



ASTM Type IT

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What is Type IT

- ASTM C595, Section 7.2 describes Type IT as:
 - “shall be a hydraulic cement consisting of an intimate and uniform blend produced either by intergrinding, by blending, or a combination of intergrinding, and blending portland cement clinker or portland cement with (1) two different pozzolans, (2) slag and a pozzolan, (3) a pozzolan and a limestone, or (4) a slag and a limestone.”
- NYSDOT 701.03 has been approving Type IT for several years, currently 2 Type IT cements are on the approval list.
- You will be seeing more Type IT Cements approved in the coming years.

Types of Type IT

- Pre-PLC rollout, Type IT was a blend of pozzolans with ASTM C150 Type I/II cement, Fly Ash, Slag Cement, and or Silica Fume.
- Now with ASTM C595 Type IL (PLC) being delivered the blending would be PLC + Fly Ash, Slag Cement, and or Silica Fume.
- The designation of what the cement is blending is clearly stated in the suffixes (X) per ASTM C595.

How Type IT Will Be Identified

- Like Type IL, ASTM C595 specifies product description in the name of the cement. See ASTM C595 Note 3
- Examples:
 - Type IT (9L) (16S) can be identified as 8% Limestone and 16% Slag. This is a total of 25% clinker substitution.
 - Also Type IT (12L) (15P) (MS) can be identified as 12% Limestone, 15% Fly Ash, and has Moderate Sulphate Resistance (separate test data needed for this descriptive identifier).

ASTM C595 Special Properties

- Table 3 of ASTM C595 offer 5 special properties that a blended cement can be tested and qualified as.
- A – This is air entrained cement
- MS – Moderate Sulphate Resistance
- HS – High Sulphate Resistance
- MH – Moderate Heat of Hydration
- LH – Low Heat of Hydration

Case Study

- This study looks at PLC with Slag Cement addition compared to Type IT with slag interground and how they perform in identical designs
- Three Mixes Tested
- Performance of Type IT compared to PLC + 15% and 25% Slag Cement addition, additional slag added to T-IT to mimic PLC percentage.
- Same Type IT (L12) S(15)
- Same Type IL
- Same Grade 100 Slag Cement
- W/C Ratio and admixture dosage equal in mixes

