



City of Austin Plan to Transition to Low – Embodied Carbon Concrete In Pursuit of a Carbon Neutral Austin

Office of the City Engineer

January 2024

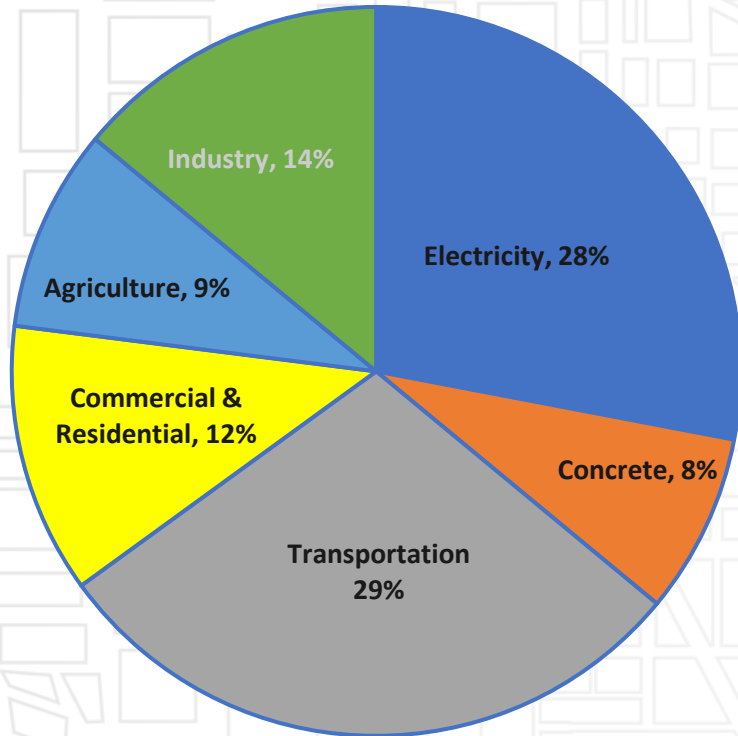




Austin

- The use of traditional cements and concretes and construction with concrete has a huge impact on the sustainability of most of our built environment and infrastructure.
- We must work together to affect change to be successful developing a future in which we all want to live.
- The City of Austin has an opportunity to take a leading role in the movement toward more sustainable infrastructure.
- The Austin City Council has passed a Resolution that empowers us to begin walking the path toward more sustainable concrete.

Climate Change and CO₂ Emissions



Year	1990	2005	2017	2018	2019	2020	2021
MMT CO ₂ Eq.	33.5	46.2	40.3	39.0	40.9	40.7	41.3
kt	33,484	46,194	40,324	38,971	40,896	40,888	41,312

- Cement industry is responsible for about 8% of carbon dioxide emissions
- Carbon dioxide emissions from cement production increased by 23.4% from 1990 through 2021.

Climate change, Environment and City of Austin

September 30, 2021 Austin City Council Regular Meeting

Item 99

Approve the adoption of the Austin Climate Equity Plan, which sets a new community-wide goal of equitably reaching net-zero community-wide greenhouse gas emissions by 2040, using a steep decline path followed by negative emissions.

Strategic Outcome(s): Economic Opportunity and Affordability, Mobility, Safety, Health and Environment, Culture and Lifelong Learning, Government that Works for All.

Item 110

Approve a resolution regarding Climate Equity Plan implementation.

Sponsors: Council Member Alison Alter, Council Member Gregorio Casar, Council Member Vanessa Fuentes, Council Member Leslie Pool, Council Member Kathie Tovo.

The climate emergency represents an existential threat to the City of Austin, the nation, and the planet.

Buy Clean Policies and Legislation Federal, State, and Local Initiatives



White House **Buy Clean Actions** Announced September 15th, 2022.

Administration Goal: Net-zero emissions by 2050 and a 50-52% reduction by 2030.

Prioritize the Federal Government's purchase of steel, concrete, asphalt and flat glass that have lower levels of emissions.

Expand lower-carbon construction materials used in federally-funded projects.

Convene states to partner on Buy Clean.

Increase data transparency through supplier reporting to track and reduce emissions.

Launch pilot programs to advance federal procurement of clean construction materials.

