pozzotive®

A presentation by

Urban Mining Industries (UMI)

Regarding

Ground Glass Pozzolans

A Better Solution for Recycled Glass and Concrete

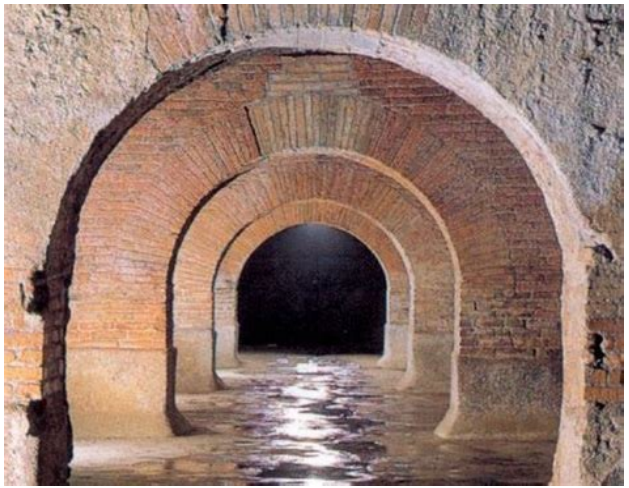
What's a Pozzolan?

Simply said, a pozzolan is fine powder that, by itself, is not cementitious but, when mixed in hydrated portland cement, becomes cementitious.

- ***Pozzolans are essential to making stronger and more durable high-performance concrete.***
- Ground Glass Pozzolans (GGP) create a low-carbon, high-performance concrete while solving the challenge of what to do with our nation's unwanted recycled glass.

History of Pozzolans

- Although pioneered by the ancient Greeks, it was the Romans who, over 2,000 years ago, more fully developed the potential of pozzolans in Roman concrete used for aqueducts and buildings that still stand today.



GGP Solutions for Today's Challenges

Using a ground glass pozzolan creates stronger and longer-lasting low-carbon concrete while providing new, large-scale solutions to the challenges facing three major industries:

- ❑ Glass Recycling
- ❑ Pozzolan
- ❑ Cement/Concrete

The first full-scale production facility of its kind worldwide opened in CT in December 2020.

ASTM GGP standard now in place to make specifying GGP easy.

Industry Problems and Solutions

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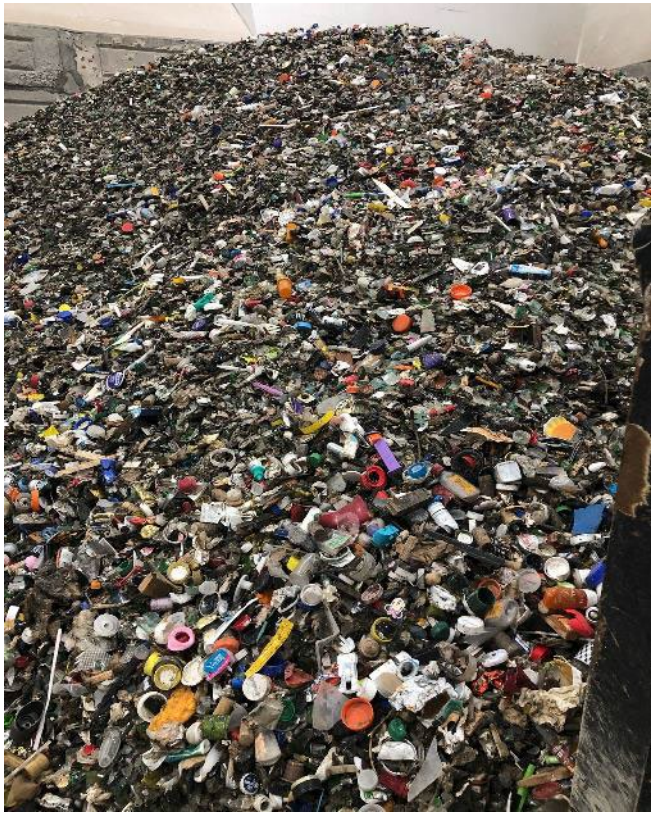
Recycling Industry:
The economics for recycling glass are challenging. Manufacturers require color segregation, ceramic and pyroceram removal, and a minimum size of ⅜". The green glass market is limited, and the CRT panel glass market is nonexistent. Most glass is still land-filled.

Solution: Pozzotive® GGP can use any size and color of glass, ceramics and pyrocerams, increasing both the value and utilization of all glass in the state.

UMI also has innovative solutions for recycled CRT panel glass, plate glass and demolition glass.



Industry Problems and Solutions

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Cement Industry:
Making one ton of cement generates about a ton of CO_2.

Solution: Pozzotive® replaces up to 50% of cement in concrete, reducing cement related CO_2 on nearly a ton-for-ton basis.

