

FINAL REPORT

IG1-05

REUSE OF GLASS AS AGGREGATE FOR ASPHALT SHINGLES

Duval County, Florida

May 31, 2004

The Florida Department of Environmental Protection administers a grant program funding innovative concepts to recycle non-traditional materials or expand markets and products utilizing traditionally recyclable materials. Duval County had the opportunity to participate in such a project, converting otherwise unusable mixed glass into a material to be used in the production of roofing shingles. This final report summarizes the concept, problems encountered, objectives met, and lessons learned.

INTRODUCTION

Background

In 2000, Owens-Corning, an international roofing shingle manufacturer, approached one of Duval County's Council Members, Ms. Faye Rustin, concerning governmental support for a cooperative project involving its local plant. The initial scope of this project was a research and development partnership between Owens-Corning and Minpro International, a Canadian company that had patented a process to grind glass into various grades of raw material, with the goal of reusing mixed glass as aggregate for the "back-dusting" of asphalt roofing shingles.

Owens-Corning was concerned about potential health hazards created by the use of silica (sand) in the production of its roofing shingles and had approached Minpro to bring its glass processing technology to the Jacksonville area to provide a source of material to its local manufacturing plant. Because this project involved utilization of a recyclable material, Council Member Rustin approached the Solid Waste Department for assistance. The Department presented this concept to the State in the form of an application for an innovative grant, which it subsequently received in 2001.

Innovation

Initial tests performed prior to the grant application suggested that switching from silica to recycled glass would be very simple, resulting in a viable recycling market for mixed cullet where none existed before. The proposed project was innovative not only in providing a product desirable to a for-profit organization, but it would utilize a recycling program byproduct, thus diverting it from the landfill.

Several other environmental and occupational safety benefits were also expected. As noted in the original grant application, silica is considered a respiratory health hazard because it is a lung irritant and prolonged exposure can lead to silicosis. Replacing it with the recycled glass aggregate should eliminate exposure to this toxic material. All parties hoped that further research and development would allow expanded use of the glass aggregate in the shingle manufacturing process as well identify other markets for the material.

Additional advantages to this change in production were expected. There is no increase in shingle production cost, yet there is less wear and tear on the production equipment since crushed glass is less abrasive. There also may be an added life to shingles made from this material, but it will take years to make that determination.

Objectives

One reason this project was so attractive to Duval County was the current recyclable market climate. The Material Recycling Facility (MRF) contract between Duval County and Browning-Ferris Industries (BFI) has been in place since 1990, and included not only a share of revenues from the curbside collection program, but also a 50-50 split in the cost of negative markets. Waste streams that contributed to a negative market situation were typically wet newspaper and mixed glass. Although wet newspaper was rare, mixed glass has been a constant issue. With no identified marketable use, it had been landfilled at a rate of \$30/ton, plus the cost of handling and transportation from the MRF to the landfill, a round trip of approximately 30 miles.

As we surveyed counties throughout Florida in preparation for implementing this project, we found that most had the same problem with mixed glass - no market. Furthermore, many surrounding counties expressed interest in sending their mixed glass to Jacksonville for recyclable uses as an alternative to disposal once the grant was awarded and the facility was operational. Our goal was not only to create a sustainable market for local mixed glass, but also to provide an outlet to other communities who wanted to find a use for this material. The estimated tons to be diverted locally were 3-7,000 tons, while the surrounding counties hoped to fill the remaining final capacity in excess of 40,000 tons per year.

Presentations and Publications

The Recycling Coordinator was very involved in the planning and implementation phases while serving as the project manager. Regrettably, three project managers have left City government since the award of this grant. Jackie Eldridge retired in 2002, Suzanne Lichter resigned in 2003, and Andrew Fairbanks joined the recycling staff in Pinellas County in 2004. Therefore, at the conclusion of this grant, no subject matter experts remain in the organization. We are relying on the owners and staff of Glass Recycling Technologies to respond to requests for information and to provide technical presentations upon request and as required by this grant.

