Sustainable Concrete Solutions in Practice

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Sustainability

- In the true sense is protection of your business by pursuing initiatives that reduce risk – environmental risk, human capital risk, social risk, economic risk

Overview of Case Studies

Use of carbon Infusion and liquid strength enhancer as an added strength development to reduce cement and labor.

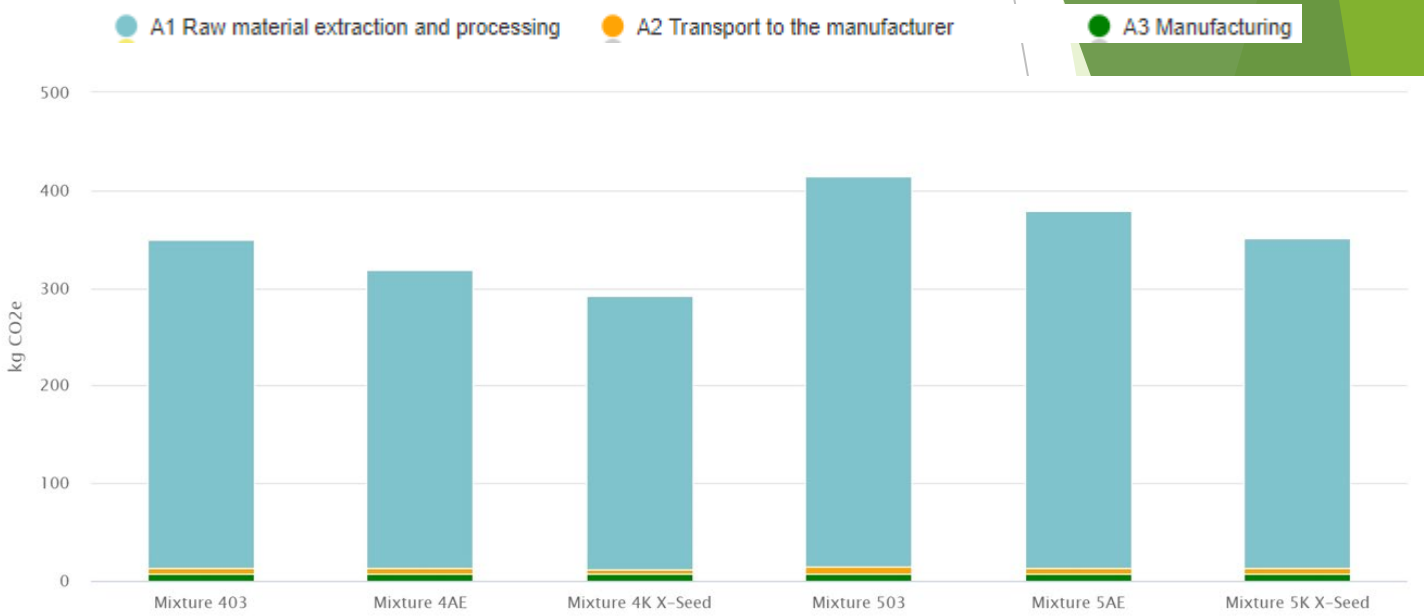
Use of a powdered polymer admixture to recycle fresh returned concrete into a reusable aggregate source

Strength Enhancement

Strength Enhancers– GWP Results

Mix design specifics

- Mixes A and B – reference mixes
- Mixes Acc and Bcc – Mixes with CO2 injection have a 20 lb. cement reduction
- Mixes Axs and Bxs – Mixes with 7 oz/cwt of liquid strength enhancer have a 50 lb. cement reduction



Global Warming Potential,kg CO 2e-Life Cycle Stages

Mix Design	A1 Raw material extraction and processing	A2 Transport to the manufacturer	A3 Manufacturing	C3 Waste Processing	Total	% Reduction in CO2e
Mix A	335.8	6.7	6.7	3.3	352.5	
Mix Acc	305.3	6.1	6.7	3.3	321.4	8.90%
Mix Axs	278.8	5.8	6.7	3.3	294.6	16.40%
Mix B	399.4	7.9	6.7	3.3	417.3	
Mix Bcc	364.7	7.1	6.7	3.3	381.8	8.50%
Mix Bxs	338.1	6.8	6.7	3.3	354.9	14.90%

