

## Communication from Public

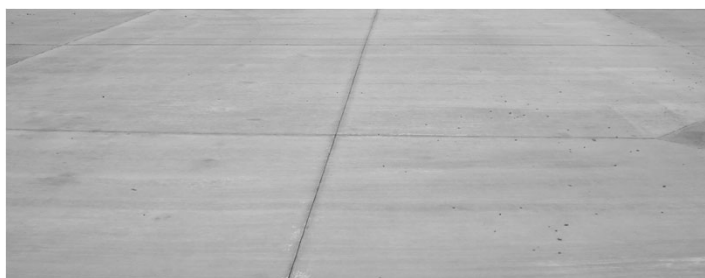
**Name:** Charley Rea  
**Date Submitted:** 03/04/2024 01:48 PM  
**Council File No:** 23-1391  
**Comments for Public Posting:** CalCIMA comments attached.

## NRMCA Concrete Carbon Calculator:

How to quantify and specify carbon

### Brandon Wray

Director, Building Innovations  
National Ready Mixed Concrete Assoc.



## How to Quantify and Specify Carbon

### Historically:

- Prescriptive measures
  - “maximum cement content”
  - “minimum SCM content”
- Byproduct:
  - Not producer-specific solutions
  - Inefficient mix design
  - Increase in cost



## How to Quantify and Specify Carbon

### Present Day:

- Life Cycle Assessment
  - Benchmark vs. Proposed Low Carbon
  - Concrete-scope embodied carbon
    - Project-wide Whole Building LCA
- Byproduct:
  - Quantifiable reductions
  - Producer specific solutions
  - Flexibility in execution



| PRODUCT STAGE       |           |               | CONSTRUCTION STAGE |                               | USE STAGE |                        |        |             |               | END OF LIFE STAGE           |           |                  |          | BEYOND THE BUILDING LIFE CYCLE                    |          |         |
|---------------------|-----------|---------------|--------------------|-------------------------------|-----------|------------------------|--------|-------------|---------------|-----------------------------|-----------|------------------|----------|---|----------|---------|
| A1                  | A2        | A3            | A4                 | A5                            | B1        | B2                     | B3     | B4          | B5            | C1                          | C2        | C3               | C4       | D   |          |         |
| Raw Material Supply | Transport | Manufacturing | Transport          | Construction and Installation | Use       | Maintenance            | Repair | Replacement | Refurbishment | Deconstruction & Demolition | Transport | Water Processing | Disposal | Reuse   | Recovery | Recycle |
|                     |           |               |                    |                               | B6        | Operational Energy Use |        |             |               |                             |           |                  |          | Benefits and Loads Beyond the Building Life Cycle |          |         |
|                     |           |               |                    |                               | B7        | Operational Water Use  |        |             |               |                             |           |                  |          |   |          |         |

UPFRONT CARBON

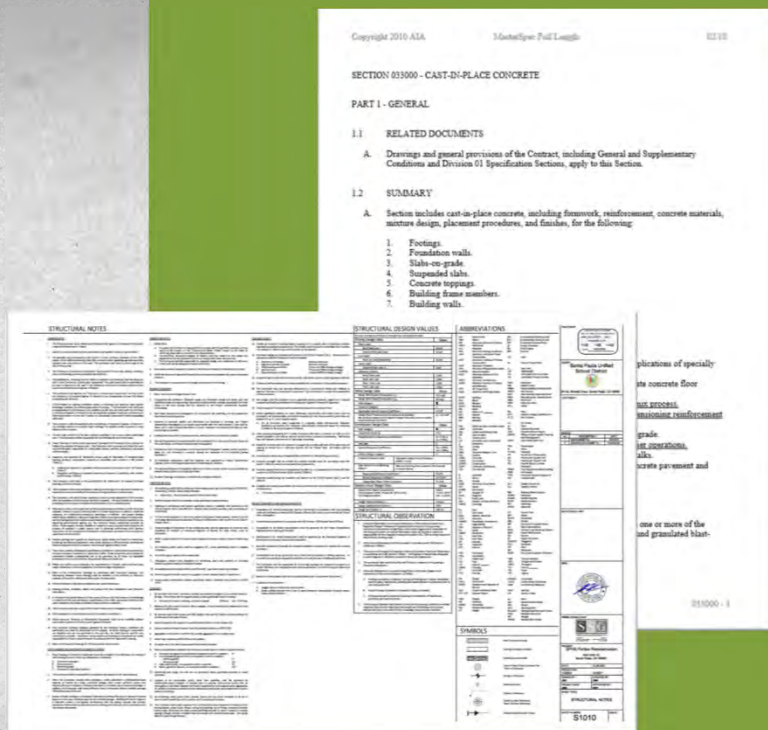
## Division 03 Section 033000 Cast-In-Place Concrete

### Step #1:

Performance-Based Improvements

### Step #2:

Carbon Accounting and Targets



## Step #1 – Performance Based Improvements

### Goal:

Prescription  Performance

### Methods:

- Emphasize ACI 318 Exposure Classes
- Alt testing for durability/design
  - Shrinkage, MOE, RCP, ASR
- Expand acceptable materials
- Extended strength development

### Results:

Efficient and Optimized Mix Designs



**ENGINEERING: Specifying for Performance**  
 Author: Steve, P.E., P.E., F.A.S., NRMCA Vice President, Technical Services and  
 Under Labor, Ph.D., P.E., NRMCA Executive Vice President, Engineering

**Guide to Improving Specifications for Ready Mixed Concrete**  
 With Notes on Reducing Embodied Carbon Footprint  
 2021

**NRMCA**  
 National Ready Mixed Concrete Association  
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## Performance Specs

They allow for sustainable mix designs, but don't require it!



