EO 22 Embodied Carbon Guidance

a. Background

On September 20, 2022, New York State issued Executive Order 22: Leading by Example (EO22) to streamline the administration of the State's lead-by-example sustainability and climate directives, and set new goals for the environmental performance of State agencies and authorities.

Under EO22 the GreenNY Council is directed to issue guidance on reducing embodied carbon from common construction materials. Specifically, subsection D calls for the following:

> "*D. The Council shall issue Operational Directives and guidance for common construction materials to reduce the amount of embodied carbon in such materials. Starting January 1, 2023, Affected Entities shall seek to reduce the embodied carbon in all new construction or construction projects consisting of adaptive reuse or significant renovations that cost greater than 50% of the cost of new construction, submitted for permitting by Affected Entities, by taking the following actions:*
>
> > *1. Design teams shall calculate the total embodied carbon that will result from the project, including shipping, transportation, and construction equipment requirements.*
> > *2. Bidders shall be required to submit environmental product declarations when available, that include the amount of embodied carbon in given building materials.*" (Executive Order 22 – Leading by Example)

In line with the ethos of Leading by Example, New York State is one of the early adopters across the country in requiring State agencies to account for embodied carbon in its procurement, following the federal government's *Buy Clean Initiative* - which requires contractors and designers to procure lower embodied carbon materials, and submit environmental product declarations (EPDs). New York is also one of an initial group of states who have joined the Federal-State Buy Clean Partnership to collaborate on that effort nation-wide. New York State's effort will make a significant contribution to reduction of the State's greenhouse gas emissions (GHG) and environmental impact by making transparent how much embodied carbon is associated with capital projects and providing data to inform future decisions to reduce embodied carbon.

This guidance is being developed with several objectives in mind. The intent is to drive the demand for, and creation of, EPDs in the market, to drive a market for reduced embodied carbon materials, and to benchmark New York State's performance on the environmental impact of our construction materials with a view to setting limits in the future.

The guidance is being developed in two phases. In this first phase the guidance:

i. provides key concepts and definitions,
ii. identifies applicable projects,
iii. specifies covered construction materials,
iv. outlines disclosure requirements,
v. provides sample text for contracts.

The next phase of guidance will include strategies for reducing embodied carbon using life cycle analysis.

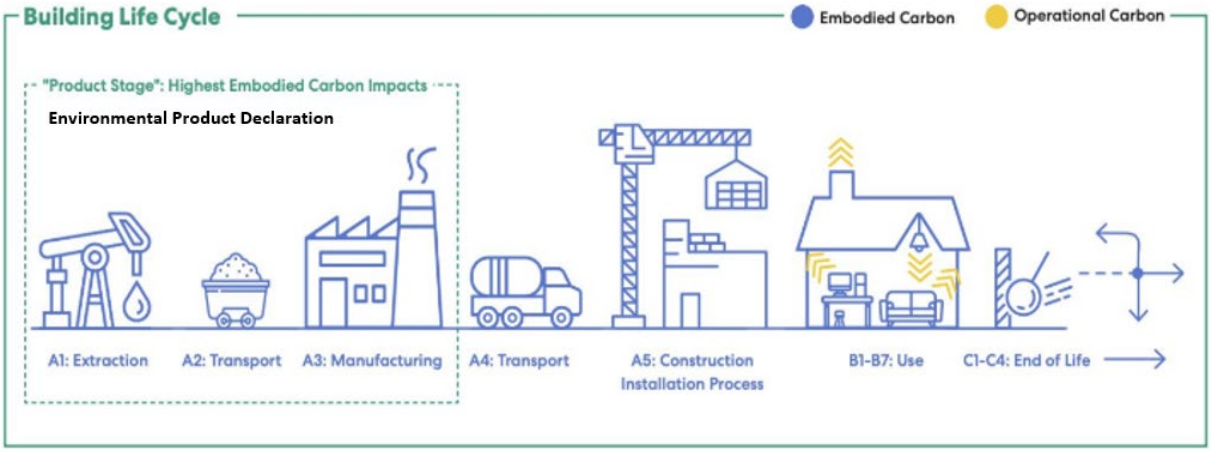
b. Definitions

i) Embodied carbon

In terms of construction, embodied carbon is the emissions that result from the mining, harvesting, processing, manufacturing, transportation, installation and use of the products and materials that are used, as well as end-of-life emissions associated with the disposal of those materials. (New York State Climate Action Council Scoping Plan, 2022).