Cement Reduction by use of Strength Enhancers

Based from 2 plants at 100,000 yards

4000 psi reference mix (mix A)

352.5 kg co2/yard

- Carbon Infusion (mix Acc)
  - 20 lb. cement reduction/yard
  - 321.4 kg co2/yard (9% reduction)
  - 3,100,000 kg co2 savings
-  Equivalent to carbon sequestered by ***3,800*** acres of trees

Production gains

- 47 tanker loads of cement eliminated
- gained 285 man hrs/yr

- Liquid strength enhancer (Mix Bxs)
  - 50 lb. cement reduction/yard
  - 294.6 kg co2/yard (16.5% reduction)
  - 5,700,000 kg co2 savings
-  Equivalent to carbon sequestered by ***7010*** acres of trees

Production gains

- 119 tanker loads of cement eliminated
- gained 714 man hrs/yr

Cement Reduction by use of Strength Enhancers

Based from 10 plants at 600,000 yards

5000psi reference mix (Mix B)

417.3 kg co2/yd

- Carbon infusion(Mix Bcc)
  - 20 lb. cement reduction /yard
  - 381.8 kg co2/yard (8.5% reduction)
  - 21,300,000 kg co2 savings
-  Equivalent to carbon sequestered by ***26,000*** acres of forest

Production gains

- 285 tanker loads of cement eliminated
- gained 1714 man hrs/yr

- Liquid strength enhancer (Mix Bsx)
  - 50 lb. cement reduction/yard
  - 354.9 kg co2/yard (15% reduction)
  - 37,400,000 kg co2 savings
-  Equivalent to carbon sequestered by ***46,000*** acres of forest

Production gains

- 714 tanker loads of cement eliminated
- gained 4285man hrs/yr

Powdered Polymer Admix for- Returned Concrete Treatment

Concrete returns to batch plant. Determine the volume of the returned concrete

Driver adds admixture. Mixes for about two minutes.