## Step #2 – Carbon Accounting and Targets

### Goal:

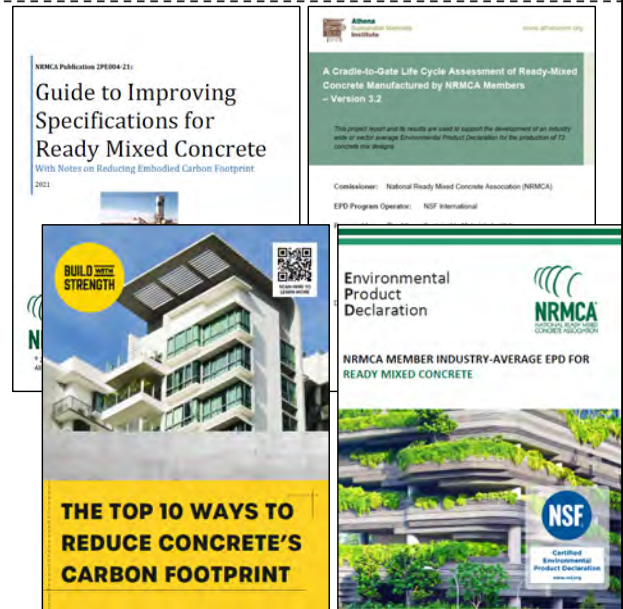
Trigger the use of low carbon materials

### Methods:

- Collect EPDs
- Establish a Carbon Budget

### Results:

- Procurement of low carbon concrete
- Flexibility for the contractor and producer
- Buffer for as-built conditions



## Specifications for Sustainability

| Member                     | Mix ID | Durability Exposure |   |   |   | Specified Strength, $f'_c$ , psi | Max w/cm or Performance Alternative | Nom. max. Aggregate, in. | Air Content | Slump/ Slump Flow | Chloride Limit | Temp. Limits |
|----------------------------|--------|---------------------|---|---|---|----------------------------------|-------------------------------------|--------------------------|-------------|-------------------|----------------|--------------|
|                            |        | F                   | S | W | C |                                  |                                     |                          |             |                   |                |              |
| Footings                   |        |                     |   |   |   |                                  |                                     |                          |             |                   |                |              |
| Foundation Walls           |        |                     |   |   |   |                                  |                                     |                          |             |                   |                |              |
| Slabs-on-grade             |        |                     |   |   |   |                                  |                                     |                          |             |                   |                |              |
| Exterior slabs             |        |                     |   |   |   |                                  |                                     |                          |             |                   |                |              |
| Suspended slabs (interior) |        |                     |   |   |   |                                  |                                     |                          |             |                   |                |              |
| Suspended slabs (exterior) |        |                     |   |   |   |                                  |                                     |                          |             |                   |                |              |
| Frame members              |        |                     |   |   |   |                                  |                                     |                          |             |                   |                |              |
| Columns (interior)         |        |                     |   |   |   |                                  |                                     |                          |             |                   |                |              |
| Columns (exterior)         |        |                     |   |   |   |                                  |                                     |                          |             |                   |                |              |
| Walls (interior)           |        |                     |   |   |   |                                  |                                     |                          |             |                   |                |              |
| Concrete toppings          |        |                     |   |   |   |                                  |                                     |                          |             |                   |                |              |



Collaborative carbon budget **vs.** GWP limit per mix class

**Preferred**

## Specifications for Sustainability

### Project Budget

TOTAL GWP:  $4.30 \times 10^6$



VS

### Individual Mix Limits

TOTAL GWP:  $4.30 \times 10^6$

**Shear Walls:**  
 180 kg CO<sub>2</sub> eq/m<sup>3</sup>

**Columns:**  
 190 kg CO<sub>2</sub> eq/m<sup>3</sup>

**Floors 2-18:**  
 240 kg CO<sub>2</sub> eq/m<sup>3</sup>

**Floors B2-1:**  
 225 kg CO<sub>2</sub> eq/m<sup>3</sup>

**Basement Walls:**  
 190 kg CO<sub>2</sub> eq/m<sup>3</sup>

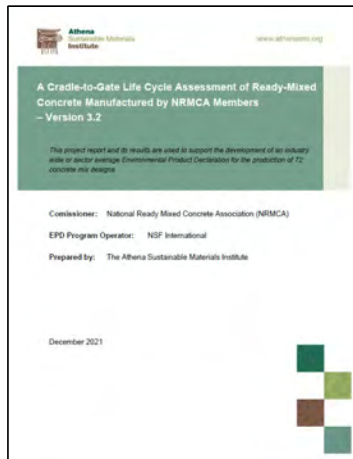
**Foundation:**  
 175 kg CO<sub>2</sub> eq/m<sup>3</sup>