Expand the Buy Clean Task Force to eight more federal agencies (total of 17 now).



U.S. Department
of Transportation

The US Department of Transportation policy statement (issued September 15th, 2022),

"...the U.S. Department of Transportation will launch a Buy Clean Initiative that will assess and address the embodied carbon emissions that come from the engineering, design, construction, procurement, maintenance, and disposal of transportation projects"

1. The Department will explore the use of Environmental Product Declarations, which are transparent, verified reports used to communicate the environmental impacts of construction materials. Standardized reporting would help industry to confidently move forward in investing in the production of clean and reliable materials.

Concrete Sustainability Initiatives

Material Transparency: Environmental Product Declarations



Nutrition Facts

Serving Size 1/2 cup dry (40 g)
Servings Per container: 13

Amount Per Serving

Calories 150 **Calories from Fat** 25

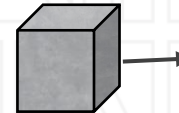
% Daily Value*

Total Fat 3 g	4%
Saturated Fat 0.5 g	2%
Trans Fat 0 g	0%
Cholesterol 0 mg	0%
Sodium 0 mg	0%
Total Carbohydrate 27 g	9%
Dietary Fiber 4 g	15%
Sugars 1 g	
Protein 5 g	
Vitamin A	0%
Vitamin C	0%
Calcium	0%
Iron	10%

*Percent Daily Values are based on a 2,000 calorie diet.
Your daily values may be higher or lower depending on
your calorie needs.

	Calories:	2,000	2,500
Total Fat	Less than	65 g	80 g
Sat Fat	Less than	20 g	25 g
Cholesterol	Less than	300 mg	300 mg
Sodium	Less than	2,400 mg	2,400 mg
Total Carbohydrate		300 g	375 g
Dietary Fiber		25 g	30 g

Nutrition Label



ENVIRONMENTAL IMPACTS

Declared Product:

Mix 45FN31C2C • Jeffco Plant
Description: CDOT CLASS B/D/P LOW SLUMP
Compressive strength: 4500 PSI at 28 days

Declared Unit: 1 m³ of concrete

Global Warming Potential (kg CO ₂ -eq)	345
Ozone Depletion Potential (kg CFC-11-eq)	8.20E-6
Acidification Potential (kg SO ₂ -eq)	1.01
Eutrophication Potential (kg N-eq)	0.39
Photochemical Ozone Creation Potential (kg O ₃ -eq)	22.4
Abiotic Depletion, non-fossil (kg Sb-eq)	7.02E-5
Abiotic Depletion, fossil (MJ)	710
Total Waste Disposed (kg)	102
Consumption of Freshwater (m ³)	3.24

Product Components: natural aggregate (ASTM C33), Portland cement (ASTM C150), batch water (ASTM C1602), fly ash (ASTM C618), admixture (ASTM C494), admixture (ASTM C260)

EPD

City of Austin City Council Resolution

Resolution 20230420-024 passed on April 20, 2023

RESOLUTION NO. 20230420-024

WHEREAS, the City of Austin has long been at the forefront of combating climate crisis by creating policies that reduce carbon emissions, and improve the environment and quality of life for residents; and

WHEREAS, the City, as a leader in innovation, routinely identifies and tests solutions to complex challenges facing the City; and

WHEREAS, the Austin Climate Equity Plan includes goals of equitably reaching net-zero community-wide greenhouse gas emissions by 2040; and

WHEREAS, in 2019 the Environmental Commission passed Motion 20190619-007c related to piloting low-carbon concrete; and

WHEREAS, Austin Energy's Green Building Program has encouraged the use of Environmental Product Declarations to increase understanding of the environmental impact of the products and materials used by the City; and

WHEREAS, the federal government has defined concrete as one of the four highest contributing construction materials to greenhouse gas (GHG) emissions along with asphalt, steel, and sheet glass; and

City of Austin Low-Embodied Carbon Concrete Initiative

Develop an initial plan to progress toward Low-Embodied Carbon Concrete by November 30, 2023

- 1) Provide Concrete Tracking that
 - a) Identifies how much concrete is used and it's impact
 - b) Require the use of EPDs to influence and encourage more sustainable concrete production
 - c) Strategy to review, pilot, and approve alternative, more sustainable concrete mix designs
- 2) Establish specifications and designs that allow for meeting the need for lower-embodied carbon concrete.
- 3) Provide annual report to City Council on progress toward the overall goal of more sustainable concrete.