Embodied carbon is measured using life cycle analysis (LCA) and expressed via a metric called Global Warming Potential (GWP). GWP is the heat absorbed by any greenhouse gas (GHG) in the atmosphere and is quantified in kilograms of CO_2 equivalent (kCO_2e).

Fig 1. What is included in Embodied Carbon Calculations



Source: Carbon Leadership Forum, with edits by Parson Healthy Materials Lab

When new buildings and infrastructure projects are constructed and renovated, clear and cost-effective opportunities exist for reducing embodied carbon emissions associated with construction materials. There are several pathways for reducing the carbon footprint of materials. One pathway is to select and procure lower embodied carbon materials. This pathway requires transparency around the embodied carbon associated with a given material or product, to allow for comparisons. Another pathway is to reuse existing buildings and materials where practical, rather than demolishing and constructing anew. The reuse of existing structures and materials can save significant amounts of new GHG from being emitted.

This guidance focuses on disclosure of the embodied carbon used in the State's large construction projects. By undertaking the steps outlined in this, and the future guidance, the State can drive transparency of the embodied carbon content of materials, reduce the carbon intensity of purchased materials for construction, and reduce the State's environmental impact in construction.

ii) Life cycle analysis (LCA) tools

Life cycle analysis (LCA), also known as life cycle assessment, is a methodology that is used to measure the environmental impacts of a building, product, or process over the full life cycle of a product, building or process, from raw material extraction through end-of-life and disposal.[1]

In addition to being the primary tool for calculating the environmental impact data for EPDs, LCA tools are very helpful on a project basis, to determine tradeoffs in carbon intensity by type and quantity of the collection of materials being used on a specific project.

There are a number of LCA tools available on the market to calculate emissions associated with a building or project. A list of these tools is available on the Carbon Leadership Forum website.

iii) Environmental Product Declarations (EPDs)

EPDs, as defined by the International Organization for Standardization (ISO) 14025, are third-party verified (also known as "type III") product declarations that quantify environmental information on the full life cycle of a product, from raw material supply, transport, manufacturing, installation, and operational use, through to waste processing and disposal at end-of-life.