SCM/Pozzolan Industry:
A pozzolan is an important component in making high performance concrete. The most common pozzolan has been fly ash from coal burning power plants. Shutdowns and conversions of those plants have significantly reduced the supply of fly ash.

Solution: Pozzotive® GGP helps fill these growing supply voids and does it with a better performing alternative.

The Dual Benefits of GGP in Concrete

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- **Environmental Benefits:**
  - Dramatic reduction in the carbon footprint of concrete
  - All glass and ceramics can be used - none to landfill
  - Yields a white material that increases reflectivity and reduces "heat island" effect
  - Made and used regionally from regionally harvested post-consumer glass, minimizing long-haul transport
- **Performance Benefits:**
  - Better performing and longer lasting concrete
  - Prevents efflorescence and reduces shrinkage
  - Reduces water demand yielding stronger concrete
  - Resistance to chloride penetration (5X) and reduced moisture penetration means a longer life for concrete and major long-term savings in infrastructure costs

A Big Solution to the CO_2 Problem

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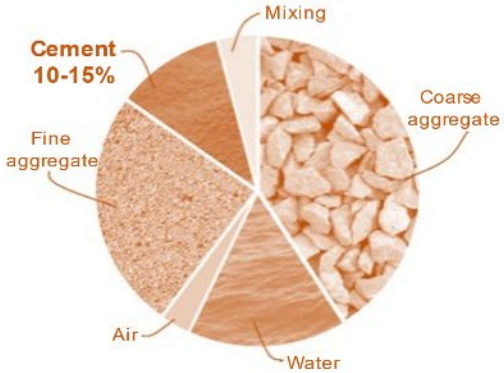
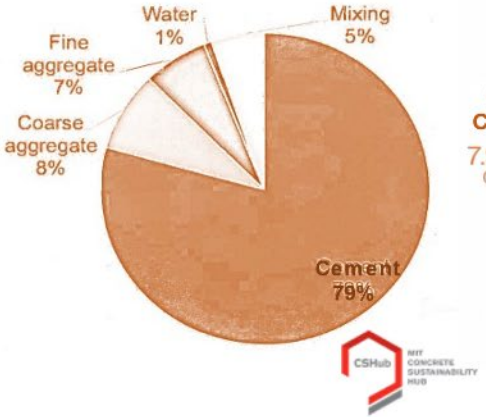
Cement's Disproportionate Impact

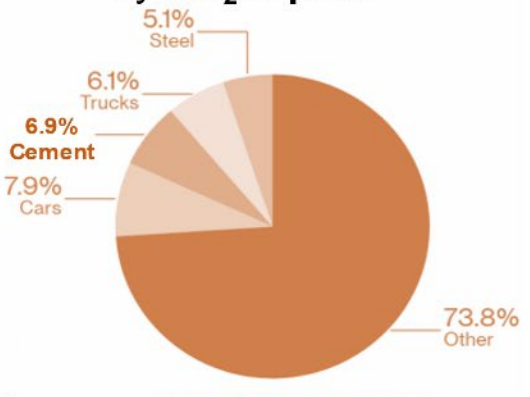
In a concrete mix, by **mass**



In a concrete mix, by **GHG**



In the world, by **CO_2 impact**



Source: IEA WEO 2018 via Bloomberg

A Solution to the CO_2 Problem

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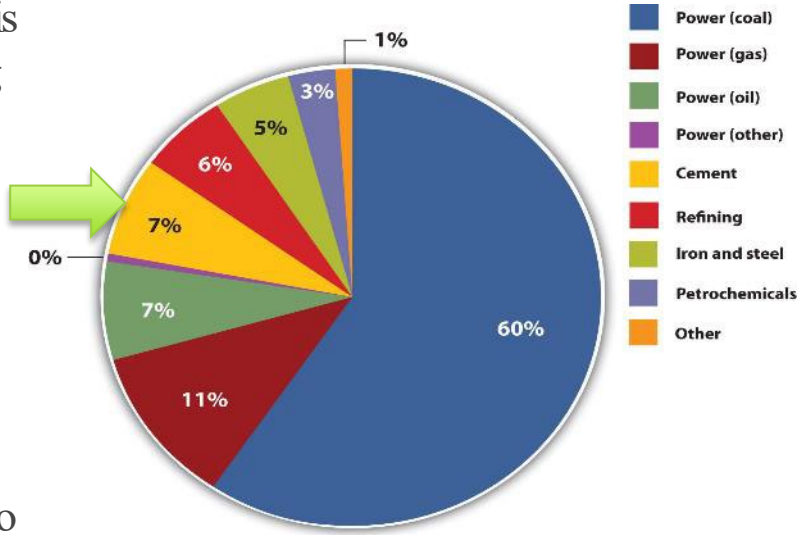
It is estimated that **7%** of the CO_2 produced globally is from the manufacture of cement. The Global Warming Potential (GWP) for **cement is over a ton of CO_2 emissions for every ton of cement made.**