City of Austin Plan

Concrete Industry Leaders



American Concrete Institute

Always advancing

The American Concrete Institute is a leading global authority for the development, dissemination, and adoption of its consensus-based standards, technical resources, and educational, training, & certification programs. Founded in 1904, ACI is headquartered in Farmington Hills, Michigan, USA, with a regional office in Dubai, UAE, and resource centers in Southern California and Chicago/Midwest. ACI has over 94 chapters, 244 student chapters, and 30,000 members spanning over 120 countries.



An ACI Center of Excellence
for Carbon Neutral Concrete

Launched in 2021, [NEU](#) was established by the American Concrete Institute to collaborate globally to drive research, education, awareness, and adoption of the use of carbon-neutral materials and technologies in the built environment.



Founded in 1930, the National Ready Mixed Concrete Association is the leading industry advocate. Our mission is to provide exceptional value for our members by responsibly representing and serving the entire ready mixed concrete industry through leadership, promotion, education and partnering to ensure ready mixed concrete is the building material of choice.

City of Austin Plan

Internal Collaboration and Reviews

- **April – July, 2023** Meeting and discussions with the COA internal Stakeholders, and the Industry experts
- **June 21, 2023** Plan draft kick-off meeting and presentation
- **July 7, 2023** Comments were due to the Office of the TPWD City Engineer (OCE).
- **July 7 – July 30, 2023** Comments revisions and plan finalizing by OCE, providing feedback to the COA stakeholders.
- **August 1 – Sept 14 2023** TPWD Executive Team review and commenting, Discussion with the CDS Executive team.
- **August 18 – Aug 31, 2023** OCE addresses the Executive team comments
- **September 14, 2023** Plan was sent to the ACM Robert Goode

City of Austin Plan

Carbon Footprint

Loosely defined, a **carbon footprint is a measure of how many greenhouse gas (GHG) emissions a person, organization, event, or product produces**. However, carbon footprints are often simplified by measuring only the amount of carbon dioxide (CO₂) produced.

When evaluating the carbon footprint of concrete usage, it is important to recognize the difference between cement and concrete. While cement is an energy-intensive product, concrete is one of the world's most CO₂-efficient and sustainable construction materials. It is the volume used that adds up.

CO₂ emissions from a cement plant are divided into two source categories:

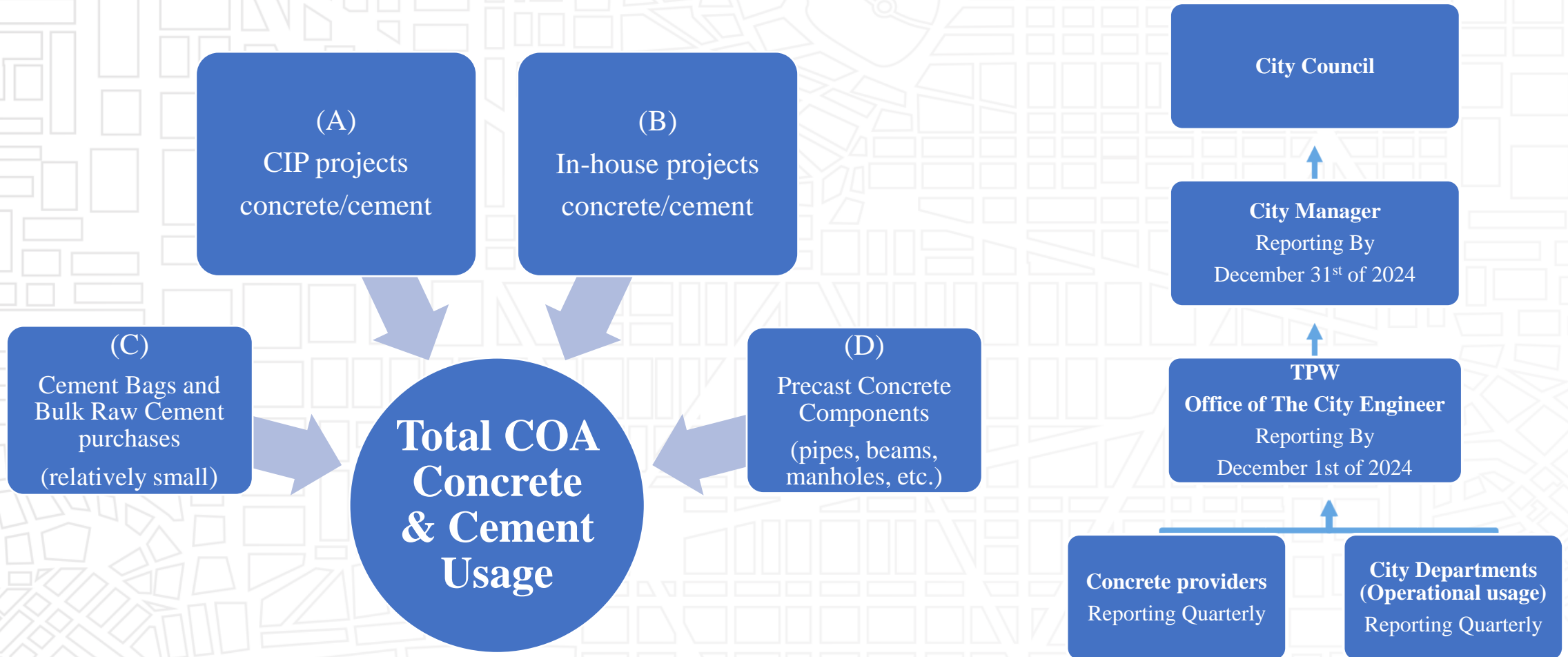
- Combustion (40% of emissions) – heat used
- Calcination (60% of emissions) – CO₂ released

The combustion-generated CO₂ emissions are related to fuel use. The CO₂ emissions due to calcination are formed when the raw materials (mostly limestone and clay) are heated to more than 2500°F and CO₂ is liberated from the decomposed minerals.



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Major Components of Concrete Use and Reporting Structure



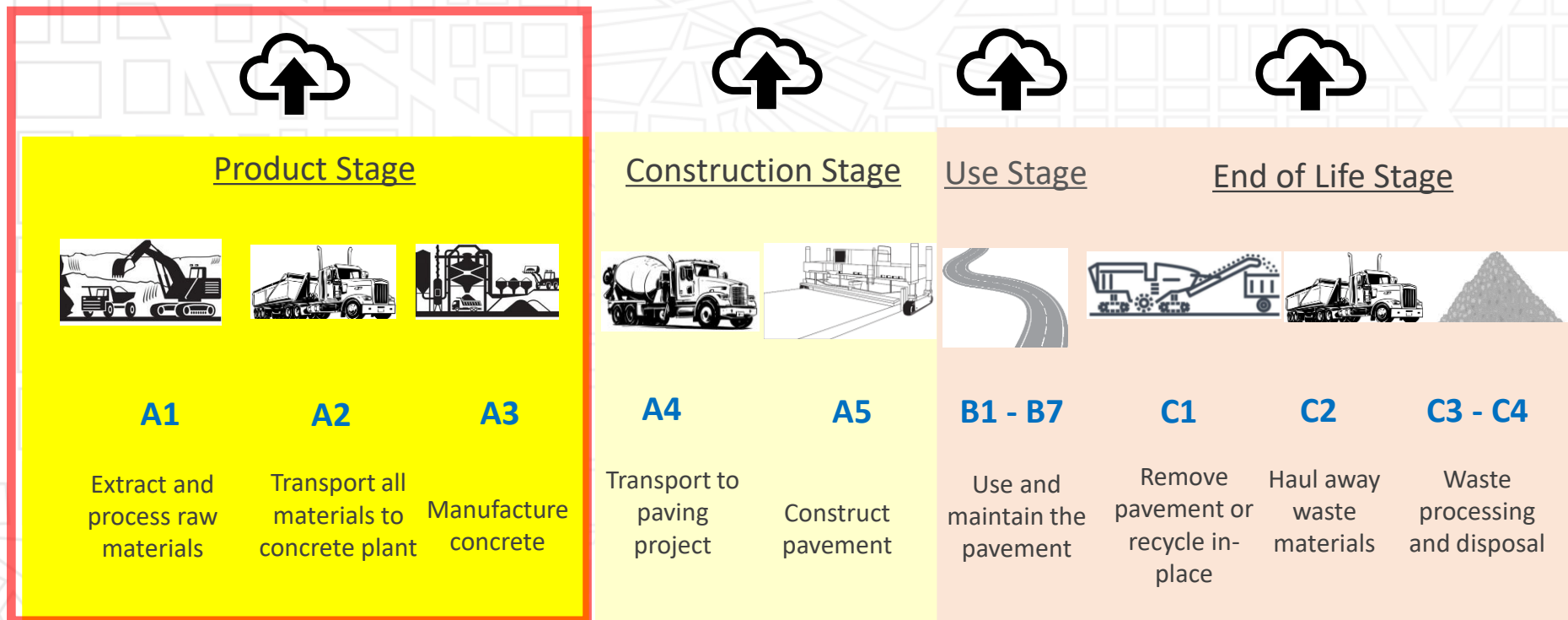
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Table of Concrete Production by Quarters