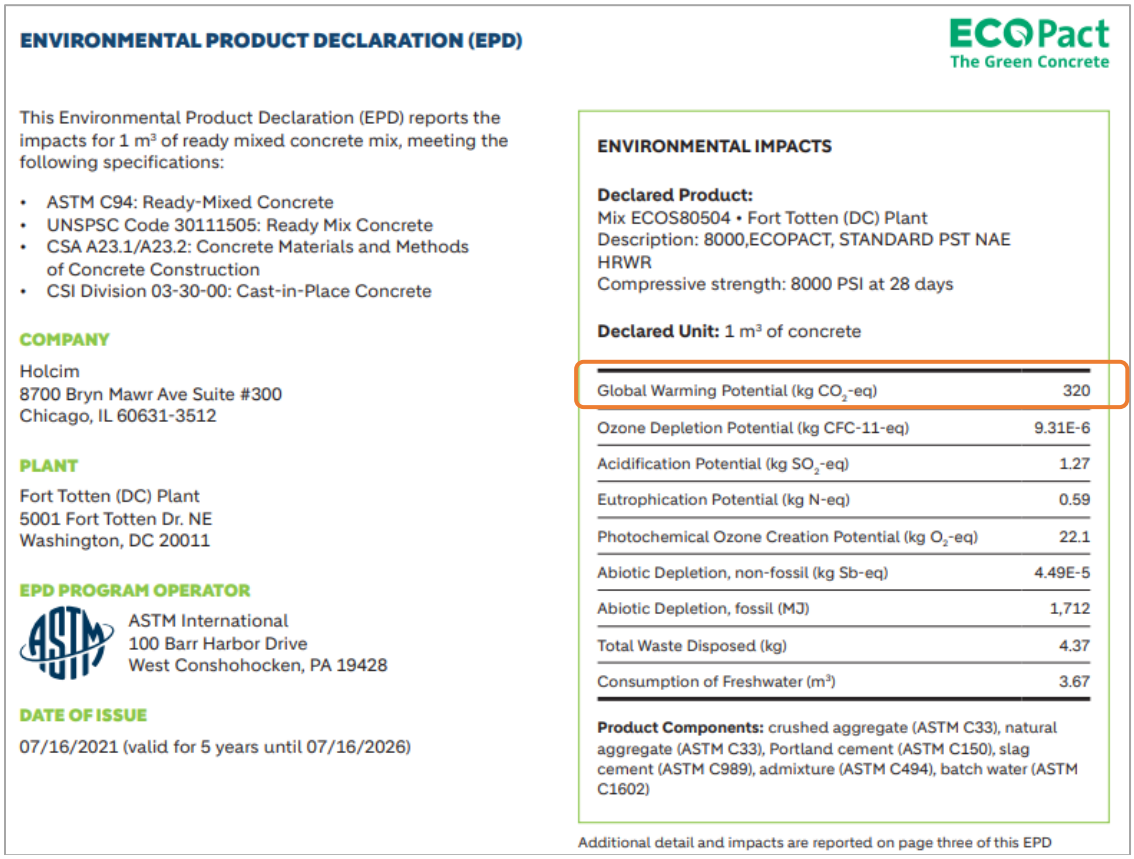
EPDs are frequently compared to the "nutrition label" of a construction product, listing its environmental impact via a number of metrics. The metric that is used as a proxy for embodied carbon emissions is GWP measured in kg CO_2 eq per quantity of construction material (e.g. cubic yard, ton).

EPDs provide a GWP quantity that represents the embodied carbon emissions associated with raw material extraction through production of a given product (stages A1 to A3), also known as "cradle-to-gate" (See Fig 1. above). The boundaries of what is included in an EPD for a given product are outlined below.

EPDs are developed by using the LCA methodology mentioned, following the standards set by ISO. A key component of the EPD is the Product Category Rules (PCR) which define how the data is collected for a specific type of product. PCRs are developed by a group of stakeholders that includes industry associations and manufacturers. For the purposes of this guidance, Affected Entities and their contractors and designers only need to be aware that industry-wide PCRs are the agreed upon basis for the data collected for EPDs.

[1] Carbon Leadership Forum, https://carbonleadershipforum.org/toolkit-2-measuring/.

Figure 2. EPD example



ENVIRONMENTAL PRODUCT DECLARATION (EPD)

ECOPact
The Green Concrete

This Environmental Product Declaration (EPD) reports the impacts for 1 m³ of ready mixed concrete mix, meeting the following specifications:

- ASTM C94: Ready-Mixed Concrete
- UNSPSC Code 30111505: Ready Mix Concrete
- CSA A23.1/A23.2: Concrete Materials and Methods of Concrete Construction
- CSI Division 03-30-00: Cast-in-Place Concrete

COMPANY

Holcim
8700 Bryn Mawr Ave Suite #300
Chicago, IL 60631-3512

PLANT

Fort Totten (DC) Plant
5001 Fort Totten Dr. NE
Washington, DC 20011

EPD PROGRAM OPERATOR

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428

DATE OF ISSUE

07/16/2021 (valid for 5 years until 07/16/2026)