## Establishing a Carbon Budget

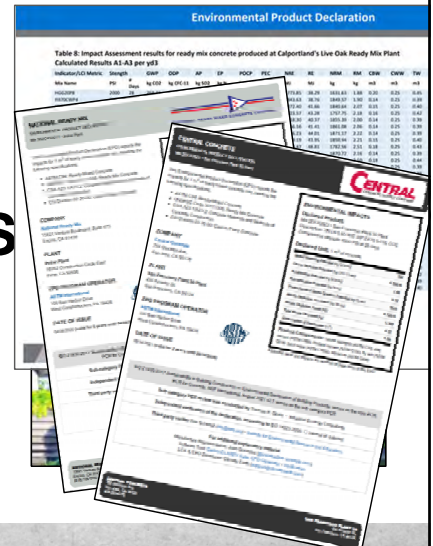


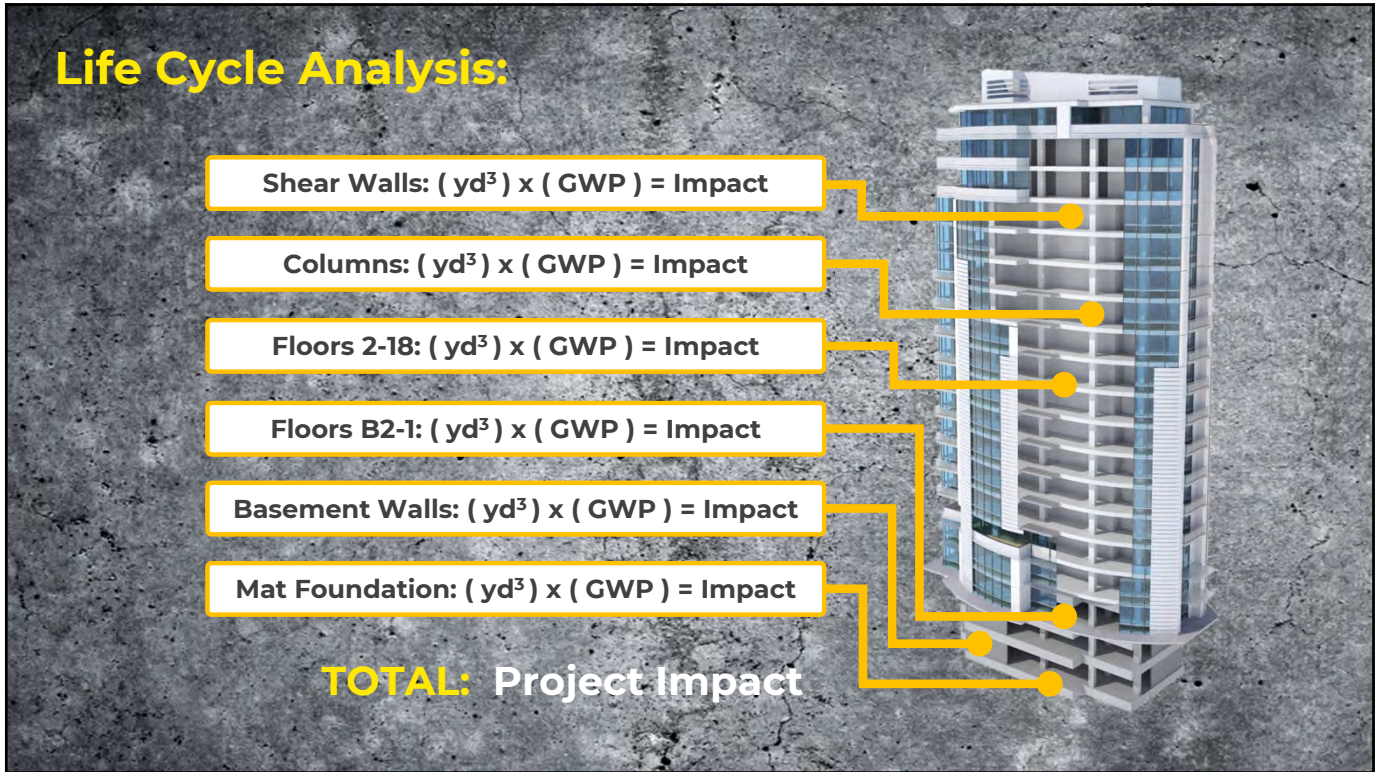
### Benchmark Project



VS

### Proposed Project





## Estimating Quantities and Properties

| Concrete Element | Concrete Volume (yd <sup>3</sup> ) | Benchmark Mixes (benchmark)* | Proposed Mixes (IW-EPD)*           |
|------------------|------------------------------------|------------------------------|------------------------------------|
| Shear Walls      | 7,630                              | 6,000 psi                    | 6,000 psi<br>30% slag, 20% fly ash |
| Columns          | 366                                | 8,000 psi                    | 8,000 psi<br>40% fly ash           |
| Floors 2-18      | 4,533                              | 5,000 psi                    | 5,000 psi<br>30% slag              |
| Floors B2-1      | 1,067                              | 5,000 psi                    | 5,000 psi<br>40% fly ash           |
| Basement Walls   | 444                                | 5,000 psi                    | 5,000 psi<br>30% slag, 20% fly ash |
| Foundation       | 3,844                              | 6,000 psi                    | 6,000 psi<br>40% slag, 30% fly ash |

\*Should be augmented with local data, knowledge, capabilities

## NRMCA Benchmark Mixes

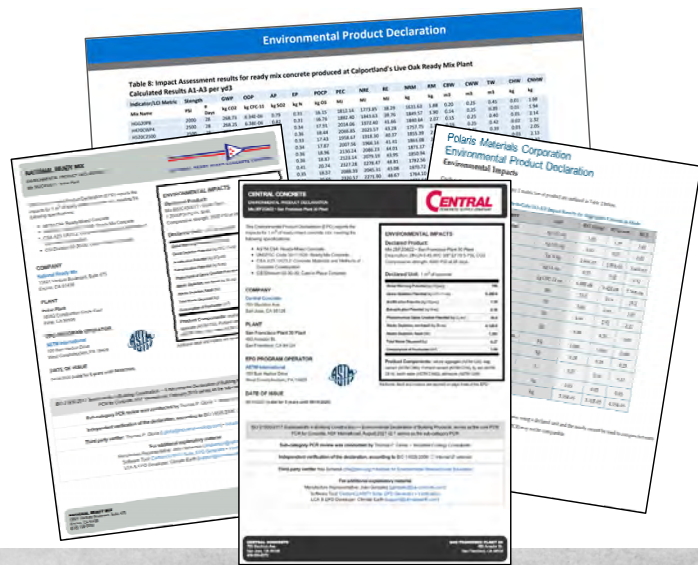
| Results Table E2-Eastern LCA Results (per cubic yard) |                      |          |          |          |          |          |          |          |          |          |
|---|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Strength  | psi @28 days         | 2,500    | 3,000    | 4,000    | 5,000    | 6,000    | 8,000    | 3000LW   | 4000LW   | 5000LW   |
| Core Mandatory Impact Indicator                       |                      |          |          |          |          |          |          |          |          |          |
| GWP   | kg CO <sub>2</sub> e | 183.29   | 201.48   | 240.22   | 289.03   | 305.26   | 360.51   | 395.35   | 437.90   | 480.10   |
