State Agency reports (background taken from the 2022 Intervening Code Cycle):**

California law has established many climate action objectives, the rationale behind them,

and assessment and management frameworks which taken together, mandate rapid and

wide-ranging building sector decarbonization. Citations that follow are examples that

broadly support the actions being proposed in this regulatory proposal.

Assembly Bill 32 (Nunez, Chapter 488, Statutes of 2006) known as the California Global

Solutions Act requires California to reduce GHG emissions to 1990 levels by 2022. AB 32

also requires the California Air Resources Board (CARB) to develop a Scoping Plan to

achieve carbon neutrality. Senate Bill 32 (Pavely, Chapter 249, Statutes of 2016)

enhanced the statewide greenhouse gas emissions reduction to 40 percent below the

1990 level by 2030. CARB’s May 10, 2022 draft 2022 Scoping Plan Update states the plan

will “…assess progress towards achieving the Senate Bill 322030 target and lay out a path

to achieve carbon neutrality no later than 2045. The 2022 Scoping Plan Update focuses on

outcomes needed to achieve carbon neutrality by assessing paths for clean technology, energy deployment, natural and working lands, and others, and is designed to meet the

State’s long-term climate objectives and support a range of economic, environmental,

energy security, environmental justice, and public health priorities. The 2022 Scoping Plan

Appendix F Building Decarbonization, acknowledges that as decarbonized buildings use

less operational energy, addressing building materials and methods of construction

lifecycle emissions becomes important. Therefore, reducing embodied carbon associated with

building materials becomes increasingly important to address. Embodied carbon of

buildings—referring to GHG emissions from extracting and manufacturing building

materials—contributes at least 11 percent of all energy-related emissions annually world-wide.

Studies may underestimate embodied carbon; a full life-cycle emissions assessment

would include transportation and disposal of building materials. Embodied carbon can be

reduced through cost-effective management practices including the optimal use of building

materials with high-recycled or low-carbon products.”

Senate Bill 1389 (Bowen, Chapter 568, Statutes of 2002) requires the California Energy

Commission to, [C]onduct assessments and forecasts of all aspects of energy industry

supply, production, transportation, delivery and distribution, demand, and prices. The

Energy Commission shall use these assessments and forecasts to develop energy

policies that conserve resources, protect the environment, ensure energy reliability,

enhance the state's economy, and protect public health and safety." (Pub. Res.

Code § 25301(a)). The 2021 Integrated Energy Policy Report (IEPR) provides information

and policy recommendations on advancing a clean, reliable, and affordable energy system

for all Californians. The 2021 Integrated Energy Policy Report Volume I-Building

Decarbonization includes discussions about Embodied Carbon in building materials and

the need for changes in CALGreen to address low-carbon design and construction criteria.

https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2022-integrated-energy-policy-report-update.

Assembly Bill 262 (Bonta, Chapter 816, Statutes of 2017) According to the Department of

General Service’s (DGS) Legislative Reports (ca.gov) “The BCCA was introduced as

Assembly Bill (AB) 262 (Bonta, Chapter 816, Statutes of 2017). It addressed the

greenhouse gases associated with the production of construction products used in

California state public works projects. According to the author, the bill was meant to “level

the playing field” and benefit those manufacturers who have made a conscious effort to

lower greenhouse gas emissions in the production of materials. The bill was signed into

law by Governor Edmund G. Brown Jr. on October 15, 2017. The BCCA was subsequently

amended by AB 1817 (Ting, Chapter 37, Statutes of 2018) and AB 137 (Ting, Chapter 77,

Statutes of 2021).

The BCCA targets carbon emissions associated with the manufacturing of structural steel,

concrete reinforcing steel, flat glass, and mineral wool board insulation. State agencies

that award contracts (“awarding authorities”) are responsible for ensuring that these

materials, when used in public works projects, do not have a GWP [global warming

potential] that exceeds the limit set by DGS. The document used to establish the GWP

limit (and ultimately determine compliance) is the EPD [environmental product

declaration].”

Assembly Bill 2446 (Holden, Chapter 352, Statures of 2022) requires State Air Resources

Board, by July 1, 2025, to develop, in consultation with specified stakeholders, a

framework for measuring and then reducing the average carbon intensity of the materials

used in the construction of new buildings, including those for residential uses. The

Legislative intent recognizes that in recent years, building decarbonization has become a growing priority for the state. As a result, the State Air Resources Board and State Energy

Resources Conservation and Development Commission may include building

decarbonization in future updates to the Scoping Plan and Integrated Energy Policy

Report. The California Energy Code, Part 6 of Title 24, address energy and water

efficiency requirements for the operation of newly constructed buildings, additions to

existing buildings, and alterations to existing buildings. However, those standards do not

address the construction phase of buildings, or the broader lifecycle impacts beyond direct

energy and water inputs during the operation or use phase of the building.

Senate Bill 27 (Skinner, 2021) requires the California Natural Resources Agency (CNRA)

is to create a Carbon Sequestration and Climate Resiliency Project Registry. The Registry

is intended to facilitate funding of nature-based and direct air capture projects that deliver

on California’s climate goals.

Senate Bill 596 (Becker, Chapter 246 of the Statutes of 2021) established the intent of the

Legislature that attaining net-zero or net-negative emissions of greenhouse gases from the

cement and concrete sector become a pillar of the state’s strategy for achieving carbon

neutrality and develop a comprehensive strategy for the state’s cement sector to achieve

net zero-emissions of greenhouse gases used within the state as soon as possible, but no

later than December 31, 2045.

Executive Order B-55-18, ordered a statewide goal to achieve carbon neutrality as soon as

possible, but no later than 2045, and achieve and maintain net negative emissions

thereafter.

Letter from the Office of the Governor to Chair of the California Air Resources Board July

22, 2022, “California is in the midst of a climate crisis. Drought, wildfire, and extreme heat

have become everyday realities. We are compelled to do more… Buildings are a large

source of carbon pollution, and decarbonization of California’s buildings must be

accelerated to achieve our climate targets.”

## DSA COMMENTS

Portions of these amendments are being co-adopted with BSC as indicated by agency banners.