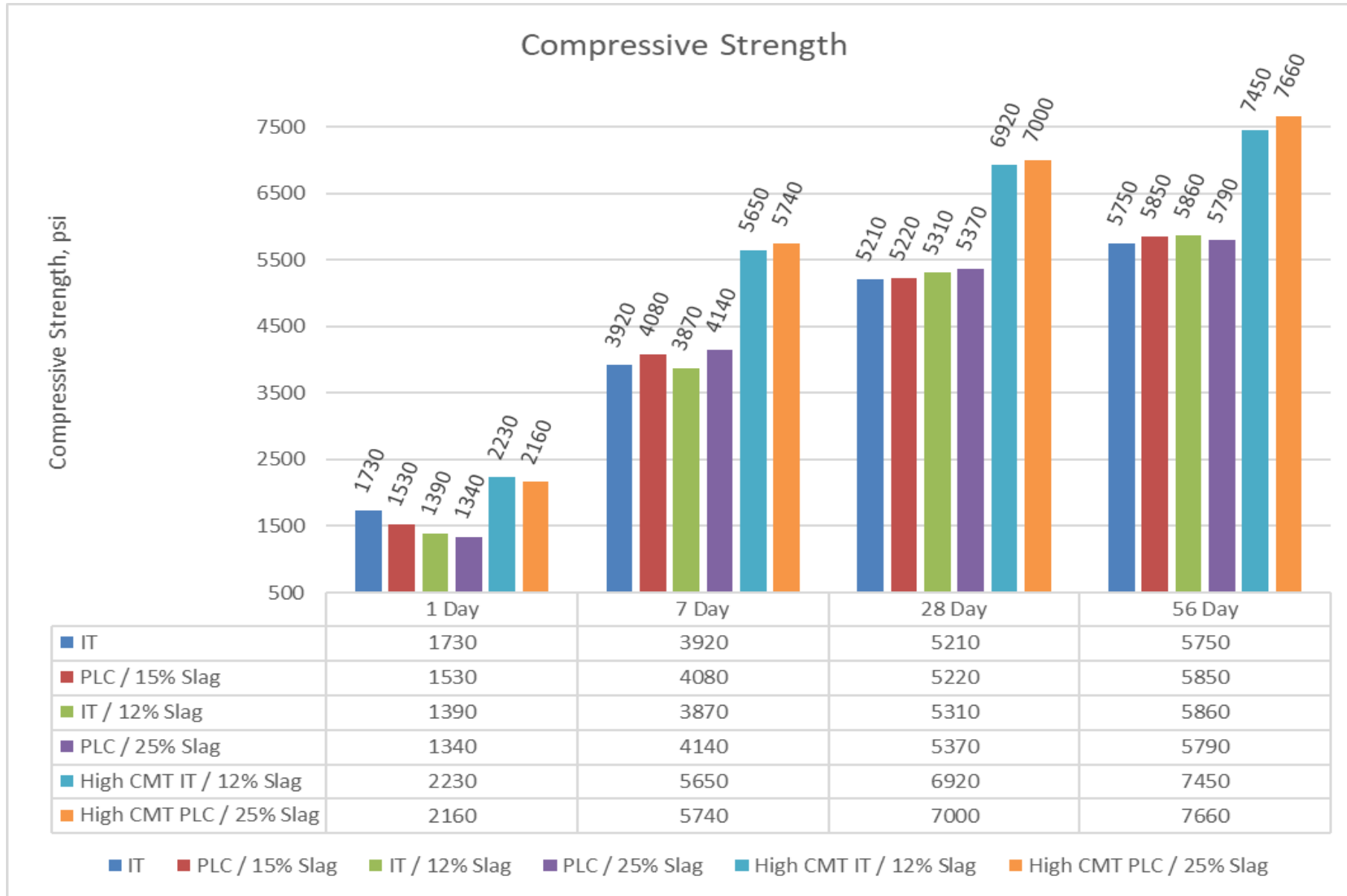
Case Study

Mix ID	Blended Cement Lbs/yd3	Slag Lbs/yd3	Water Lbs/yd3	W/C	Limestone Lbs/yd3	Sand Lbs/yd3	HRWR Oz/cwt
100% T-IT	505	-	283	.560	1661	1562	2.0
85% PLC 15% Slag	429	76	283	.560	1661	1562	2.0
88% T-IT 12% Slag	446	59	283	.560	1661	1562	2.0
75% PLC 25% Slag	379	126	283	.560	1661	1562	2.0
88% T-IT 12% Slag	539	72	283	.463	1661	1562	3.0
75% PLC 25% Slag	458	153	283	.463	1661	1498	3.0

Case Study

Mix ID	Slump Inches	Air %	Density Lbs/ft3	Temperature °F
100% T-IT	3.0	2.7	147.9	72
85% PLC 15% Slag	3.5	2.7	148.2	72
88% T-IT 12% Slag	3.5	3.3	147.1	72
75% PLC 25% Slag	3.25	2.9	147.7	72
88% T-IT 12% Slag	3.25	3.5	148.2	72
75% PLC 25% Slag	3.5	3.3	148.1	72

Case Study



Case Study

- Takeaways:
 - Type IT plastic performance is like PLC when blended with Slag Cement
 - Compressive Strength Testing similar
- This shows us that Type IT will react closely to PLC Cement with a blend of whichever supplemental cementitious material added to the blend.

Initial Testing

- Alkali Silica Reactivity
 - Tests are ongoing and only have early values.
 - Shows values that coincide with reduction of clinker, and addition of supplemental cementitious material.
 - ASTM C595 suggests guidance from ASTM C1778

How will This Affect EPD's

- Type IT overall EPD values will be lower due to reduction in the clinker percentage used in the creation of that specific cement.
- Lower cement EPD values will in turn offer lower concrete EPD Values.
- The overall carbon footprint will be reduced.

Environmental Product Declarations

- Environmental product declaration (EPD)
- Product category rule (PCR)
- Life cycle assessment (LCA)
- There are different PCRs and EPDs for cement, ready mix concrete, and concrete masonry products



Slag Cement Life Cycle Assessment Calculator

Slag cement Life Cycle Assessment Calculator

The Slag Cement Association (SCA) Commissioned the National Institute of Standards and Technology to produce this Ready Mixed Concrete Life Cycle Assessment (LCA) Calculator for Slag Cement - Version 1.0 to show the impacts of using slag cement in ready mixed concrete.