Discharge the treated concrete onto the ground in piles

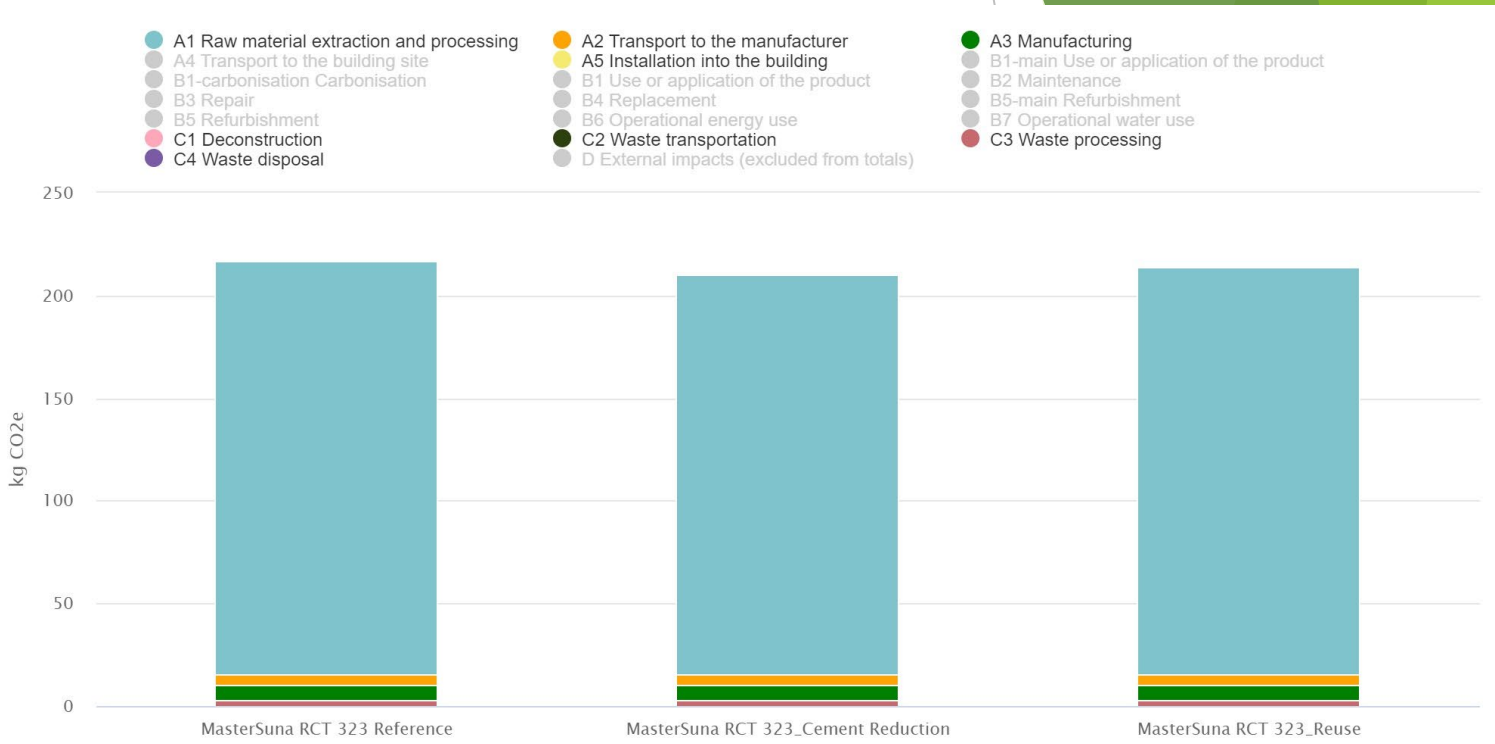
<u>That day</u>: Flatten the treated piles. <u>Next day</u>: Mix and turn the treated concrete piles

Treated material sold or reused into concrete

Returned Concrete- GWP Results

Mix design specifics

- Mix F1- Reference mixture(3000 PSI)
- Mix F2 -Replacement of virgin aggregate with Returned concrete as aggregate replacement - 20%
- Mix F3-Cement reduction of 4% and aggregate replacement of 20%.



Global Warming Potential,kg CO 2e-Life Cycle Stages

Mix Design	A1 Raw material extraction and processing	A2 Transport to the manufacturer	A3 Manufacturing	C3 Waste Processing	Total	% Reduction in CO2e
F 1 Mix	201.21	5.73	6.73	3.3	217	
F 1 + 20% agg replacement	198.06	5.6	6.73	3.3	213.7	1.50%
F 1 + 20% agg replacement and 4% cement reduction	194.56	5.62	6.73	3.3	210.2	3.10%

Recycled Aggerate Material Case Study

Based from 4 rural plants at 265,000 yards

5500 yards produced 2.1% of total production

Reference 3000psi mix 217 kg of co2/yard

- 20% recycled agg replacement
  - 213.7 kg co2/yard (1.5% reduction)
  - 5500 yards recycled agg produces 25k yards of concrete
  - 82,000 kg co2 savings
-  Equivalent to carbon sequestered by ***101*** acres of forest per year

Production gains

- 659 man hrs gained vs crushing
- 825 man hrs gained vs hauling of site

- 20% recycled agg replacement and 4% cement reduction
  - 210.2 kg co2/yard (3.1% reduction)
  - 5500 yards of recycled agg produces 25k yards of concrete
  - 170,000 kg co2 savings
-  Equivalent to carbon sequestered by ***210*** acres of trees per year

Production gains

- 679 man hrs gained vs crushing
- 843 man hrs gained vs hauling of site

Conclusion

- Environmental risk- all case studies use less raw materials to make the same performance concrete.
- Human capital risk- all case studies reduce labor while making the same performance concrete.
- Social risk - all case studies positively promote further use of concrete through less depletion of our natural resources.
- Economic risk- all case studies have a positive impact by reducing material and labor cost.