John Perkins, Glass Recycling Technologies, is scheduled as a speaker at the 2004 Recycle Florida Today Conference to be held in St. Petersburg, Florida in June. His presentation will be directed at members of the State's recycling community, including County recycling coordinators and their staffs, as well as Department of Environmental Protection representatives. He will focus on the developing technology of glass recycling, specifically the operation resulting from the partnership leading to the award of innovative grant. He will discuss problems encountered, lessons learned, obstacles and opportunities for the future.

Several articles have been written in both local media and national trade publications concerning the political roadblocks encountered during the implementation of this process. In the near future, The Jacksonville Business Journal plans to publish a report on the business unit and its contribution to the community.

IMPLEMENTATION

Services Purchased

Once the grant was in place, Minpro quickly located a site for its plant in the general proximity of the Owens-Corning operation. The location selected was in a blighted area, zoned as light industrial, and had served as a fuel storage facility approximately 10 years earlier, but had been abandoned in recent years. The situation was ideal for economic development proponents. It was an opportunity to visually and economically improve a depressed environment, provide jobs for neighborhood residents, and support the community by contributing to the tax base. No one anticipated the delays that this particular site would create.

After the grant was awarded and funds were appropriated, a formal relationship between Duval County and Minpro was put in place in the form of a purchase order. Since the relationship between Owens-Corning and Minpro already existed, and because Minpro had the proprietary experience necessary to develop the plant and equipment, a formal bid was not required.

As anticipated in the grant application, no grant funds were used to purchase equipment. Instead \$125,000 was used to reimburse the company for site preparation, lease and utility costs, and engineering expenses related to equipment development and placement. As this plant was a pilot program, no equipment was available “off the shelf”. Component parts were purchased and all equipment was fabricated on site to meet the specifications of end users. The balance of the grant was designated as reimbursement of processing costs at an amortized rate of \$30/ton shipped. This rate was negotiated between the County and the State as an approximate fully loaded cost to produce each ton of recycled material. Coincidentally, \$30/ton is also the rate of disposal at TrailRidge Landfill, the local disposal facility.

Problems Encountered

The first obstacle encountered was the lack of support from a publishing business located on an adjacent site. The owner of the business began a campaign to stop the plant from leasing the site based on his perception that he and other neighbors would be harmed by it, both environmentally and by reduced property values. Complaints were filed with FDEP, creating a criminal investigation against Minpro. Also, the zoning designation was protested, resulting in further delays to allow the community to communicate concerns to the City Council. The media was called on several occasions and conducted

many on-air interviews with these opponents, creating a political environment that delayed the approval of zoning changes.

Unfortunately, in anticipation of plant start up, Minpro negotiated with Alachua County to receive its glass as of September 2002. Deliveries were made, and glass was placed on the ground prior to the erection of storage bunkers. When the implementation was put on hold pending zoning issues, the material remained on the ground for over a year. FDEP investigated, found the company in violation of recycling placement laws limiting storage of recyclable materials to one year, and fined the property owner.

After several months of public hearings, zoning meetings, and negotiations, the property owner received the zoning exception in November 2002. Duval County requested and received a grant extension because of this delay.

Investors in this project persisted, however, and continued an outreach campaign to educate the neighborhood concerning the project. They explained to the surrounding community that the operation would be a clean, recycling process and promised to limit hours of operation and truck traffic, even to build sidewalks and repair fences.

During this time, ownership of the glass recycling facility changed hands, having been purchased by Glass Recycling Technologies of Florida, Inc. (GRTF). GRTF hired as its Vice President of Operations a neighbor who shared the same vision for the project and community as the investors. Several other local residents were hired by GRTF to clean up the site and prepare for the installation of the glass recycling equipment.

Another significant delay occurred when buried fuel tanks were discovered as a section of ground was excavated in preparation for a concrete slab. City inspectors and FDEP officials responded and assisted GRTF in testing soils and groundwater for contamination. The tanks were successfully removed and GRTF was given the green light to continue installing the equipment.

While responding to various unexpected delays and crises, the company focused its efforts on establishing and expanding markets for the recycled glass product. Meanwhile, engineers for GRTF continued to install and modify the equipment to separate the glass from other materials (residue) that are inherent in recycling operations.