Quarterly Usage Reported by Concrete Producers & Volumetric Trucks	Q1	Q2	Q3	Q4	FY23
	2022	2023	2023	2023	Annual
	Oct – Dec	Jan – Mar	Apr – Jun	Jul – Sep	
Total Concrete (CY)	99,176	132,954	124,360	132,029	488,519
Total Cement (lbs)	40,669,218	51,699,402	49,955,542	50,455,808	192,779,970
Approx. CO ₂ (lbs)	36,603,000	46,529,462	44,959,988	45,410,227	173,501,973
Approx. CO ₂ (MMT)	16,638	21,150	20,436	20,641	78,700

City of Austin Plan

Concrete Pavement and Bridge Life-Cycle Stages



current emphasis

City of Austin Plan

Type III ISO 14025 Environmental Product Declaration (EPD)

ENVIRONMENTAL IMPACTS

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DECLARATION OF ENVIRONMENTAL INDICATORS DERIVED FROM LCA

Impact Assessment	Unit	A1	A2	A3	Total
Global warming potential	kg CO ₂ -eq	312	20.2	12.6	345
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11-eq	7.56E-6	8.40E-10	6.47E-7	8.20E-6
Eutrophication potential	kg N-eq	0.35	0.02	0.02	0.39
Acidification potential of soil and water sources (AP)	kg SO ₂ -eq	0.62	0.26	0.13	1.01
Formation potential of tropospheric ozone (POCP)	kg O ₃ -eq	11.7	7.17	3.47	22.4

Resource Use

Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb-eq	6.68E-5	-	3.41E-6	7.02E-5
Abiotic depletion potential for fossil resources (ADPfossil)	MJ	225	285	200	710
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ	49.5	0.00E+0	6.72	56.2
Renewable primary resources as material, (RPRM)*	MJ	0.00E+0	-	0.00E+0	0.00E+0
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ	1,466	285	205	1,956
Non-renewable primary resources as material (NRPRM)*	MJ	3.99	-	0.00E+0	3.99
Consumption of fresh water	m ³	3.20	-	0.04	3.24

City of Austin Plan

Informing the Concrete Mix Producers

- May 1st, 2023 1st communication via emails and letters about City Council Resolution
- June 20th, 2023 EPD survey to 12 Producers (3 replied)
- August 21st, 2023 2nd communication via emails and letters about COA Office of the City Engineer plan to EPD implementation

Effective FY 2025, all concrete producers operating within the City of Austin will be required to submit product specific Type III EPDs as defined in ISO standard 14025 for their concrete mixes. These EPDs must be third-party verified by an accredited organization. The EPDs will be reviewed by the OCE to ensure compliance with the established standards and requirements.

Preliminary Phase: October 2023- September 2024. During this phase, we encourage concrete producers to familiarize themselves with the EPD requirements, including the type of EPD, environmental impact categories and the EPD format.

EPD Submission Phase: Mandatory Starting October 1, 2024.

