



Using Data Visualizations to Identify Opportunities for GWP Reductions

John O'Hagan

Forell | Elsesser Engineers

November 20, 2024



- **60+** years of experience | established in 1960
- Sustainable design leaders
- Diverse portfolio | New & existing structures
- Pioneer in seismic base isolation systems
- Known for our innovative approach
- Early adopters of new technologies & processes



John O'Hagan, P.E.

Role at Forell | Elsesser

- Engineer
- Lead Technical Development of Sustainable Design Capabilities

Beyond Forell | Elsesser

- Chair of Sustainable Design Committee within the Structural Engineers Association of California
- Our role is to provide learning opportunities and resources to practicing engineers in California

Why is Data So Important?





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From: U.S. Green Building Council, Board of Directors
Date: Monday, February 26, 2007
Subject: TSAC Report on PVC

MEMORANDUM

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In November 2002, at the request of the USGBC’s LEED Steering Committee, the Technical and Scientific Advisory Committee (TSAC) established a PVC Task Group to assist TSAC in investigating the charge of:

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PVC-based materials have a significant market share. Then, to explore whether there was a basis for a PVC-related credit, the Task Group *investigated whether for those applications the*

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To compare the impacts of alternative materials choices, two assessments – an environmental **life cycle assessment (LCA)** and a **risk assessment** – were completed for each material in each application. The analytical process used is summarized below, followed by the findings.

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that can

Summary of Findings

No single material shows up as the best across all the human health and environmental impact categories, nor as the worst. This primary finding from the integration of LCA and risk

Requirements for Informed Reduction Strategies



1) Robust set of data



2) Confidence that data set is representative of what will be procured

Isn't this a Concrete Webinar?

Concrete EPD Data Development

2010

Carbon Leadership Forum (CLF) officially established

2012

CLF publishes first North American Product Category Rule (PCR, basis of an EPD) for Concrete

2014

First Concrete Product EPD published in the US

2016

CLF publishes material benchmark report

2017

BuyClean CA Passed

Concrete Industry Baselines

TABLE D: CO₂e LIMITS IN CONCRETE MIXTURE

Specified 28-day compressive strength f _c , psi	CO ₂ e Limits in Mixture (75% percentile)*			Marin County	NRMCA ¹²	2021 CLF Baselines ¹⁶		
	Maximum kg/m ³ (SI)	High-early strength** Maximum kg/m ³ (SI)	Lightweight concrete Maximum kg/m ³ (SI)	Maximum kg/m ³ (SI)	NRMCA Average 50%	Achievable (low) kg/m ³ (SI)	Typical (Median) kg/m ³ (SI)	Baseline (high)
≤ 2499	302	393	578	260	266	190	266	340
2500-3499	382	497	578	289	291	210	291	380
3500-4499	432	562	626	313	342	260	343	470
4500-5499	481	625	675	339	405	320	406	580
5500-6499	505	657	N/A	338	429	330	429	610
≥ 6500	518	655	N/A	394	498	380	498	710

Credit: New Building Institute

Specified compressive strength (f _c in PSI)	Maximum Global Warming Potential Limits for GSA Low Embodied Carbon Concrete (kilograms of carbon dioxide equivalent per cubic meter - CO ₂ e kg/m ³)		
	Standard Mix	High Early Strength	Lightweight
up to 2499	242	314	462
2500-3499	306	398	462
3500-4499	346	450	501
4500-5499	385	500	540
5500-6499	404	526	N/A
6500 and up	414	524	N/A

These numbers reflect a 20% reduction from GWP (CO₂e) limits in proposed code language: "Lifecycle GHG Impacts in Building Codes" by the New Buildings Institute, January 2022.

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Concrete Data Visualization

Concrete EPD Availability By State

Fill color indicates the number of matching EPDs normalized by population. Hover for additional info. Click for comparison of state to region.