Several counties expressed an interest in participating in this project by providing material. Unfortunately, with the increase in fuel and transportation costs, participation became financially difficult for some communities. However, Alachua County has been shipping material since September 2002, and Broward County has been shipping since October 2003. GRT is currently negotiating with other counties as well.

Unfortunately, in July 2003, St. Johns County, which is adjacent to Duval County, decided to remove glass from its curbside collection program. The media immediately ran a story on the glass project, and many letters to the editor were published in favor of glass recycling. The citizens fought back, and ultimately, the County set up a few drop off stations to handle glass. As expected, the volumes at these sites are minimal, with the majority of St. John's County glass now ending up in the landfill.

Operation Description

The operation is fairly simple. The raw material, which is primarily MRF residue, is delivered to the plant and dumped into bunkers. A front-end loader scoops up the material and transports it to a conveyor belt. Materials first pass through a system of magnets that pulls out any metals and deposits them into a container. A puffing system blows plastics out of the material stream and into another container. Remaining material moves through a sorting line, where employees manually pull out residual non-glass materials, leaving only mixed glass.

The conveyor system then carries the material through a series of grinders and screens modified for the specifications of each end use. Quality control continuously inspects output, running material back through the process until specifications are met. A conveyor belt then carries the finished product upward into storage silos. Specially fabricated bags are placed under the silos and filled prior to transporting product to customers.

Attached to this report are pictures of the various components of the plant.

Project Timeline

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| 4/30/2001 | Original award letter from FDEP |
| 5/26/2001 | Grant is approved and funding appropriated by City Council. |
| 9/11/2001 | Project Manager, Jackie Eldridge, is hospitalized and ultimately retires on disability, and is replaced by Suzanne Lichter. |
| 10/2001 | Minpro leases an abandoned warehouse as the plant site. |
| 11/2001 | Asbestos contamination is discovered at facility site. Resolved by owner.
Property owner applies for zoning exception for recycling facility. |
| 12/2001 | Minpro starts negotiation with BFI and other sources for mixed glass. |
| 3/2002 | Construction is delayed again pending zoning exception. |
| 4/5/02 | Zoning exception is granted. |
| 4/11/02 | Zoning exception is appealed, and construction again delayed. |
| 8/27/2002 | Zoning exception is issued to property owner. |
| 9/2002 | Glass is received from Alachua County. |
| 11/04/2002 | Zoning approval is granted by City Council |
| 11/14/2002 | Grant extension is received through 7/31/2003. |

- 11/15/2002 Plant construction begins.
- 1/2003 Underground fuel tanks are discovered during silo construction, resulting in DEP involvement and further delay.
- 5/19/2003 Request is submitted to DEP to extend the grant for a second time due to unforeseen and uncontrollable delays. Grant is extended through 5/1/04.
- 9/1/2003 GRTF's plant is operational.
- 9/5/2003 Project Manager Suzanne Lichter resigns and is replaced by Suzanne Hamrock.
- 10/1/2003 GRTF begins shipping significant quantities of recycled glass aggregate.
- 5/1/2004 Grant ends.
- 5/31/2004 Eleventh Work Period Progress Report and Final Report submitted.

PROJECT RESULTS

Objectives

The objective of this project was to establish a sustainable operation that would divert mixed glass destined for disposal facilities from Duval and surrounding counties, and convert it to a usable material having a long-term market potential. While the project did not divert the volume anticipated during the grant period, the potential remains strong for future quantities.

Innovation

GRTF is the first mixed-glass recycling alternative for the Northeast Florida region, serving Duval and surrounding counties, as well as providing a model for other regions. The one-of-a kind facility has the ability and flexibility to match quality of processed material to meet the specifications of the end user, from sandblasting and roofing shingles to beach sand for coastal renourishment projects. If GRTF can secure enough funding to stay afloat while establishing material sources, we expect this new glass recycling process to be very successful. Owens-Corning estimates that it will use approximately 15,000 tons of the fine glass aggregate for the back dusting of their asphalt shingles, and they are researching other applications of the glass for their products.

Flexibility in the design allows for processing different consistencies of recycled glass aggregate, which can be marketed for a variety of different uses. For example, GRTF has sold aggregate for landfill applications and is researching applications for beach renourishment projects by the Army Corps of Engineers, "glass-phalt" for road construction with contractors for the Better Jacksonville Plan, and for sand blasting. All of these markets are in addition to the originally planned use as aggregate for asphalt shingles.