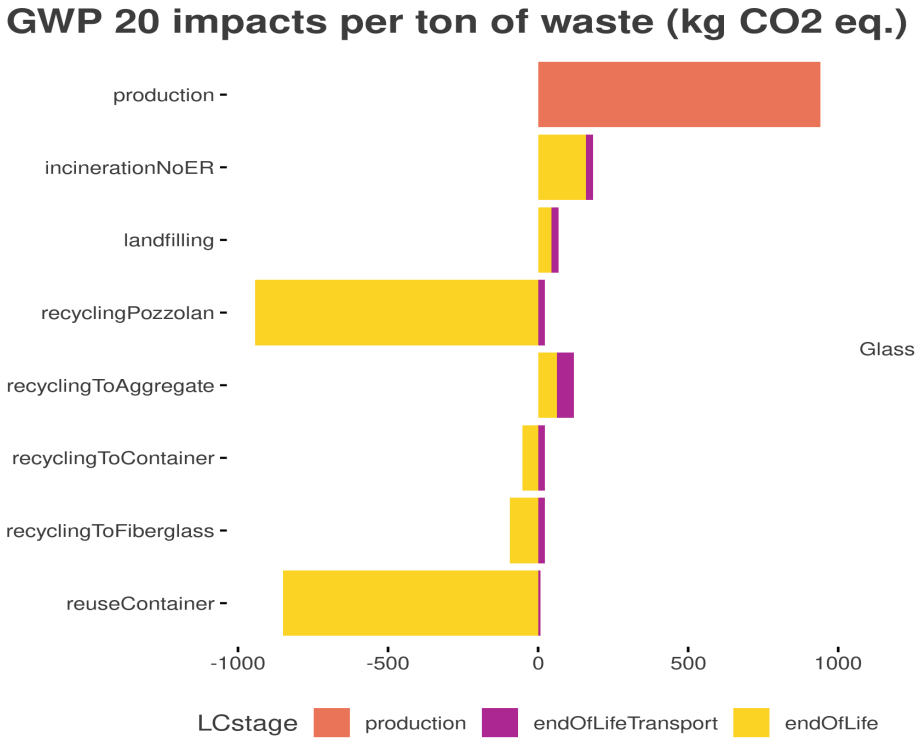
In stark contrast, Climate Earth, an independent firm, recently found that the **GWP of Pozzotive® is just 5% of the portland cement it replaces!**

The carbon impact of our CT plant will be equivalent to taking about 8,000 cars off the road a year.

Glass-to-concrete has, by far, the greatest positive climate impact when compared to other recycling options.



A Big Solution to the CO_2 Problem



Recycling glass to a GGP has by far the largest impact on GWP reduction than recycling to any other product.

Graphic courtesy of Oregon Department of Environmental Quality

42% Reduction in Carbon Footprint of Concrete

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50% replacement of cement in a 9,000-psi concrete mix design yielded a 42% reduction in the concrete carbon footprint.

The 28-day break was 9,623 psi and the 56-day break was 12,852 – outstanding strength performance.

Cradle to Gate GWP (kg CO2e) per cubic yard of a 9,000 psi mix design with and without Pozzotive®

Material	Units	Quantity/Cubic Yard	
		W/out Pozzotive	With Pozzotive
Type I/II Cement	lb	850	425
Pozzotive	lb	-	425
Sand	lb	1,150	1,150
Stone 1	lb	1,000	1,000
Stone 2	lb	700	700
Water	Gal	34.7	34.7
Admix1	fl.oz	46.8	46.8
Admix2	fl.oz	17.0	17.0
Admix3	fl.oz	25.5	25.5
GWP (kg CO2e)		**625.0**	**361.0**
28-day break (psi)			**9,623**
56-day break (psi)			**12,852**

Products Suited for GGPs

- Cast-in-place concrete
- Precast/prestressed concrete
- Tilt-up construction
- Structural CMUs
- Architectural CMUs and brick
- Pavers
- Retaining wall units
- Roof panels and tiles
- Grouts and mortars
- Floor levelling compounds
- Terrazzo and countertops

Strong Market Acceptance

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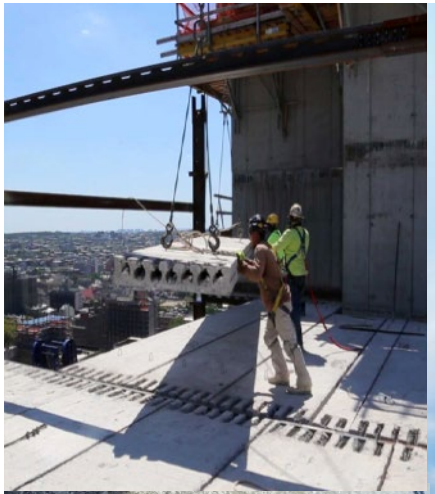
Successful third-party lab testing completed by:

McInnis, US Concrete, CEMEX, O&G Industries, Unilock Pavers, CCNY, Rensselaer Polytechnic Institute, Clarkson University, NYCDDC/DOT, BASF, 3M, FL and CT DOT

Representative projects using Pozzotive:

- Sidewalks: NYC (DDC) and Mountain View, CA (Google)
- About 10 million concrete blocks: 2nd Ave subway, NYPD Academy, Yankee Stadium, 855 Sixth Ave, US Navel Drone Facility, NYU, Columbia, Sloan Kettering, Univ. of West Virginia, UCONN, ESPN HQ, Marine Gateway (Vancouver)
- Over 500,000 SF of pre-stressed concrete slabs: Various residential developments in the NY metro area
- Permeable Pavers: The United Nations Plaza, Whole Foods, Brooklyn, NYCSCA Net Zero School
- Structural High-Rise Pour: Halletts Point, NYC



Strong Market Acceptance

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Pozzotive® can also transform demolition waste glass into a new building product: 60 tons of UN window glass were recovered, crushed and milled into Pozzotive® and then used to make Sustainable High-Performance Concrete pavers now at the entrance to the U.N.

Clockwise from top left:
United Nations Plaza
A&E firms already specifying Pozzotive ®
Carnegie Mellon University
El Jardin de Selene
Via Verde

SPECIFIED BY:

PERKINS+WILL GRIMSHAW
HAZEN AND SAWYER
Environmental Engineers & Scientists
DattnerArchitects
AECOM
Severud Associates
CONSULTING ENGINEERS P.C.

Industry Turning Point:

Halletts Point in NYC was the first structural high-rise pour nationally to use a glass pozzolan.

The Perfect Local Circular Story

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In Use In New England

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Recognition for Solutions Found

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BuildingGreen selects new building products that significantly reduce energy consumption and carbon emissions and improve product life cycles. We have now won this national award twice!

BuildingGreen APPROVED
TOP 10 PRODUCT FOR 2019
Pozzotive Ground Glass Pozzolan

Pozzotive® also earned the United States EPA's Environmental Quality Award in Region 2, the highest award given to the public by the USEPA.

The Northeast Recycling Council (NERC), a non-profit consortium of 11 states united for environmentally sustainable materials management, awarded Pozzotive® its 2020 Environmental Sustainability Leadership Award.

NERC NORTHEAST RECYCLING COUNCIL
Environmental Leadership Award
PRIVATE SECTOR 2020
NERC.ORG

Contributing to Envision & LEEDS Certification

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Institute for Sustainable Infrastructure

MATERIALS
RA1.1 Reduce Net Embodied Energy
RA1.3 Use Recycled Materials
RA1.4 Use Regional Materials
RA1.5 Divert Waste From Landfills

ENERGY
RA2.1 Reduce Energy Consumption

EMISSIONS
CR1.1 Reduce Greenhouse Gas Emissions
CR1.2 Reduce Air Pollutant Emissions

RESILIENCE
CR2.5 Manage Heat Island Effects

- Sustainable Sites
- Energy & Atmosphere
- Material & Resources
- Innovation
- Regional Priority

Pozzotive® CT Plant

Benefits to Local Communities

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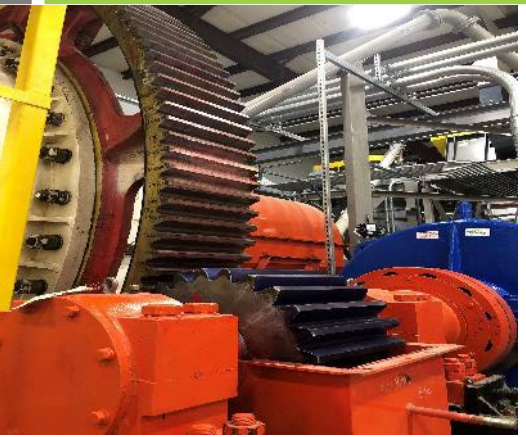
Using Ground Glass Pozzolans provide our communities with a:

- Cost-effective, large-scale solution to our glass challenges
- Real alternative to costly and diminishing landfill options
- New and commercially viable low carbon solution for concrete
- Better performing and longer lasting concrete
- Great environmental and community outreach story on many levels - feedstock is sourced locally, and finished products are manufactured and used locally
- Significant capital investment and the creation of new local jobs

Questions?



Urban Mining Industries
270 North Avenue
New Rochelle, NY 10801
914-633-3393

www.pozzotive.com