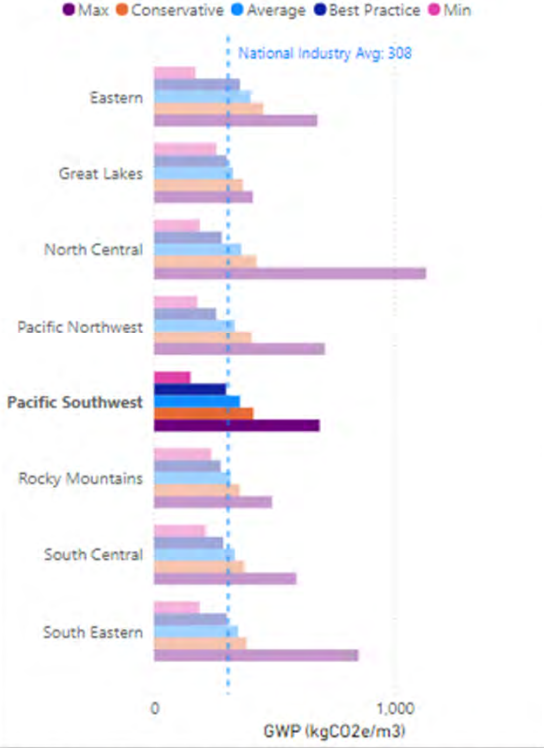
3,733 EPDs meet criteria

Category <input type="radio"/> CementGrout <input type="radio"/> FlowableFill <input checked="" type="radio"/> ReadyMix <input type="radio"/> Shotcrete	Concrete Weight <input type="radio"/> LWC <input checked="" type="radio"/> NWC	28 Day Strength <input checked="" type="checkbox"/> Select all <input type="checkbox"/> 0 psi-2500 psi <input type="checkbox"/> 2501 psi-3000 psi <input checked="" type="checkbox"/> 3001 psi-4000 psi <input type="checkbox"/> 4001 psi-5000 psi <input type="checkbox"/> 5001 psi-6000 psi	Statistic <input type="checkbox"/> Select all <input type="checkbox"/> Max <input type="checkbox"/> Conservative <input type="checkbox"/> Average <input type="checkbox"/> Best Practice <input type="checkbox"/> Min
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Disclaimer Definitions

Stats by Region

Click on Y axis labels to see extent of regions. NRMCA National Industry GWP shown for reference when applicable.



<https://forell.com/concrete-epd-availability>



Requirements for Informed Reduction Strategies



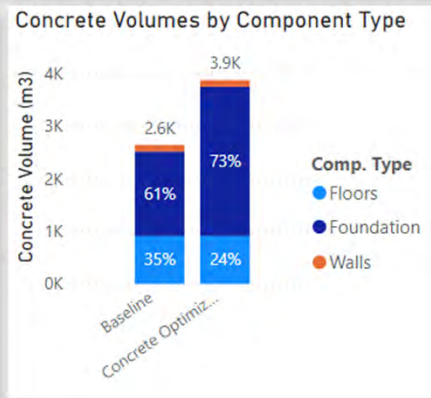
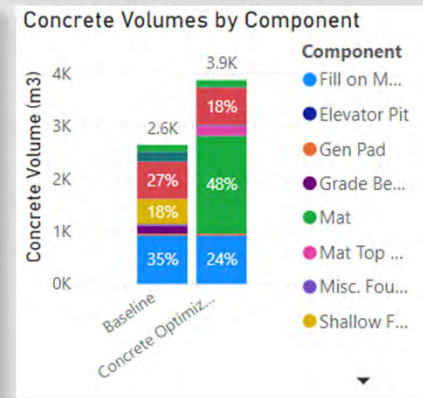
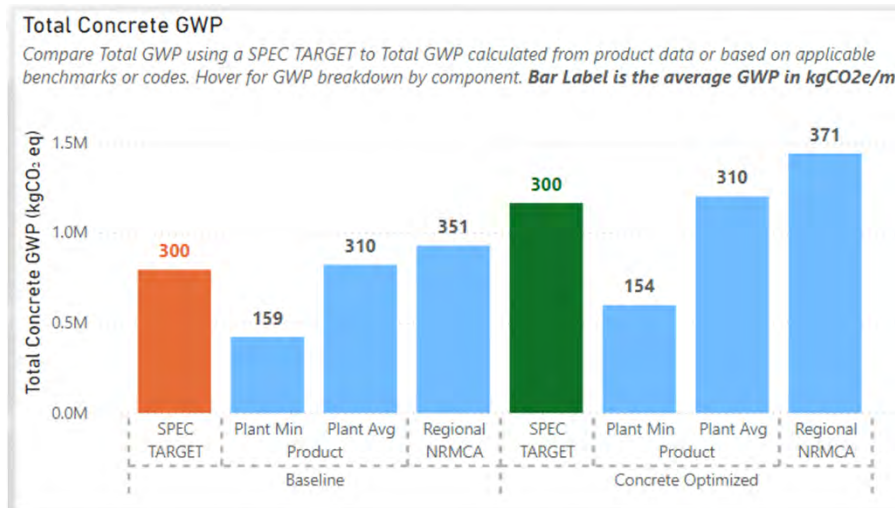
1) Robust set of data