| ODP   | kg CFC11e            | 5.91E-06 | 6.36E-06 | 7.32E-06 | 8.52E-06 | 8.96E-06 | 1.03E-05 | 1.47E-05 | 1.58E-05 | 1.69E-05 |
| AP  | kg SO <sub>2</sub> e | 0.67     | 0.71     | 0.81     | 0.93     | 0.98     | 1.12     | 2.10     | 2.22     | 2.33     |
| EP  | kg Ne                | 0.24     | 0.26     | 0.30     | 0.36     | 0.37     | 0.44     | 0.69     | 0.74     | 0.79     |
| SFP   | kg O <sub>3</sub> e  | 14.31    | 15.21    | 17.18    | 19.61    | 20.57    | 23.34    | 29.65    | 31.81    | 33.89    |
| ADP <sub>f</sub>                                      | MJ, NCV              | 400.61   | 412.16   | 442.07   | 482.50   | 503.70   | 548.75   | 2,225.23 | 2,290.96 | 2,344.41 |
| ADP <sub>e</sub>                                      | kg Sbe               | 1.28E-04 | 1.30E-04 | 1.36E-04 | 1.42E-04 | 1.48E-04 | 1.55E-04 | 1.71E-04 | 1.79E-04 | 1.87E-04 |

Download at <https://www.nrmca.org/sustainability>

## Environmental Product Declaration (EPD)

3<sup>rd</sup> party verified & registered documents that communicate transparency

| ENVIRONMENTAL IMPACTS  |          |
|--|----------|
| Declared Product:<br>Mix 2EFZG8Z2 • San Francisco Plant 30 Plant<br>Description: 2IN LN 0.45 W/C 3/8" EF70 5-7SL C02<br>Compressive strength: 4000 PSI at 28 days            |          |
| Declared Unit: 1 m <sup>3</sup> of concrete  |          |
| Global Warming Potential (kg CO <sub>2</sub> -eq)  | 190      |
| Ozone Depletion Potential (kg CFC-11e)   | 3.39E-06 |
| Acidification Potential (kg SO <sub>2</sub> -eq)   | 1.59     |
| Eutrophication Potential (kg N-eq)   | 0.16     |
| Photochemical Ozone Creation Potential (kg O <sub>3</sub> -eq)   | 36.6     |
| Abiotic Depletion, non-fossil (kg Sb-eq)   | 4.12E-5  |
| Abiotic Depletion, fossil (MJ)   | 1,393    |
| Total Waste Disposed (kg)  | 0.27     |
| Consumption of Freshwater (m <sup>3</sup> )  | 1.69     |
| Product Components: natural aggregate (ASTM C33), slag cement (ASTM C989), Portland cement (ASTM C150), fly ash (ASTM C618), batch water (ASTM C1602), admixture (ASTM C494) |          |



