

MINPRO CRUSHED GLASS DEMONSTRATION PROJECT

(WDO OPT-R2-06)

Prepared by:

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EXECUTIVE SUMMARY

The Region of Peel proposed to process 1000 tonnes of stock piled mixed glass at the Caledon Sanitary Landfill Site (CSLS) by using the MinPro glass technology. The mixed glass was processed into two particle sizes, a half-inch (12.7 mm) and a quarter inch (6.35 mm).

Waste Management staff have been actively pursuing internal markets for the crushed glass product. Four areas were identified as possible applications that warrant further research. The Region of Peel is in the process of hiring a Consultant to continue the research in order to confirm these internal markets and provide recommendations of other promising markets for the crushed glass product. The four internal markets are as follows:

- Landfill Cover Material
- Additive to Cement Fabrication
- Golf Course Bunker Sand/Sand Putting Greens
- Road Base Application

1.0 INTRODUCTION

The Region of Peel collected approximately 4,000 tonnes of coloured and mixed glass in 2000, which represents one percent of the residential waste generated in Peel. Managing the mixed glass waste stream is a problem for many municipalities across Ontario due to the limited markets for this material.

2.0 METHODOLOGY

The test project was conducted over a two-month period. The MinPro demonstration unit began processing the mixed glass on July 25, 2001 at the Caledon Sanitary Landfill Site (CSLS). By September 21, 2001 the unit processed approximately 1,150 tonnes of mixed glass into two different particle sizes, a half-inch (12.7mm) and a quarter inch (6.35mm). The MinPro unit is still in operation and processing additional mixed glass at the CSLS.

The following two photos show the MinPro demonstration unit. The photo on the left is of the crusher feed conveyor, crusher, screen and output conveyor. The photo on the right is of the feed hopper and the crusher feed conveyor and generator.



The mixed glass was loaded directly into the five tonne hopper. The glass was conveyed to the grinder where it was ground into smaller component. The edges were continuously smoothed and worked over until the particles dropped out of the grinder. This preliminary grinding not only

crushed the glass but also permitted the removal of most non-glass debris such as corks, neck rings and plastic caps. Once out of the grinder the glass particles were conveyed down to a finer grinding blade where the glass particles were broken down further to meet the designated mesh sizes. The material was then transported up and dropped in to a third grinding blade for further processing. Following this grinding action, the glass material was screened to produce mesh size 2 and 4.

The photo of the left shows a large pile of feedstock (mixed, broken glass). The end product – a coarse, sand like material – is show on the right.



Currently, the processed glass material is stock piled at the CSLS. The glass material will be further examined by Consultants employed by the Region of Peel for application purposes. In addition, Engineers from the City of Toronto have also visited the CSLS and removed samples of glass for their own analysis. Results from the analysis will be shared upon completion.

3.0 ANALYSIS RESULTS

During the processing of the mixed glass an evaluation was performed on various aspects of the glass processing operation. The results of the evaluation will help determine if full implementation of this technology in the Region's Material Recovery Facility (MRF) will be feasible and cost effective in the future.

3.1 Quality and Quantity of Feedstock

The stock piled glass was left stationary at the landfill site for months prior to the processing began. The material was in contact with rain and snow and as a result affected the glass feedstock. The wet glass feedstock caused the crushed glass to clump together and cling to the screens during the processing period. The clinging of the glass to the screens contributed to many shutdowns of the MinPro unit so that the glass could be removed from the screens. An automated dryer unit along with storing the glass indoors is recommended to correct this drawback.

Over a two-month period the MinPro demonstration unit processed over 1,150 tonnes of mixed glass into two different particle sizes, a half-inch (12.7mm) and a quarter inch (6.35mm). The processing of mixed glass continues at the CSLS.

3.2 Material Flowrate

The average flowrate of processed glass was measured during the operation of the MinPro demonstration unit. The flowrate was approximately 10 tonnes per hour.

3.3 Percent Contamination

MinPro International Ltd. analyzed an average sample of the mixed glass for contamination. It was determined that 97.7 percent of the total sample material was mixed glass and the remaining 2.3 percent was a residue material. The residue includes plastics, corks, aluminum neck rings and labels. The MinPro unit functions effectively to separate the residue material from the glass material.

3.4 Operational costs

The operational cost related to the processing of mixed glass was established to be \$25.00 per hour. The flat rate was agreed upon by both parties for this particular pilot project. Other costs associated with this project included a flat monthly rate of \$2000 for a generator to power the unit and a loader operator at a cost of \$45.00 per hour to load the glass material into the hopper.

3.5 Potential Revenue

The potential revenue that could be generated from the sale of processed glass may vary according to a few variables, such as, the type of application for the processed glass, the cost of the material that the processed glass would replace and the transportation costs involved. As a result, an estimated price for the processed glass was suggested to be in the range of \$5 to \$15 per tonne for low-grade internal application. Again just to reiterate this is only an estimate and the potential revenue may change as soon as potential markets are identified and secured.

