

GLASS AGGREGATE

Raw Materials

Glass aggregate is also known as cullet or recycled glass, soda lime glass, crushed glass, or processed glass aggregate (PGA). A recovered material, it is unusable for recycling into new glass for containers but can be recovered for uses in the construction industry to replace sand and virgin rock aggregate.



Figure 1

Suitable sources of recycled crushed glass are glass or ceramic bottles, glass jars, ceramic tableware and cookware, vases, ceramic flowerpots, plate glass, mirror glass, and residential incandescent light bulbs (National Resource Recovery Association (NRRA)).

Unsuitable sources of PGA are larger ceramic items such as tubs, sinks, toilets, large fixtures (unless large crushing facilities are available), lab or medical waste glass, TV tubes, computer monitors, automotive glass, tempered glass, hazardous product containers, and fluorescent light bulbs (NRRA).

Manufacturing Process



Figure 2

Process: Thousands of tons of container glass are collected and processed for use in the manufacture of new glass containers. However, some of this glass, such as drinking glasses or ceramic dinnerware, is unusable for these purposes. King County asserts that if container glass becomes “broken, color-mixed, or otherwise contaminated,” it cannot be used for new containers. Collected glass is crushed and screened to remove contaminants (NRRA).

Benefits/Uses

“PGA requires no color separation – saving space and labor. It provides a new use for unmarketable or contaminated glass, eliminates the capital expense of storage containers, and can remove as much as 50% more material from the waste stream by including ceramics and other household glass not normally part of a traditional glass recycling program” (NRRA).

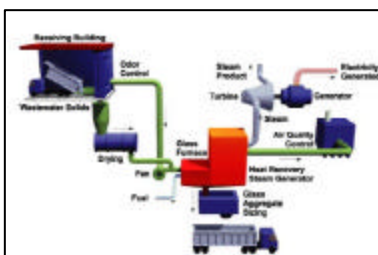


Figure 3

Glass aggregate and blends are strong, clean, safe, and economical. It can be used in unbound (non-composite) construction aggregate applications. Crushed glass aggregate holds a grade, compacts well, and drains well. Though it doesn't look or behave exactly the same as regular aggregate, it is a good replacement for conventional gravel or sand. It does not heave in cold weather and does not biodegrade or corrode. It does not leach contaminants into surrounding groundwater, surface water, or topsoil. It has good compaction characteristics providing good workability.

King County specified recycled glass aggregate for a variety of projects in the last five years. It has used the material as pipe-bedding, backfill for a retaining wall, for conventional filter

sand (where it performed better than the sand would have), and as a filtration medium in stormwater systems.

Since the 1960s, Washington State Department of Transportation (WSDOT) has used a portion of glass aggregate in bituminous concrete pavements. WSDOT allows aggregate blends with up to 15% in the following applications: ballast, shoulder ballast, crushed surface base course, aggregate for gravel base, gravel backfill for foundations (classes A and B), gravel backfill for walls, gravel backfill for pipe bedding, gravel backfill for drains, backfill for sand drains, sand drainage blanket, gravel borrow, bedding material for rigid and flexible pipe, foundation material (classes A, B, and C), bank run gravel for trench backfill. WSDOT also allows up to 100% glass aggregate in the following applications: backfill for walls, backfill for pipe bedding, backfill for sand drains, sand blanket, and bedding material for flexible pipe (Clean Washington Center).

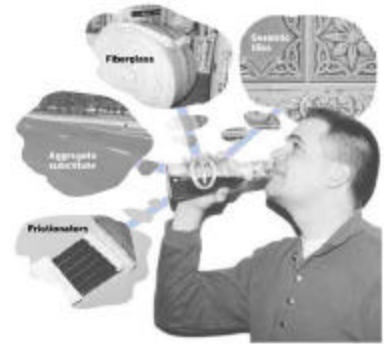


Figure 4

In experiments conducted at Stoneway Concrete 10 years ago, it was determined that glass aggregate in structural applications was “not worth it” for building applications. Glass aggregate has been fine for non-structural uses such as backfill, but as aggregate in concrete it seems less feasible (McKinnon 2002).