ENVIRONMENTAL IMPACTS

Declared Product:
Mix ECOS80504 • Fort Totten (DC) Plant
Description: 8000,ECOPACT, STANDARD PST NAE HRWR
Compressive strength: 8000 PSI at 28 days

Declared Unit: 1 m³ of concrete

Global Warming Potential (kg CO_2-eq)	320
Ozone Depletion Potential (kg CFC-11-eq)	9.31E-6
Acidification Potential (kg SO_2-eq)	1.27
Eutrophication Potential (kg N-eq)	0.59
Photochemical Ozone Creation Potential (kg O_3-eq)	22.1
Abiotic Depletion, non-fossil (kg Sb-eq)	4.49E-5
Abiotic Depletion, fossil (MJ)	1,712
Total Waste Disposed (kg)	4.37
Consumption of Freshwater (m³)	3.67

Product Components: crushed aggregate (ASTM C33), natural aggregate (ASTM C33), Portland cement (ASTM C150), slag cement (ASTM C989), admixture (ASTM C494), batch water (ASTM C1602)

Additional detail and impacts are reported on page three of this EPD

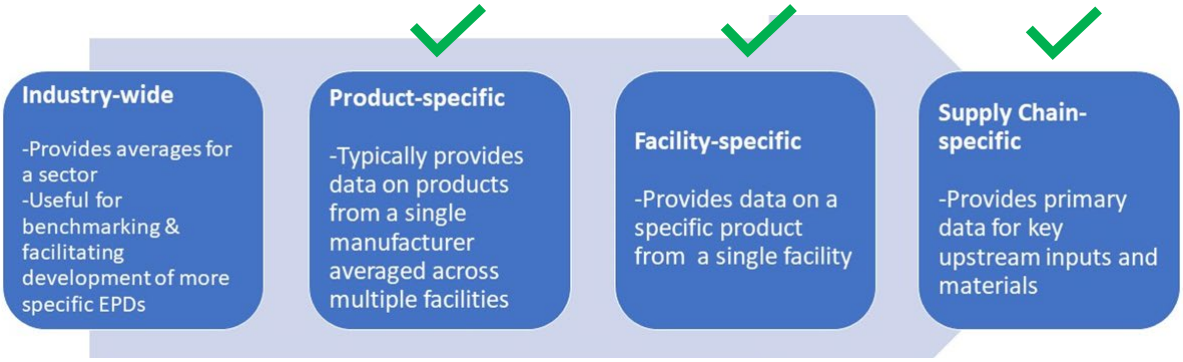
Source: Holcim (https://www.holcim.us/sites/us/files/2022-03/Holcim_ECOPact_EPD_v2.pdf)

iv) Acceptable EPDs

Acceptable EPDs under this guidance are non-expired, Product-specific, Facility or Plant-specific, or Supply Chain-specific type III (third-party reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

Digitized EPDs can be found on online EPD databases, or sourced directly from the manufacturer.

Figure 3. Types of EPDs in increasing levels of specificity and comparability:



Source: EPA webinar: Getting to Substantially Lower Embodied Greenhouse Gas Emission Construction Materials Environmental Product Declaration Assistance

c. Applicable Projects

The following guidelines are being issued for both transportation and non-transportation construction projects awarded by Affected Entities for their own or State operations.

The guidelines are applicable to non-transportation construction projects awarded by Affected Entities for their own or State operations, where 1) **the total project cost is over $1 million**, and 2) **the minimum (or larger) quantities of at least one of the covered construction materials are used**.[2]

For transportation projects, the **thresholds are by material quantities only**, not by project value. See Table 1. Covered Construction Materials for the minimum quantities of covered construction materials for which an EPD must be collected and reported.

d. Covered Construction Materials and Minimum Quantities

While all construction materials contain embodied carbon, the highest impact materials are those 1) with a high carbon footprint, 2) which are used in significant quantities on State projects, and 3) where reductions will result in the greatest GHG reductions for State projects.