## NRMCA Proposed Industry Wide EPD Mixes

**Table 10b. Summary Results (A1-A3): 5001-6000 psi (34.5-41.4 MPa) RMC product mix design, per cubic yard**

|  |           | Minimum  | Maximum  | 5001-6000-00-FA/SL | 5001-6000-20-FA | 5001-6000-30-FA | 5001-6000-40-FA | 5001-6000-30-SL | 5001-6000-40-SL | 5001-6000-50-SL | 5001-6000-50-FA/SL |  |
|--|-----------|----------|----------|--------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--------------------|--|
| <b>Core Mandatory Impact Indicator</b> |           |          |          |                    |                 |                 |                 |                 |                 |                 |                    |  |
| GWP                                    | kg CO2e   | 231.47   | 377.44   | 377.44             | 322.63          | 293.01          | 261.73          | 290.83          | 261.97          | 233.11          | 231.47             |  |
| ODP                                    | kg CFC11e | 6.50E-06 | 9.71E-06 | 9.16E-06           | 7.90E-06        | 7.22E-06        | 6.50E-06        | 9.49E-06        | 9.60E-06        | 9.71E-06        | 6.25E-06           |  |
| AP                                     | kg SO2e   | 0.81     | 1.10     | 1.07               | 0.95            | 0.88            | 0.81            | 1.08            | 1.09            | 1.10            | 0.97               |  |
| EP                                     | kg Ne     | 0.30     | 0.45     | 0.45               | 0.39            | 0.35            | 0.32            | 0.37            | 0.34            | 0.32            | 0.30               |  |
| SFP                                    | kg O3e    | 17.76    | 23.30    | 22.81              | 20.42           | 19.13           | 17.76           | 23.10           | 23.20           | 23.30           | 20.73              |  |
| ADPF                                   | MJ, NCV   | 503.28   | 575.31   | 575.31             | 541.31          | 522.84          | 503.28          | 550.69          | 542.48          | 534.27          | 515.21             |  |
| ADPe                                   | kg Sbe    | 1.21E-04 | 1.50E-04 | 1.50E-04           | 1.36E-04        | 1.29E-04        | 1.21E-04        | 1.36E-04        | 1.31E-04        | 1.27E-04        | 1.22E-04           |  |

Download at <https://www.nrmca.org/sustainability>

## Identifying Global Warming Potential

| Concrete Element | Concrete Volume (yd <sup>3</sup> ) | Benchmark Mixes GWP (Eastern Region) | Proposed Mixes GWP (IW-EPD)*  |
|------------------|------------------------------------|--------------------------------------|-------------------------------|
| Shear Walls      | 7,630                              | 305                                  | 232<br>30% slag, 20% fly ash  |
| Columns          | 366                                | 361                                  | 303<br>40% fly ash            |
| Floors 2-18      | 4,533                              | 289                                  | 277<br>30% slag               |
| Floors B2-1      | 1,067                              | 289                                  | 249<br>40% fly ash            |
| Basement Walls   | 444                                | 289                                  | 220<br>30% slag, 20% fly ash  |
| Foundation       | 3,844                              | 305                                  | 166*<br>40% slag, 30% fly ash |

\*Should be augmented with local data, knowledge, capabilities

# NRMCA Concrete Carbon Calculator

**Producer**

**Designer**

**NRMCA**

**Concrete Budget Report**

Contractor: ABC Construction  
 Ready Mix Producer: NRMCA Member  
 Prepared by: bway@nrmca.org  
**Fruit Technology Inc. - New Office Campus**  
 Sunny, California

| Mix ID | Application                 | Concrete Quantity (CY) | Fx (CY) | Baseline CO2E (lb/CY) | Proposed Mix CO2E (lb/CY) | Total Project Baseline CO2E (lb) | Total Project Proposed CO2E (lb) | Difference from Baseline | Carbonation Potential (lb) |
|--------|-----------------------------|------------------------|---------|-----------------------|---------------------------|----------------------------------|----------------------------------|--------------------------|----------------------------|
| 1      | FG Foundation               | 8,000                  | 8,000   | 908.4                 | 558.1                     | 7,267,200                        | 4,464,800                        | -2,802,400               | -13,800                    |
| 2      | Slabs on Grade              | 3,400                  | 4,000   | 347.3                 | 198                       | 1,181,820                        | 792,000                          | -389,820                 | -19,480                    |
| 3      | Slab on Walls and Columns 1 | 2,200                  | 8,000   | 908.4                 | 237                       | 2,008,280                        | 55,040                           | -1,953,240               | -16,720                    |
| 4      | Slab on Walls and Columns 2 | 1,800                  | 8,000   | 349                   | 273                       | 628,200                          | 497,000                          | -131,200                 | -5,380                     |
| 5      | Slabs and Beams             | 8,500                  | 8,000   | 908.4                 | 273                       | 7,720,200                        | 2,815,000                        | -4,905,200               | -46,420                    |
| 6      | Mat Foundation              | 1,000                  | 8,000   | 347.3                 | 183                       | 347,300                          | 150,000                          | -197,300                 | -11,000                    |
| 6      | Mat Foundation              | 1,000                  | 8,000   | 347.3                 | 183                       | 347,300                          | 150,000                          | -197,300                 | -11,000                    |

