



THE CONCRETE INDUSTRY BOARD OF NEW YORK

IMPROVING THE CONCRETE INDUSTRY SINCE 1951
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April 17, 2023

Mr. Kazimir Vilenchik, P.E.
Acting Commissioner
New York City Department of Buildings
Kvilenchik@buildings.nyc.gov

Dear Commissioner Vilenchik,

The Concrete Industry Board of New York wishes to propose a new program to reduce the carbon footprint of concrete construction overseen by the Department of Buildings. The proposal requires no notable expenses to the city or the industry and will positively impact the construction industry. We offer the following outline for your review.

- 1. Overview Statement** – The Concrete Industry Board of New York recognizes the need for the industry to reduce our carbon footprint. Our members are reporting increasing requests by clients for the reduction of the carbon footprint by developers and other project stakeholders. As a first step, we propose to the Department of Buildings that they implement a letter grade system included on the TR3 form evaluating each mix submitted. The goal will be to reduce cement within mixes through awareness incurred by the letter grade.
- 2. Who we are** – The Concrete Industry Board of New York (CIB) was founded in 1951 as an organization to improve the quality of concrete construction and to promote concrete education within the industry. Its members are comprised of contractors, engineers, suppliers, fabricators, admixture producers, and testing/inspection agencies along with others who contribute to the concrete profession. The CIB and its members contribute to the New York City building code, provide a certification process for concrete producers, provide ACI certification classes, and work with the DoB and the industry on numerous issues related to concrete.
- 3. Carbon footprint of the Concrete Industry** – It is estimated that concrete accounts for roughly 8% of global carbon emissions. It is also recognized that concrete is an invaluable building material and its use is not anticipated to be reduced nor eliminated. This general acceptance pushes the goal to reducing the carbon footprint of concrete. There are many aspects of concrete production that contribute to the total carbon footprint, but the majority come from the manufacturing of cement, a key ingredient found in all concrete.
- 4. Observation of cement waste** – The CIB has recognized that some mixes used in the industry are incorporating more cement than needed. The reason for this waste is unclear but contributing factors may include off-the-shelf historic mixes, off-the-shelf mixes originally specified to comply with agency requirements and, mixes used for much lower strengths than they have been designed to achieve. It seems the single largest factor in the use of these cement-heavy mixes is a lack of awareness related to carbon footprint. The CIB has observed many excellent mixes that have very low carbon footprints from the same mix designers and

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concrete producers involved in inefficient mixes. This indicates that the issue is related to awareness or project specification requirements, not the ability of the producers.

5. **The letter grade system and expected outcome** – Applying a standardized letter grade to each concrete mix will allow all those involved a means of quick evaluation for the impact on carbon. It is expected that those involved will question poorly graded mixes internally before they are ever submitted for use on projects. Further, poorly graded mixes that are submitted are more likely to be questioned by the Engineer of Record and the contractor. The CIB feels that this added awareness and scrutiny will make considerable strides in minimizing use of inefficient mixes and result in reducing the carbon footprint of the industry. Such a letter grading system is nothing new in New York City; success has been seen in the restaurant industry and to evaluate the energy efficiency of buildings.
6. **Importance of allowing industry to control mix designs** – The CIB feels that regulating the mix design of concrete would not be beneficial to the industry, public safety, or the carbon footprint of concrete at this time. It is important to understand that concrete production is not an exact science, but more similar to baking a cake. The individuals involved are most familiar with the materials they have available and most familiar with the placement methods and conditions. They are therefore best suited to specify whatever mix they feel is the most appropriate and safe for the conditions. The CIB believes that a proper mix grading system would naturally establish a spectrum of standards in carbon efficiency and result in industry self-regulation and setting and meeting of goals without external city mandates on materials.
7. **Importance of a grade as opposed to a mandated cap** - The CIB has concluded that carbon awareness will make considerable strides in reducing the carbon footprint of the industry. We believe that designers and suppliers need to proceed with mixes with which they have confidence and should not be forced to choose between carbon footprint and quality concrete. This method will be more well received by the industry, and ultimately result in similar reductions as a mandate. It also allows teams sufficient time to organically adjust their practices in order to adapt to the industry effects of the new grading system.
8. **Proposed calculation of grades** – The CIB has concluded that keeping carbon calculations simple is imperative to encourage adoption and minimize cost and time inefficiencies. We feel that a grading system based on cement alone would sufficiently impact and reduce carbon output but wish to recognize the expanded use of Environmental Product Declarations (EPDs) and EPD awareness. We also sought to avoid unduly punishing high-strength mixes which justifiably incorporate higher total cement.

In studying over 150 random mixes contributed from our active members used today in the industry, we concluded that four simple calculations would be required: one for total cement content favoring lower strength mixes, one for mix design strength relative to cement content favoring high-strength mixes, one for a simple Global Warming Potential (GWP) lookup from an EPD form when available, and one for a calculated EPD. The best of the letter grades from any of these separate grading scales would be the single grade given to a mix.

The first calculation would be equating the cement content to a letter grade rating.

Eq 1: X =weight of cement per cubic yard of concrete (lb/yd³)

$X \leq 300$	= A
$300 < X \leq 375$	= B
$375 < X \leq 450$	= C
$450 < X \leq 600$	= D
$600 < X$	= F

The second calculation would be equating the ratio of concrete design strength ($f'c$) to cement to a letter grade rating.