For this reason, the GreenNY Council directs the Affected Entities to disclose embodied carbon that will result from projects utilizing the following materials if used in quantities above the stated thresholds**.**

[2] Some agencies bundle contracts, while others bid out work on a project for trades individually – hence the GreenNY Council is asking agencies to use a reasonable boundary in reporting contracts for projects over $1 million. This does not apply to projects supported through programmatic implementation, for example those awarded by NYSERDA or ESD.

Table 1. Covered Construction Materials

Covered Construction Material	**Minimum quantity for disclosure (subject to change)[3] for Buildings Projects**	**Minimum quantity for disclosure (subject to change) for Transportation Projects**
Concrete mixes	50 cubic yards or more	200 cubic yards (per mix design)
Asphalt mixes	16,854 pounds (or 10 cubic yards) or more	8,000 short tons (per mix design)
Steel i. Rebar ii. Hollow Structural Sections iii. Fabricated Steel Plate iv. Hot-Rolled Sections v. Cold-Formed & Galvanized	20,000 pounds or more for rebar 5,000 pounds or more for all others (categories ii – v)	20,000 pounds or more for rebar (per fabrication location) 15,000 pounds or more for all other categories (ii – v) per fabrication location
Glass (see footnote for conversion factor)[4] i. Flat Glass ii. Processed Glass iii. Insulated Glazing Units	2,000 square feet or more	2,000 square feet

e. Disclosure & Reporting

Disclosure will be comprised of two components. The first is disclosure of the material quantities and associated embodied carbon values. The second is an annual report on an Affected Entity's projects.

i) Disclosure of materials quantities and associated embodied carbon values

For all applicable projects and materials, Affected Entities will be required to disclose:

1) quantities of covered construction materials, whether or not there is an EPD,

2) provide a link to the EPD, if one is available,

3) and if an EPD is available, provide the total GWP calculation (kg CO_2e) per used material or product (with the kgCO_2e factor from the EPD).

[3] Materials and minimum quantities for disclosure were developed through extensive research, including the GSA's Interim Low Embodied Carbon Materials Requirements and Caltrans Buy Clean California Act requirements.

[4] UPDATED June 2024: The EO22 Embodied Carbon guidance Covered Construction Materials' table has a threshold for flat glass that is based on square feet. Typically flat glass is ordered by area, however, the Environmental Product Declarations (EPDs) for flat glass use a weight measurement - pounds or tons. So when reporting glass, especially glass that has an EPD, please ensure that you are also capturing the thickness of the glass as this will allow you to calculate the weight. When calculating the weight, please use this link (https://ogs.ny.gov/flat-glass-conversion-factors) to download the National Glass Association's Flat Glass area to weight conversion factors. Or see Appendix A.

Affected Entities, or their contractors, are recommended to enter their project data in EC3 or equivalent software with a database of acceptable EPDs. The use of such a database will greatly streamline and simplify reporting and tracking the above information as well as allow for efficient sourcing of available EPDs in the US market today. A project manager, or equivalent, from the Affected Entity will be responsible for verifying the accuracy of the information contained in the report before it is finalized.

If your agency will not be using EC3, please contact OGS to discuss reporting: sustainability@ogs.ny.gov with the subject line "EO22 Embodied Carbon Guidance Reporting".

ii) Annual Project List by Affected Entities
Affected Entities shall prepare a report listing all construction projects active in the previous fiscal year with a total project cost of over $1 million. This report should indicate which projects and associated contracts have used any of the covered construction materials in the minimum quantities mentioned here, and which have not. This reporting should identify if there are multiple contracts that are part of the same project.

Affected Entities will submit their Annual Project List to sustainability@ogs.ny.gov.

iii) Key dates
No later than **October 1, 2023,** Affected Entities shall include embodied carbon disclosure language in all authorized contracts.

The reporting period will be the State fiscal year.