This report was generated using the NRMCA's Concrete Carbon Calculator, powered by Climate Earth. The results of this analysis indicate that an estimated -25.11% reduction in embodied carbon could be achieved for the concrete scope on Fruit Technology Inc. - New Office Campus\*. The baseline used to calculate this reduction is based on NRMCA v3.2 Pacific SW

\*This study includes the following life cycle stages:

Access at <https://www.nrmca.org/sustainability>

## NRMCA Carbon Tool

**Project**  
Start New Project

1 Basic Information

2 Project Settings

3 Project Data

4 Online Report

**Project Basic Information**

Name \*  
Residential Tower - Boston

Description \*  
18 Story CIP Frame

Project type \*  
Building

**Project Address**

Street  
123 Main Street

City \*  
Boston

State \*  
Massachusetts (MA)

Zip Code \*  
02114

**Project Complementary Information**

Contractor name  
ABC Contracting

Ready Mix Producer  
NRMCA Producer

Plant Name  
Downtown Boston

## NRMCA Carbon Tool

**Project**  
Start New Project

1 Basic Information 2 Project Settings

**Basic Settings**

Unit of Measure System \* imperial Total Project Area \* 500000

**Carbon Budget Source Settings**

Source for carbon budget \* I will use an industry or local policy baseline

Source for baseline \* NRMCA v3.2 Eastern

Reset Cancel < Previous Next >

- NRMCA Benchmarks v3.2
  - National
  - 8 Regions
- GSA (General Services Administration)
- City of Portland
- CLF Baseline (Carbon Leadership Forum)

More to be added in the future

## NRMCA Carbon Tool

**Project**  
Edit Project

1 Basic Information 2 Project Settings 3 Project Data 4 Online Report

| Mix ID | Strength PSI | Mix Type | Application | Total Volume yd³ | Proposed Mix GWP kgCO2e/yd³ | Carbonation Factor kgCO2e/yd³ | Baseline GWP kgCO2e/yd³ | Baseline GWP Budget kgCO2e/project | Proposed Project GWP kgCO2e/project | Total Achievable Carbonation kgCO2e/project |
|--------|--------------|----------|-------------|------------------|-----------------------------|-------------------------------|-------------------------|------------------------------------|-------------------------------------|---|
| 1      | 6000         | Norm...  | Shear Walls | 7630             | 232                         | -7.6                          | 305.3                   | 2,329,439                          | 1,770,160                           | -57,988                                     |
| 2      | 8000         | Norm...  | Columns     | 366              | 303                         | -17.8                         | 360.5                   | 131,943                            | 110,898                             | -6,515                                      |
| 3      | 5000         | Norm...  | Floors 2-18 | 4533             | 277                         | -12.4                         | 289                     | 1,310,037                          | 1,255,641                           | -56,209                                     |
| 4      | 5000         | Norm...  | Floors B2-1 | 1067             | 249                         | -17.7                         | 289                     | 308,363                            | 265,683                             | -18,886                                     |
| 5      | 5000         | Norm...  | Basement V  | 444              | 220                         | -18.6                         | 289                     | 128,316                            | 97,680                              | -8,258                                      |
| 6      | 6000         | Norm...  | Foundation  | 3844             | 166.4                       | -0.7                          | 305.3                   | 1,173,573                          | 639,642                             | -2,691                                      |
| TOTALS |              |          |             | 17,884           |                             |                               |                         | 5,381,671                          | 4,139,704                           | -150,547                                    |

# NRMCA Carbon Tool

**Proposed Mix GWP for 'Foundation'**

**Important information**

This result is NOT an EPD. This GWP was calculated using the same LCI data sources as prescribed in Table A1 of the PCR for Concrete, NSF International, August 2021 v2.1. A3 is assumed to be 9.04 kg CO<sub>2</sub>eq/m<sup>3</sup> per NRMCA's Benchmark Report v3.2. This GWP is strictly an estimate and is based on industry averages, regional data, and average transportation impacts and should be used for estimation purposes only. For more accurate results, it is recommended that a Type III Third-Party Verified Product Specific EPD be developed.