4.0 MARKET STUDY ANALYSIS

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- Road Base Application

5.0 MARKET STUDY RESULTS

5.1 Landfill Cover

Processed glass as a landfill cover material is considered as a low value application. The Region of Peel will only consider using the glass for this purpose if all other potential applications are proven to be unsuccessful. Presently, the Region of Peel operates two Sanitary Landfill Sites, one is located in Mississauga and the other is located in Caledon. Once all the waste material has been dumped and compacted, bulldozers cover the fresh layer of waste with cover material. The amount of cover material applied over fresh waste should be about 25% of the tipped refuse. On a daily basis, approximately 43 tonnes of waste along with 10.75 tonnes of cover material is used at the Caledon Sanitary Landfill Site (CSLS). Covering waste material is important in order to:

- prevent exposure to health hazards
- contain odours
- minimize the amount of surface water infiltrating the waste.

Most landfill designs require a cover material that exhibits a low hydraulic conductivity. As a result the crushed glass material which exhibits a modest hydraulic conductivity can be mixed with virgin dirt and soil to act as an efficient cover material. Landfills can apply this alternate cover material to save money that would otherwise be spent to purchase large quantities of dirt.

5.2 Additive to Cement Fabrication

The Region of Peel has approached a local cement producing company with a proposal to manufacture Portland cement blocks with processed glass as an additive or replacement for sand. Based on Ontario Provincial Standard Specification it states, “where the use of a manufactured sand is proposed and it is determined at the time the mix design is made, that a natural blending sand is required to produce a concrete of the specified properties and quality, then the Contractor shall provide a suitable natural blending sand”. The fine processed glass matches this specification of sand considering both natural sand and glass are rich in silica.

The cement company welcomes the opportunity to work with the Region of Peel to utilize and test the processed glass in cement production. The first part of the test will involve the

production of large interlocking cement blocks with the finely processed glass product. The concrete blocks will be analyzed for structural consistency and durability. Following the structural analysis, the large blocks will be transported to the Region's Material Recovery Facility (MRF). The blocks will be assembled at the MRF to form a partial enclosure for recyclable material awaiting processing. If the application proves successful, the Region may also consider using processed glass as a sand additive or replacement in concrete pavement for a Regional facility. The Region of Peel is in the process of constructing a Community Recycling Centre (CRC) in Brampton. The Contractor responsible for the construction of the CRC may be approached by Waste Management staff to include the fine processed glass material in the concrete application. The facility will be equipped with approximately 1800 m² (19,375 ft²) of concrete paved areas.

5.3 Golf Course Bunker Sand/Sand Putting Greens

The Britannia Hills Golf Course is owned by the Region of Peel and operated by the City of Mississauga. The construction of the Britannia Hills Golf Course on the Britannia Sanitary Landfill Site (BSLS) was completed and opened in July of 1999. The existing interim executive golf course was designed to be compatible with a future long-term design for Britannia Hills. The long-term design includes a combined Championship 18-hole (par 71) Golf Course, Executive 9 Hole (par 30) Course, Driving Range and a new clubhouse to be located at the existing landfill site office.

The use of crushed glass as an alternative to the Ohio white sand, which is currently being used to form the bunkers at the Britannia Hills Golf Course may be an option for the second phase of the Golf Course. The Consultant employed by the Region of Peel will examine the physical properties of the crushed glass and compare it with the standard bunker sand in terms of particle size, colour, infiltration rate and overall playing quality, etc. If the results of the analysis prove favourable, the glass material will be used to create new bunkers or for replenishing purposes at the Britannia Hills Golf Course. According to the City of Toronto's Glass Market Development Study (WDO OPT-R2-10) final report, bunker sand depending on certain factors is replenished once every 5 to 10 years. Once this market has been secured, Waste Management staff will approach other public and private golf courses in the Greater Toronto Area (GTA).

Crushed glass product exhibits another potential use within the confines of the golf course. A representative from MinPro International Ltd. has mentioned that the crushed glass material may be a useful component in the construction and maintenance of the sand putting greens. Part of the green construction requires a sand material to permit proper drainage and ideal contours and slopes. The Glass material like most sand material must be analyzed to determine particle size distribution. The United States Department of Agriculture (USDA) sieve sizes provides a standard for comparative purposes. Generally, putting green sand should have 90 to 100 percent of its particles between 0.1 and 1.0 mm. In addition to particle size distribution the infiltration rate of compacted sand must also be determined. On average, an adequate laboratory infiltration rate is approximately greater than 50 centimeters per hour.

5.4 Asphalt Base Application

The biggest application of processed glass material will be as a base aggregate for over-lying asphalt material. As already mentioned, the Region of Peel is in the process of constructing a Community Recycling Centre (CRC) in the City of Brampton. Along with concrete pavement this facility will have approximately 15,500 m² (166,841 ft²) of asphalt paved areas for parking lots, driveways and public drop-off ramps for the disposal of recyclable and non-recyclable materials. The Contractor responsible for the construction of the facility has been approached by Waste Management staff to incorporate the processed glass as a coarse aggregate replacement. The glass material will be graded accordingly and provide a base for the overlying hot mixed asphalt pavement. Both the glass material and the hot mixed asphalt will meet the particle size as outlined in the Ontario Provincial Standard Specification.

6.0 TRANSFERABILITY TO OTHER REGIONS/MUNICIPALITIES IN ONTARIO

Once markets have been established and secured for the processed glass, other municipalities may be more inclined to adopt this technology. In addition, some municipalities may choose to form partnerships and share the technology to save costs. Broader implementation would therefore make a meaningful contribution to the 50% diversion goal in Ontario.