Set Baselines & Initial Targets: OCE will be working with NRCMA and ACI to establish the minimum EPD requirements (baseline) for concrete mixes used in the Austin area by end of the FY-25, that will be revised periodically and based on industry advancement.

City of Austin Plan

Partnering with Concrete Industry Leaders for Success



Dear Concrete Producer,

I wanted to remind you of the upcoming mandatory Environmental Product Declaration (EPD) Submission Phase starting October 1, 2024. As part of the Austin City Council's commitment to environmental sustainability, the Office of the City Engineer (OCE) is enforcing the requirement for EPDs for concrete mixes used in City projects. During this phase, concrete producers are required to submit completed EPDs for each mix design to the OCE.

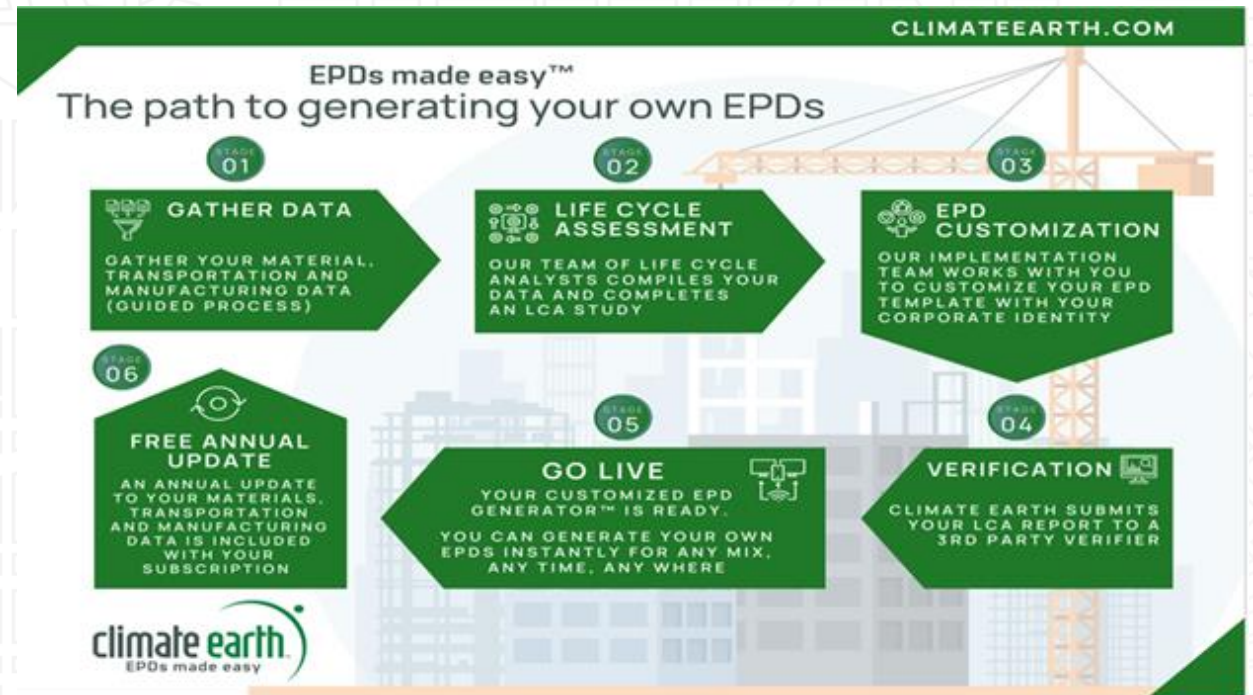
For assistance in generating EPDs, Brian Davis, North America Sales at Climate Earth Inc., is available to help. You can contact Brian at 510-831-6350 or brian@climateearth.com.

Thank you for your attention to this matter. We look forward to working together to promote and implement sustainable practices, ensuring a livable and environmentally healthy Austin for future generations.



FY 2024-FY 2029 Reducing Embodied Greenhouse Gas Emissions for Construction Materials and Products

Texas produces the most concrete in the US, equal to the combined sum of concrete produced in both #2 (California) and #3 (Florida). We are supportive of TACA's goal to increase awareness and significantly increase the number of plants in Texas with EPD capabilities. With these financial incentives available to the 1000 plants in Texas we will encourage smaller companies and plants located in the remote areas where government agencies are building to develop EPDs.