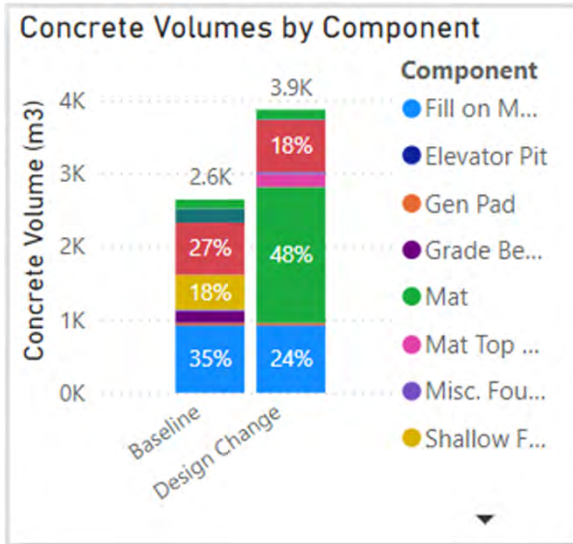
2) Confidence that data set is representative of what will be procured

What Next?

Component by Component Comparison

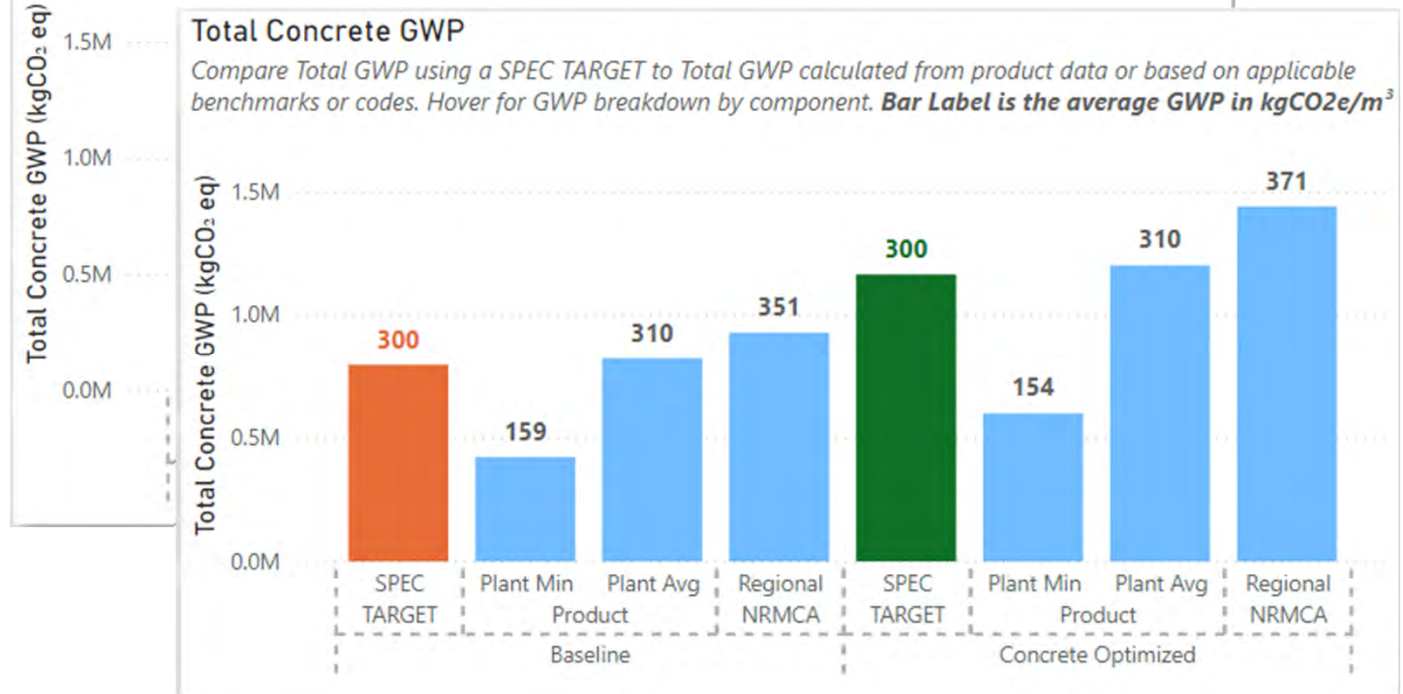


Component by Component Comparison



Total Concrete GWP

Compare Total GWP using a SPEC TARGET to Total GWP calculated from product data or based on applicable benchmarks or codes. Hover for GWP breakdown by component. **Bar Label is the average GWP in kgCO₂e/m³**



Questions/Comments

Concrete EPD Availability By State