Eq 2: $Y = f'c$ (Design Strength psi) /cement (lb/yd³) (Ignore units)

$Y \leq 15$	= F
$15 < Y \leq 19$	= D
$19 < Y \leq 23$	= C
$23 < Y \leq 27$	= B
$27 < Y$	= A

The third calculation is optional and would be a simple lookup of a proved EPD value. EPD forms are becoming more available in the New York City region and will continue to do so in the coming years. The GWP value for A1, A2, and A3 can be entered into the below table for an alternative grade. It is noted that EPDs are not readily available in NYS at this time so the following equation may need to be adjusted as more information becomes available.

Eq. 3:

$GWP \leq 300$	= A
$300 < GWP \leq 350$	= B
$350 < GWP \leq 400$	= C
$400 < GWP \leq 490$	= D
$490 < GWP$	= F

All units are kg/m³.

The fourth calculation is optional and for individuals that would like to provide a EPD equivalent but find that EPDs are not available from their preferred supplier, we offer the below calculated EPD values. Each ingredient in lb/yd³ shall be multiplied by the below values and summed to calculate the EPD equivalent value. It is noted that this calculated value only includes the A1 equivalent on the EPD and does not include the A2 & A3 values. For that reason, the calculated EPD shall not be measured on the same scale as equation 3 and shall be calculated below in optional equation 4. The user has the ability to use the best grade for any of the four equations.

Eq. 4:

$$EC_c = \text{Cement}(\text{LB}/\text{yd}^3) * .622$$

$$EC_{LC} = \text{Limestone Cement (LB/yd}^3) * .564$$

$$EC_{SL} = \text{Slag(LB/yd}^3) * .157$$

$$EC_{FLY} = \text{Flyash(LB/yd}^3) * .195$$

$$EC_{SA} = \text{Silica(LB/yd}^3) * .333$$

$$EC_{FA} = \text{Fine Aggregate(LB/yd}^3) * .0015$$

$$EC_{CA} = \text{Coarse Aggregate (LB/yd}^3) * .0022$$

$$EC_{LW} = \text{Light weight aggregate (LB/yd}^3) * .178$$

$$GWP_{EQ} = EC_C + EC_{LC} + EC_{SL} + EC_{FLY} + EC_{SA} + EC_{FA} + EC_{CA} + EC_{LW}$$

$$GWP_{EQ} \leq 225 = A$$

$$225 < GWP_{EQ} \leq 275 = B$$

$$275 < GWP_{EQ} \leq 325 = C$$

$$325 < GWP_{EQ} \leq 415 = D$$

$$415 < GWP_{EQ} = F$$

The above factors account for the conversion from lb/yd³ to kg/m³.

A summary of the 4 grading systems is below for comparison:

Eq.	Description	A	B	C	D	F
1	weight of cement per cubic yard (#/cy)	< 300	300 ~ 375	376 ~ 450	451 ~ 600	> 600
2	normalized for design strength f'c (f'c/#c)	> 27	23 ~ 27	19 ~ 22	15 ~ 18	< 15
3	Global Warming Potential (published EPD)	< 300	300 ~ 350	350 ~ 400	400 ~ 490	> 490
4	Global Warming Potential (independently calculated)	< 225	225 ~ 275	275 ~ 325	326 ~ 415	> 415

9. **Proposed implementation of grading system on TR3** - The CIB recommends that this grade have prominent placement in large font on the TR3. With the implementation of DOB Now, we recommend that the Mix Designer, Engineer of Record, Producer, and Owner, be asked to confirm "I accept this design mix with a Carbon Usage Grade ___" for each mix submitted.
10. **Cost Impacts** – The members of the CIB feel the added cost to a project will be minimal, if any. With the grade in place the client will be able to quickly understand their carbon efficiency and if desired determine any premium cost to the project for improvements.
11. **Achievability of mix grades** – The CIB feels that almost all mix types can achieve B or better grades with a few exceptions. The CIB also believes that there is no design or placement circumstance that would require an F outside of specific cement content mandates by an agency or designer. Mixes that may inherently require more cement and have a lower letter grade would be trowel finished pumped concrete in the winter which may be graded as a C or D or any lightweight mix.

12. **Incorporation into Specifications** – The CIB encourages designers to incorporate the use of the CIB letter grades into their concrete specifications. Each type of concrete could be assigned letter grade goals, and overall project goals could be set that would incorporate a weighted average based on volume used. Separate from this recommendation, the CIB will issue a *Concrete Industry Boards Green Concrete Guidelines* that may be consulted and incorporated by design teams.
13. **Industry Warning!** – The best mix for the environment may not be the best mix for the project. It could be detrimental to a project if a well-intended owner, architect, engineer, or construction manager mandates a minimum letter grade across a project. There are many instances within standard concrete practice that require more cement within a mix. A letter grade mandate is more likely to result in construction defects than reduction in carbon footprint. The CIB strongly recommends that these individuals strive for the best mixes possible, but communicate with the mix designers, concrete suppliers, and contractors to understand what is practical for each aspect of the project.
14. **Update Path** – the science of “Green Concrete” is rapidly developing. The CIB will continue to monitor progress and will communicate recommended adjustments to the above grading system as they become available.

The Concrete Industry Board of New York respectfully requests that the New York City Department of Buildings consider our recommendation as a simple step towards global carbon reduction. We feel that the industry is capable of improving and only needs a gently push and additional awareness to do so. Should you have any questions or concerns regarding our proposal, we would be more than happy to meet at your convenience.

Sincerely,

The Concrete Industry Board of New York



Benjamin Pimentel, P.E.
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