The LCA calculator allows you to enter custom concrete mixes and then substitute varying amounts of slag cement through a simple dashboard interface. You simply select a preset mix or enter the details of a custom mix and the calculator will allow you to increase or decrease the percentage of slag cement and calculate LCA results in real time. The tool also allows you to compare custom mixes against region-specific industry average mixes and to substitute these mixes into a generic whole building to calculate cumulative whole-building results.

[Download the Calculator Here](#)

Registration is required to download content. Registration information is used by the SCA to track use and will not be distributed to any third party.

Please review additional information below for instructions and frequently asked questions.

- [Supporting Documents](#)
- [User Cautions](#)
- [Worksheet Instruction](#)
 - [Slag Substitution](#)

- Available for free download at www.slagcement.org

Ready Mixed Concrete LCA Calculator for Slag Cement - Version 3.0



Adjust Slag Cement %

Select Mix to Adjust

Select Region

Slag Cement %

< 50% >

Concrete Mix

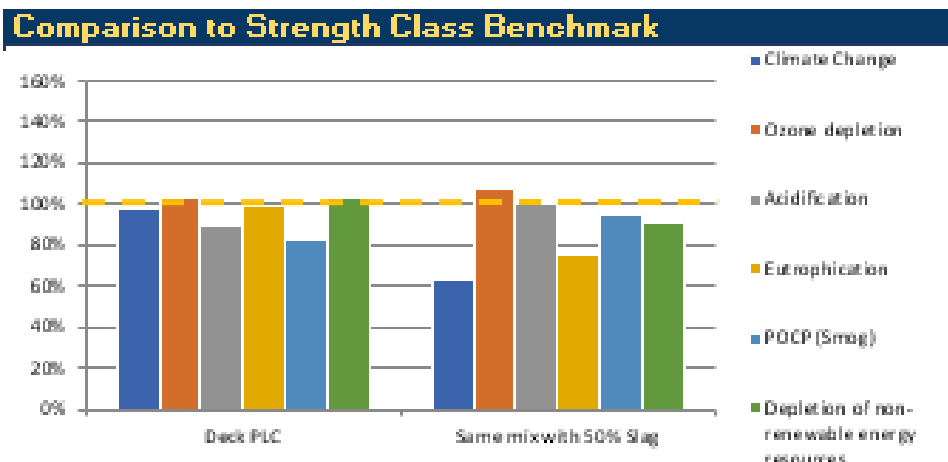
Mix ID	Deck PLC	Same mix with 50% Slag
Slag Cement (%)	0%	50%
Strength (psi)	5000	5000
Portland Cement (lb)	0	0
Portland Limestone Cement (lb)	611	306
Masonry Cement (lb)	0	0
Slag Cement (lb)	0	306
Fly Ash (lb)	0	0
Crushed Coarse Aggregate (lb)	1750	1750
Natural Coarse Aggregate (lb)	0	0
Crushed Fine Aggregate (lb)	0	0
Natural Fine Aggregate (lb)	1380	1380
Manufactured Lightweight Aggregate (lb)	0	0
Accelerating Admixture-Chlorides (oz)	0	0
Air Entraining Admixture (oz)	0	0
Water Reducing Admixture - plasticizer (oz)	24	24
High Range Water Reducing Admixture - superplasticizer (oz)	48	48
Water (gal)	30	30

Additional Mix Options

Crushed Demolition Concrete (lb)	0	0
Crushed Returned Concrete (lb)	0	0
Fly Ash (prepacked) (lb)	0	0
Mineral Filler (lb)	0	0
Road Dust Control Chemicals (lb)	0	0
Silica Fume (no processing) (lb)	0	0
Steel Fibers (lb)	0	0
Synthetic Fibers (lb)	0	0
Accelerating Admixture-Non Chlorides (oz)	0	0
Cementation Inhibiting Admixture (oz)	0	0
Shrinkage Reducing Admixture (oz)	0	0
Water Retarding Admixture (oz)	0	0
Waterproofing Admixture (oz)	0	0