Supplies of crushed glass aggregate are highly variable. Check sources before specifying a particular supplier and be alert regarding the quality of the glass before it is used in the application.

Concerns

Silica is derived from sand, flint, or quartz. Glass is comprised of sand. When glass cullet is used as a replacement aggregate in a mix, silica reacts chemically with the alkali content in cement, causing an alkali-silica reaction that can, in turn, cause expansion in concrete and early failure. Specific aggregates can be used in a mix to limit the alkali content of cement, thereby limiting alkali-silica reaction when glass aggregate is used. Another way to mitigate the reaction when PGA is present is to specify blast slag that reduces total alkalis in the system and the overall alkali-silica ratio. Fly ash, as well, can be used (McKinnon 2002).

There is also a dust hazard potential including eye contact or inhalation of dust. Though the dust is purported to not produce organic disease or toxic effects, concerns have been voiced about the silica content of crushed glass aggregate. Bottle glass does consist of amorphous or non-crystalline silica, but is classified by OSHA only as a “nuisance” dust (not a hazardous dust). An easy way to mitigate dust problems is to work with the material in a slightly dampened state.

Recycled glass is reportedly somewhat more difficult to handle than conventional gravel aggregate, but other sources state that regular safety precautions for crushed rock suffice for crushed glass. Recycled glass is non-combustible, inert material. Human injury is limited as

crushed glass aggregate is similar to regular crushed rock aggregate. Bottle glass has few shards and a different breaking pattern than plate glass. As the glass is crushed it becomes more and more rounded.

Cost

Costs for crushed glass aggregate are either comparable to or cheaper than conventional gravel.

Suppliers

FIBRESinternational

9208 4th Avenue South, Seattle WA 98108.

Rich Yost: (206) 762-8520

ryost@fibres.net

Cadman

Scott Thompson, Building Materials Supervisor

18816 NE 80th Street, Redmond, WA 98073

Phone: (425) 867-1234

www.cadman.com or info@cadman.com

Other locations: Seattle, Issaquah, Black Diamond, Mill Creek

Stoneway Rock and Recycling

1915 Maple Valley Highway, Renton, WA 98055-3906

Phone: (425) 226-1000

Other locations: Seattle, Kent

Waste Management of Seattle

7901 1st Avenue South, Seattle, WA 98108

Phone: (206)762-3000 or 763-8326

References / Resources

* available in the Environmental Works Resource Library

Clean Washington Center. *Washington State Department of Transportation Specifications for Glass Aggregate*. Clean Washington Center, 1997. <http://www.cwc.org/glass/g1953.htm> *

Commonwealth Scientific & Industrial Research Organisation (CSIRO). "Recycled Glass as Concrete Aggregate," *Built Environment Innovation & Construction Technology*, No. 24, April 2002. <http://www.cmit.csiro.au/innovation/2002-04/glass.htm> *

McKinnon, Greg. Stoneway Concrete, Seattle, WA. Personal Communication, Nov. 19, 2002. *

King County Environmental Purchasing Program. *Aggregate, Recycled Glass*. www.metrokc.gov/procure/green/glass.htm, accessed Nov. 11, 2002. *

National Resource Recovery Association (NRRA). *Processed Glass Aggregate (PGA): An Alternative Reuse for Post-Consumer Glass*. www.recyclewithus.com, accessed Nov. 11, 2002. (Website no longer available. Current NRRA website at: www.recyclewithus.org). *

Owens-Brockway. *Glass Containers: Material Safety Data Sheet*. Owens-Brockway, 1991. *

Image Credits

1. Minnesota Office of Environmental Assistance:

<http://www.moea.state.mn.us/lc/purchasing/glassaggregate.cfm>

2. Glass Aggregate Manufacturing Equipment (GAME):

http://www.glassagg.com/recycled_glass.html

3. Minergy, a Wisconsin Energy Corporation:

<http://www.minergy.com/technology/vitrification.htm>

4. City of Bloomington, MN:

<http://www.ci.bloomington.mn.us/news/briefing/bf2001/01-04bf/6-7/04-01bf6.htm>