For a more accurate plant specific estimate, use your EPD tool provider's EPD estimator.

|  |      |   |       |
|--|------|---|-------|
| Portland Limestone Cement (Type II)/ASTM C595 - Domestic | 282  | ✓ | LB    |
| Slag Cement/ASTM C989 - Imported                         | 170  | ✓ | LB    |
| Fly Ash  | 112  | ✓ | LB    |
| Crushed Coarse Aggregate/ Crushed Fine Aggregate         | 1650 | ✓ | LB    |
| Natural Fine Aggregate                                   | 1400 | ✓ | LB    |
| Plasticizer and Superplasticizer                         | 24   | ✓ | FL.OZ |

# NRMCA Carbon Tool

**Project**  
Edit Project

Basic Information | Project Settings | **Project Data** | Online Report

| Mix ID        | Strength PSI | Mix Type | Application | Total Volume yd <sup>3</sup> | Proposed Mix GWP kgCO <sub>2</sub> e/yd <sup>3</sup> | Carbonation Factor kgCO <sub>2</sub> e/yd <sup>3</sup> | Baseline GWP kgCO <sub>2</sub> e/yd <sup>3</sup> | Baseline GWP Budget kgCO <sub>2</sub> e/project | Proposed Project GWP kgCO <sub>2</sub> e/project | Total Achievable Carbonation kgCO <sub>2</sub> e/project |
|---------------|--------------|----------|-------------|------------------------------|--|--|--|---|--|--|
| 1             | 6000         | Norm...  | Shear Walls | 7630                         | 232  | -7.6   | 305.3  | 2,329,439                                       | 1,770,160  | -57,988  |
| 2             | 8000         | Norm...  | Columns     | 366                          | 303  | -17.8  | 360.5  | 131,943   | 110,898  | -6,515   |
| 3             | 5000         | Norm...  | Floors 2-18 | 4533                         | 277  | -12.4  | 289  | 1,310,037                                       | 1,255,641  | -56,209  |
| 4             | 5000         | Norm...  | Floors B2-1 | 1067                         | 249  | -17.7  | 289  | 308,363   | 265,683  | -18,886  |
| 5             | 5000         | Norm...  | Basement V  | 444                          | 220  | -18.6  | 289  | 128,316   | 97,680   | -8,258   |
| 6             | 6000         | Norm...  | Foundation  | 3844                         | 166.4  | -0.7   | 305.3  | 1,173,573                                       | 639,642  | -2,691   |
| <b>TOTALS</b> |              |          |             | 17,884                       |  |  |  | 5,381,671                                       | 4,139,704  | -150,547   |

# NRMCA Carbon Tool

**Carbonation Factor**

Use type: Building Interior - Structural elements

Reference Service Life (RSL) (years): 60

Exposed surface (yd<sup>2</sup>/yd<sup>3</sup>): 5.5

Exposure category: Without cover

Cement content (lb/yd<sup>3</sup>): 470

Percent clinker in cement (%): 93

Percent limestone in concrete (%): 0

Percent silica fume in concrete (%): 0

Percent fly ash in concrete (%): 20

Buttons: Cancel, Calculate

| Mix ID        | Strength PSI | Mix Type | Baseline GWP Budget CO <sub>2</sub> e/project | Proposed Project GWP kgCO <sub>2</sub> e/project | Total Achievable Carbonation kgCO <sub>2</sub> e/project |
|---------------|--------------|----------|---|--|--|
| 1             | 6000         | Norm...  | 2,329,439                                     | 1,770,160  | 57,988   |
| 2             | 8000         | Norm...  | 131,943                                       | 110,898  | -6,515   |
| 3             | 5000         | Norm...  | 1,310,037                                     | 1,255,641  | -56,209  |
| 4             | 5000         | Norm...  | 308,363                                       | 265,683  | -18,886  |
| 5             | 5000         | Norm...  | 128,316                                       | 97,680   | -8,258   |
| 6             | 6000         | Norm...  | 1,173,573                                     | 639,642  | -2,691   |
| <b>TOTALS</b> |              |          | <b>5,381,671</b>                              | <b>4,139,704</b>                                 | <b>-150,547</b>  |