Region

Great Lakes Midwest



Mix ID	Deck PLC	Same mix with 50% Slag
Strength (PSI) of Relevant Benchmark	5000	5000
Climate Change	97%	63%
Ozone depletion	103%	107%
Acidification	89%	100%
Eutrophication	99%	76%
POCP (Smaq)	83%	95%
Depletion of non-renewable energy resources	103%	91%

Life Cycle Assessment Results

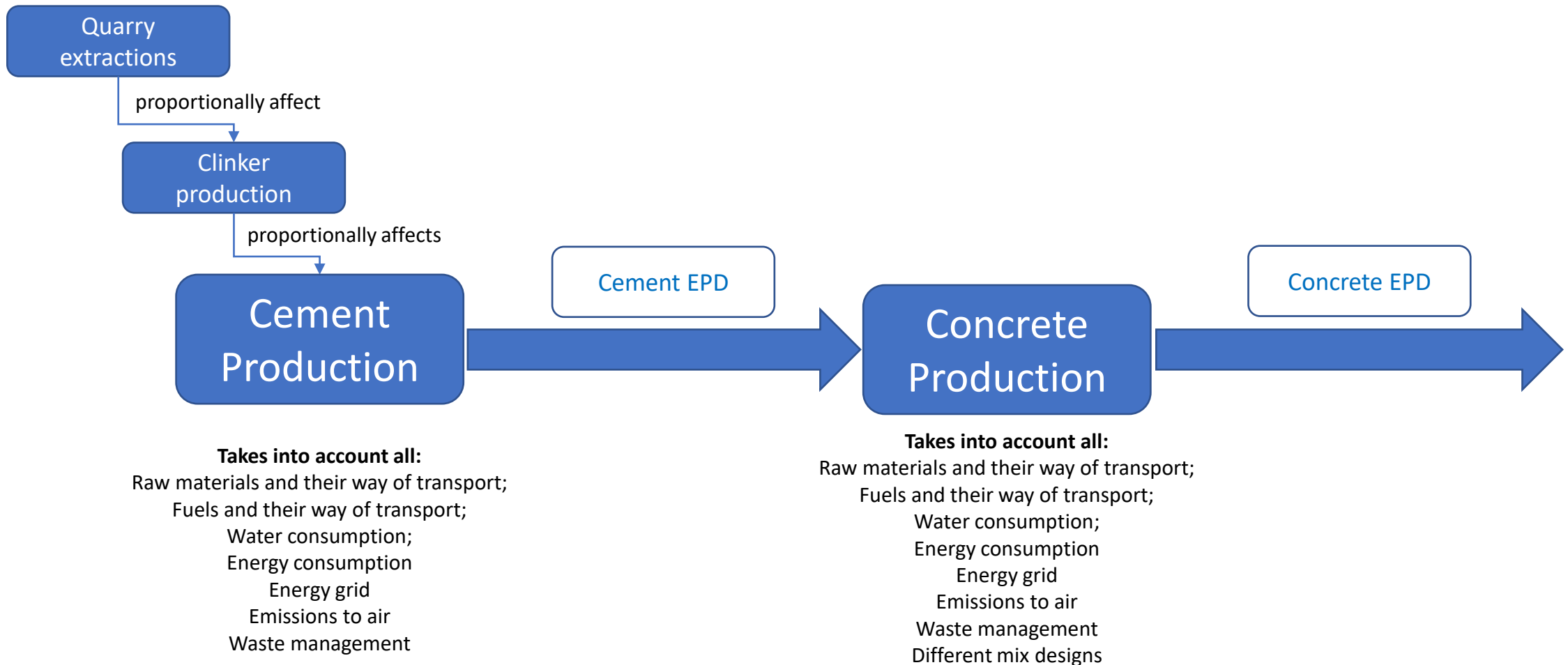
Mix ID	Deck PLC	Same mix with 50% Slag
Climate Change (kg CO2-eq)	270.31	175.80
Ozone depletion (kg CFC-11-eq)	7.70E-06	8.02E-06
Acidification (kg SO2-eq)	0.71	0.79
Eutrophication (kg N-eq)	0.35	0.27
Photochemical Ozone Creation/Smaq (kg O3-eq)	13.02	15.02
Abiotic Depletion Potential ADPf (MJ)	449.92	468.25
Abiotic Depletion Potential ADPc (kg Sb-eq)	0.00	0.00
Use of renewable primary energy (MJ)	55.80	45.62
Use of non-renewable primary energy (MJ)	1,676.57	1,476.97
Fresh water consumption (m3)	0.49	0.39