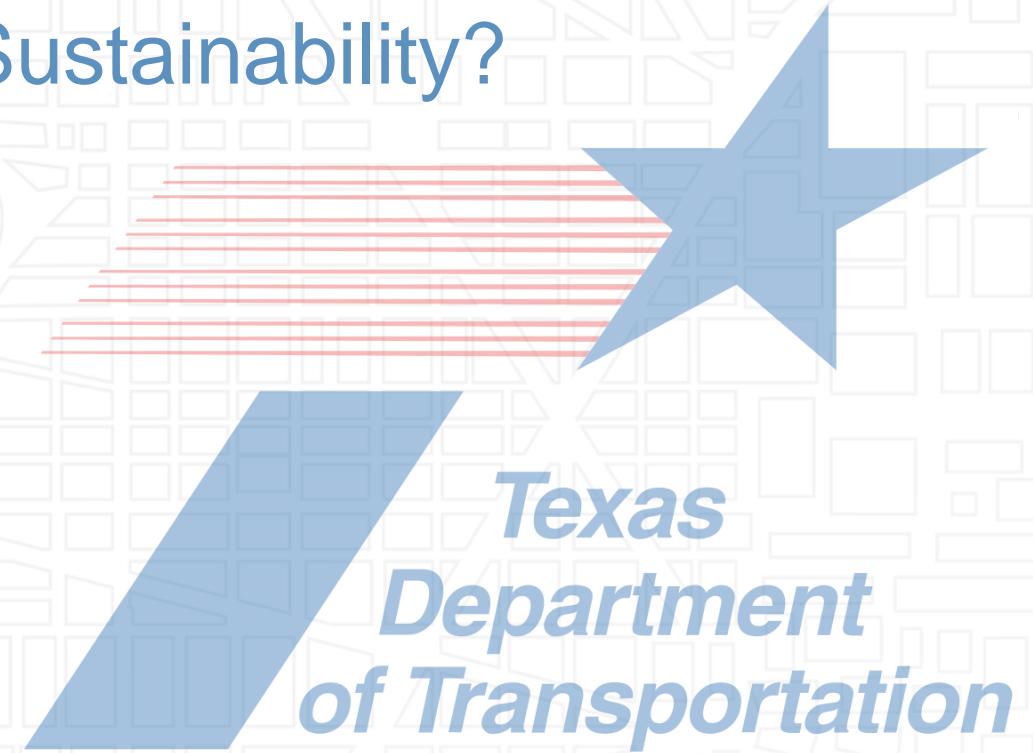
Who Will Lead the Way to Sustainability?

For decades our City specifications have been highly based on TxDOT specs.

However, it appears that the State of Texas and TxDOT are not as progressive specifically regarding sustainable concrete.

Thus, to succeed here we must get ahead of the Texas curve.

Please note: In all fairness to TxDOT, we believe they are a strong and capable agency; however, concrete sustainability is one area in which we cannot remain in their “shadow.”



TRANSPORTATION
PUBLIC WORKS

City of Austin Plan

Summary of plan

Our General Plan of Action

- 1) Suggested a protocol on how to establish the City of Austin's (COA) carbon footprint and to track it on an annual basis moving forward – Resolution Task (1a). Introduced a plan to implement Environmental Product Declarations (EPD) – Resolution Task (1b). Based on the above steps completion, we will develop a process to allow for low-embodied carbon, sustainable, and innovative concrete mix designs, materials, aggregates, and admixtures – Resolution Task (1c).
- 2) Will revise the concrete specifications to encourage more environmentally friendly mixes – Resolution Task (2). Revision of the City purchasing and contracting documents are recommended and needed.
- 3) Annually summarize progress to City Council – Resolution Task (3).

Note: this plan is not for particular type of concrete mix – flat work vs vertical construction. Rather it is laying the foundation for all concrete mixes to be supplemented with EPDs that will allow us to create a “moving acceptance threshold”. Progressively, to transition to a Carbon Neutral Austin, higher carbon concrete mixes will not be accepted.

Thank you!

We are asking for your support



The course is already well charted.
Let's get going

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