# NRMCA Carbon Tool

Project Settings

| Mix ID        | Strength PSI | Mix Type | Application | Total Volume yd <sup>3</sup> | Proposed Mix GWP kgCO <sub>2</sub> e/yd <sup>3</sup> | Carbonation Factor kgCO <sub>2</sub> e/yd <sup>3</sup> | Baseline GWP kgCO <sub>2</sub> e/yd <sup>3</sup> | Baseline GWP Budget kgCO <sub>2</sub> e/project | Proposed Project GWP kgCO <sub>2</sub> e/project | Total Achievable Carbonation kgCO <sub>2</sub> e/project |
|---------------|--------------|----------|-------------|------------------------------|--|--|--|---|--|--|
| 1             | 6000         | Norm...  | Shear Walls | 7630                         | 232  | -7.6   | 305.3  | 2,329,439                                       | 1,770,160  | -57,988  |
| 2             | 8000         | Norm...  | Columns     | 366                          | 303  | -17.8  | 360.5  | 131,943   | 110,898  | -6,515   |
| 3             | 5000         | Norm...  | Floors 2-18 | 4533                         | 277  | -12.4  | 289  | 1,310,037                                       | 1,255,641  | -56,209  |
| 4             | 5000         | Norm...  | Floors B2-1 | 1067                         | 249  | -17.7  | 289  | 308,363   | 265,683  | -18,886  |
| 5             | 5000         | Norm...  | Basement V  | 444                          | 220  | -18.6  | 289  | 128,316   | 97,680   | -8,258   |
| 6             | 6000         | Norm...  | Foundation  | 3844                         | 166.4  | -0.7   | 305.3  | 1,173,573                                       | 639,642  | -2,691   |
| <b>TOTALS</b> |              |          |             | <b>17,884</b>                |  |  |  | <b>5,381,671</b>                                | <b>4,139,704</b>                                 | <b>-150,547</b>  |

# NRMCA Carbon Tool

**Concrete Budget Report**

**Residential Tower – Boston**  
Boston, Massachusetts

**ions (continued):**

ifications: A company manufacturing ready mixed concrete who rents its production facilities and equipment...  
concrete plants with current certification under the NRMCA...  
crete Production Facilities, certification or approval by a state or...  
riteria of equivalent certification shall be included in the submittal...  
responsibility for concrete mixtures shall document qualifications...  
experience with concrete technology and development of performance...  
of as an NRMCA Concrete Technology Level 2, or equivalent. Details...  
on program shall be documented in the submittal.  
user shall furnish a Quality Plan.  
If supplier participated in supplying data to the NRMCA Cradle-to-Gate...  
Mixed Concrete.

total GWP of all proposed concrete on the project is less than or equal...  
to that of a weighted average of 301 kgCO2e/yd<sup>3</sup>

| Mix ID | Application    | Concrete Quantity (yd <sup>3</sup> ) | f'c (PSI) | Baseline GWP (kgCO2e/yd <sup>3</sup> ) | Proposed Mix GWP (kgCO2e/yd <sup>3</sup> ) | Total Project Baseline GWP (kgCO2e/project) | Total Project Proposed GWP (kgCO2e/project) | Difference from Baseline | Carbonation (kgCO2e/project) |
|--------|----------------|--------------------------------------|-----------|--|--|---|---|--------------------------|------------------------------|
| 1      | Shear Walls    | 7,630                                | 6,000     | 305.3                                  | 232  | 2,329,439                                   | 1,770,160                                   | -24.0%                   | -74,774                      |
| 2      | Columns        | 366                                  | 8,000     | 360.5                                  | 303  | 131,943                                     | 110,898                                     | -16.0%                   | -6,515                       |
| 3      | Floors 2-18    | 4,533                                | 5,000     | 289                                    | 277  | 1,310,037                                   | 1,255,641                                   | -4.2%                    | -56,209                      |
| 4      | Floors B2-1    | 1,067                                | 5,000     | 289                                    | 249  | 308,363                                     | 265,683                                     | -13.8%                   | -18,886                      |
| 5      | Basement Walls | 444                                  | 5,000     | 289                                    | 220  | 128,316                                     | 97,680                                      | -23.9%                   | -8,258                       |
| 6      | Foundation     | 3,844                                | 6,000     | 305.3                                  | 166.4                                      | 1,173,573                                   | 639,642                                     | -45.5%                   | -2,691                       |
|        |                |                                      |           | <b>5,381,671</b>                       | <b>4,139,704</b>                           |   |   | <b>-23.1%</b>            | <b>-167,333</b>              |

This report was generated using the NRMCA's...  
this analysis indicates that an estimated 23.08...  
scope on Residential Tower - Boston™. The Ba...  
Eastern.  
\*This study includes the following life cycle st:

ponsored by: climate earth

## Final Results

| Project                                     | Project GWP (kg) | Weighted GWP (kg/yd <sup>3</sup> ) | GWP Reduction |
|---|------------------|------------------------------------|---------------|
| <b>Benchmark Mixes</b>                      | <b>5,382,000</b> | <b>301</b>                         | <b>0</b>      |
| <b>Proposed with Fly Ash and Slag Mixes</b> | <b>4,140,000</b> | <b>232</b>                         | <b>- 23%</b>  |
| <b>Establish Carbon Budget</b>              | <b>4,300,000</b> | <b>240</b>                         | <b>- 20%*</b> |

\* Consider added buffer/tolerance

# Set Targets for Carbon Footprint

## Concrete Materials:

A. Supply concrete mixtures such that the total Global Warming Potential (GWP) of all concrete on the project is less than or equal to **4,300,000 kg** of CO<sub>2</sub> equivalents or a weighted average of **240 kgCO<sub>2</sub>e/yd<sup>3</sup>**



## NRMCA Concrete Carbon Calculator:

How to quantify and specify carbon

**Brandon Wray**

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Director, Building Innovations  
National Ready Mixed Concrete Assoc.



**Questions?  
Thank You!**