INDUSTRY-AVERAGE EPD FOR CONCRETE

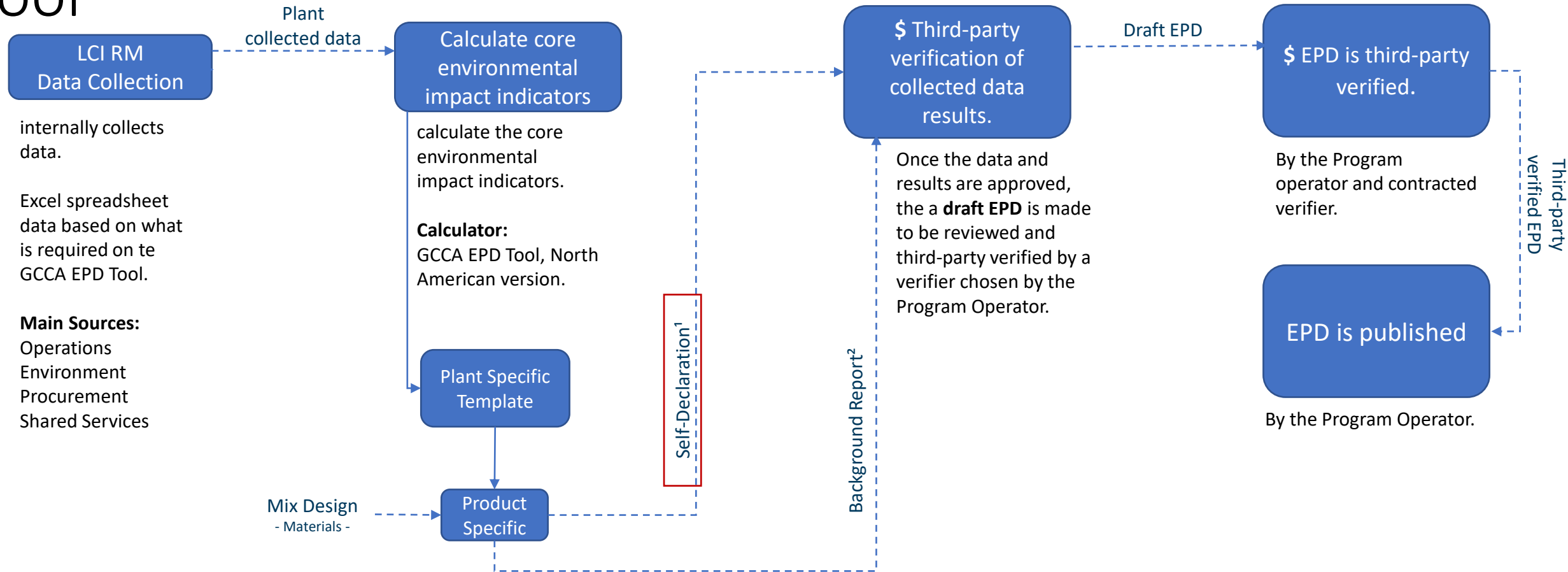
Environmental Product Declaration

EPD

- It tells the **life cycle story** of a product in a single report.



Concrete EPDs Flowchart – GCCA EPD Tool



- 1. Self-declaration:** One of the GCCA EPD Tool outputs. It contains all core environmental impact indicators, such as the Global Warming Potential (GWP), in an EPD format, but it's not an EPD.
- 2. Background Report:** Another GCCA EPD Tool output. It shows all data that was input to the tool, and is mainly used by third-party verifiers to check entry data.

In Conclusion

- Type IT Cement has been around, but with introduction of PLC and future blending with supplemental cementitious materials new cements will be coming
- ASTM C595 covers the designations and specifies the performance of blended cements either PLC or IT.
- Case Study shows that when compared to PLC + Slag, a Type IT performs similarly.
- Type IT cement will help reduce carbon footprint that is created by the Ready-mix, precast, and block industry.

Thank you.

Questions?