By **August 31st, annually, starting August 31st 2024**, Affected Entities will have to report on the two items detailed above: an Annual Project List, and the Disclosure on Covered Materials - including GWP values and EPDs where available.

f. Sample contract language
To ensure contractors of Affected Entities disclose the requested information on quantities and emissions of Covered Construction Materials, the following sample contract language is provided, to be used in procurement documents, including solicitations, contracts, RFPs, RFQs, RFIs, SOWs, and others. This text should also be included, with any modifications necessary, in Affected Entities' standard contract terms and conditions, general conditions, project requirements, reporting guidelines, or individual material specifications.

> "**Embodied Carbon Disclosure:** For building materials covered by the GreenNY Council Embodied Carbon Guidance, contractors and designers shall disclose, at regular intervals during the course of the contract period (and no less than once a year), the exact materials/product type and estimated quantities used. For materials for which Environmental Product Declarations (EPDs) exist that comply with the GreenNY Council requirements, contractors are also required to submit $kgCO_2$ equivalent estimates by

material/product, and quantity used, on the project to date, with a link to the digital EPD."

"**Embodied Carbon Disclosure:** Contractors and designers shall be required to submit environmental product declarations (EPDs), if available, for all Covered Construction Materials used in this project under all circumstances.

EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

Digitized EPDs can be found on EPD databases and sent as a link to [*the designated person/entity collecting the EPDs on behalf of the agency*] as part of the submittals process, or entered directly into [*EPD reporting software, such as EC3*]."

Affected Entities can also include the below optional language where possible to reduce the embodied carbon of a project.

"The contractor shall seek to reduce the embodied carbon of this project by specifying and selecting low carbon or carbon sequestering materials[5] during procurement, through use of designs that reduce the needed quantity of carbon intensive materials, and/or by reusing existing materials and existing equipment."

g. Implementation

The GreenNY Council convenes an interagency Embodied Carbon Working Group, which provide resources and trainings for key staff. This working group provides feedback on the issues that are most relevant for NYS government construction projects, and has access to tools and supplemental guidance to integrate considerations for reducing embodied carbon into procurement and design activities.

The next phase of this guidance is being developed in conjunction with the Embodied Carbon Working Group.

For further information on this topic, guidance or working group please email:
sustainability@ogs.ny.gov for the attention of:
Mariane Jang, Senior Policy Advisor, Resiliency & Sustainability, Office of General Services.

[5] The U.S. Geological Survey defines carbon sequestration as "the process of capturing and storing atmospheric carbon dioxide. It is one method of reducing the amount of carbon dioxide in the atmosphere with the goal of reducing global climate change."

Appendix A.

Glass Technical Paper **FM01-08 (2020)**

Approximate Weight of Architectural Flat Glass

Design professionals, wall system manufacturers, and construction managers often need the weight of materials for engineering and construction site considerations. The table below provides approximate weights of architectural flat glass by thickness designations as published by North American manufacturers:

Architectural Flat Glass - Published Approximate Weight	
Glass Thickness Designation Inches (mm)	**Approximate lb/ft² (kg/m²)**
3/32 (2.5)	1.2 (5.7)
1/8 (3.0)	1.6 (7.6)
5/32 (4.0)	2.0 (9.9)
3/16 (5.0)	2.4 (11.9)
1/4 (6.0)	3.0 (14.6)
5/16 (8.0)	4.0 (19.5)
3/8 (10.0)	5.0 (24.4)
1/2 (12.0)	6.4 (31.2)
5/8 (16.0)	8.1 (39.5)
3/4 (19.0)	9.8 (47.8)

Approximate weights do not apply to patterned glass or products incorporating multiple lites of glass fabricated into an assembled product. Additional glass thicknesses are available. Consult individual manufacturers for detailed product availability. ASTM International[1] C1036 - *Standard Specification for Flat Glass* addresses quality requirements. If the exact thickness is known, the exact weight may be calculated using a glass density of 158 lb/ft³ (2531 kg/m³).

[1] ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 United States, Phone: 610.832.9500; Website: www.astm.org.

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