Diversion

This process has the potential to divert a considerable amount of waste from disposal sites. Because the lead-time from project implementation to completion was much longer than anticipated, we do not have proven results to report. Therefore, we have had to extrapolate potential benefits resulting from this program. If we assume a maximum annual capacity of 48,000 tons produced vs. landfilled, we can assume a diversion rate of the same amount. If this material was diverted from a single landfill site, and if we assume an average landfill disposes of 480,000 tons per year, we can extrapolate an extension of landfill life of one year for every ten years of diversion. Note that in actuality, because raw material will be diverted from various counties who utilize local landfills, the impact in extending landfill life will not be experienced in a single community.

Another way to look at the diversion rate is by volume. It has been reported that the average cubic yard diverted by the operation weighs 2,295 pounds, or 1.14 tons per cubic yard. At a rate of 48,000 tons diverted annually, the project can conserve 42,105 cubic yards of landfill space each year.

Costs and Benefits

The following chart summarizes financial contributions and benefits per unit as of 5/1/04.

	FDEP	GRTF	Duval County	Totals
Costs				
Administration	\$	\$ 250,000	\$ 30,522	\$ 280,522
Facility Costs	125,000	1,798,399		1,923,399
Operations	96,625	**		96,625
Total	\$ 221,625	\$2,048,399	\$ 30,522	\$2,300,546
Population				741,508
Tonnage to date				3,331
\$ Per Capita	\$.30	\$ 2.76	\$.04	\$ 3.10
\$ Per Ton*	\$ 66.55	\$ 614.95	\$ 9.16	\$ 690.65

* This analysis is flawed since it is obvious that the majority of facility costs are long term and should be amortized over the life of the facility rather than the life of the grant.

** Operation expenses through 5/1/04 have been funded via the amortized rate of \$30/ton and are reflected as a DEP expense.

Assuming that the counties providing material would experience a tipping fee comparable to that of Duval County's, the tonnage diverted by this project from October 2003 through April 2004 has saved almost \$100,000. It is important to note that in some cases, GRTF is charging a disposal fee to cover costs unrelated to processing, such as segregating and disposing of non-recyclable material. We hope that the plant will become profitable to the point that at a minimum, no fee is charged, and at a maximum, companies will be paid for material provided to the plant.

We were unable to find any similar programs in which to compare our current and expected cost benefits

As shown in the table above, taxpayer cost per capita, including both FDEP and County expenses, totaled \$.34/ton processed, while including private funding increases the cost to \$3.10 per capita. In order to fully evaluate the financial impact of this process, the analysis must include the value added to the raw material through converting it to a usable product, i.e. what the price will be for finished material once the market is firmly established. Unfortunately, the value is an unknown at this time.

Note that because of the delays in start up, awarded funds were not depleted by the end of the grant. One component in the original application was the production of an educational video. However, a video was produced by Minpro in a similar plant located in Canada and has been used as an education tool on glass recycling, so the grant funds allocated for such a video were not needed. The video is available upon request.

Ongoing Issues

Challenges remain in securing adequate sources of recyclable glass to produce enough material to meet the needs of the end users. The operation relied on receiving mixed glass from the Duval County curbside program. However, because the County's contract with BFI gives the MRF total marketing responsibility, local government could only recommend, but not demand, that the glass be provided to GRTF. Another company in competition with GRTF had been receiving non-mixed glass in the past and convinced BFI to pay it a higher disposal fee for the glass than GRTF was charging. BFI felt its long-term relationship was important to maintain and was concerned about being named as a participating responsible party if GRTF ever closed the plant and left raw materials at the site.

However, BFI will no longer provide MRF services to Duval County after June 1, 2004, having sold its local operation. It is important that GRTF establish a relationship with the new MRF operator, Jefferson Smurfit, in order to receive local raw material. The company must continue to negotiate with surrounding counties for available material.

The plant owners continue to expand operations. With additional capital improvements planned for later this year, the plant should be processing 3,500-4,500 tons of waste glass when it reaches its full capacity.