Fill color indicates the number of matching EPDs normalized by population. Hover for additional info. Click for comparison of state to region.



Category

- CementGrout
- FlowableFill
- ReadyMix
- Shotcrete

Concrete Weight

- LWC
- NWC

28 Day Strength

- Select all
- 0 psi-2500 psi
- 2501 psi-3000 psi
- 3001 psi-4000 psi
- 4001 psi-5000 psi
- 5001 psi-6000 psi

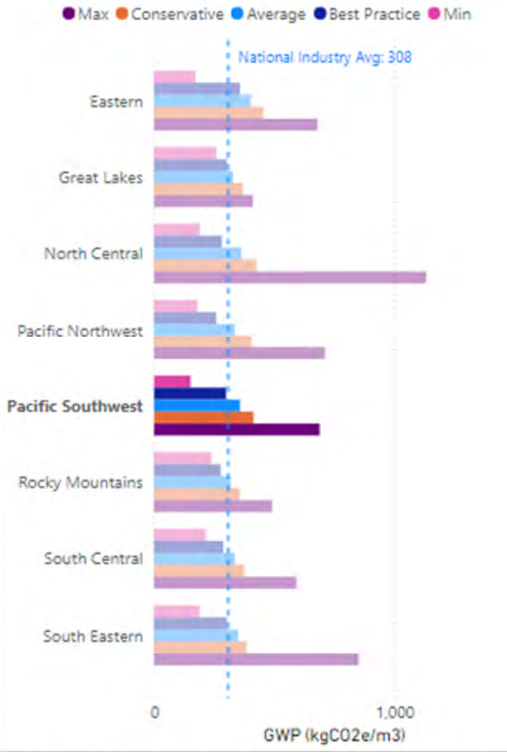
Statistic

- Select all
- Max
- Conservative
- Average
- Best Practice
- Min

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