Seguin Township
Compacting Bin Automation and Energy Savings
CIF Project Number 891

Final Report
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Prepared for:
Waste Diversion Ontario
Continuous Improvement Fund Office
Barrie, Ontario

Acknowledgement

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Executive Summary

Seguin Township and the Continuous Improvement Fund (CIF) previously invested in the installation of 8 compacting recycling bins at the 4 main transfer sites in the township under CIF project 832. The impact of this investment is lower program costs, the result of increasing the amount of recyclables hauled each trip to the contracted Material Recovery Facility (MRF) in Bracebridge, Ontario. Once operational, it became apparent that automation of the compaction cycles would further reduce program costs. The CIF provided financial support under project 891 for the automation of the Township's compacting bins.

The automation project installation of:

- optic beam hopper level indicators in the charge hoppers
- supporting hardware for the optic beam systems
- audio and visual warning systems for residents
- insulation to the hydraulic systems

Metro Compactor was retained to refine the initial designs of the system and complete the installation. The design of the system took approximately 4 weeks and the actual installation was completed over a 2 day period at all 4 sites in the fall of 2015. Staff had worked out all the technical aspects of the new system by the January 1, 2016. The costs to implement this project were approximately $15,500 which was slightly under the anticipated $16,000 total project costs.

The project was initially scoped to target the areas of electricity and staffing for cost savings. Electrical use was to be timed for off-peak hours to reduce rate charges as indicated by Hydro One billings. The automation of the compaction process would reduce staff time on site. Staffing hours were monitored using a specifically assigned labour code for recycling used to track hours spent working with the compacting bins. Initial cost savings were estimated at $6,300 per year.

Estimates from 10 months of data following installation of the automated system and work optimizing other aspects of our compacting bin setup result in labour savings of $10,560 and electrical savings of $8,100 annually. The Township entered into a fixed rate electrical agreement which has negated any off-peak savings that were anticipated. However, the efficiencies noted above, in addition to working with Hydro to meet the specific needs of our sites, have resulted in the average billings per month declining approximately $170 or 50% per site. The total cost savings of this project work and the continued optimization of the compacting bins is estimated at $18,660 per year.

The Township has been working with Hydro One to sort out the electrical use data received in our monthly billings. While there are still some issues to be worked out, it is clear that we are achieving much greater efficiencies in power use.

This project was completed on time and below budget. The anticipated payback on this investment is estimated at less than 1 year.

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1 Introduction

1.1 The Project

The compacting bins installed under CIF 832 were operational July 1, 2015. It became immediately obvious that changes to the timing of bin cycling would reduce energy and staffing costs. Although the hoppers were very large, and provided a large buffer capacity, operators were always required to go to the site and start compaction. The automation of the compacting bins would allow staff to remotely monitor and cycle the bins. The Township received funding to automate the compactors under CIF 891.

The automation project involved installing an optic beam hopper level indicator in the charge hopper. Once the level of recycled materials reaches the height of the electric eye and breaks the beam, the compactor ram cycles. After the cycle completes, the ram will continue to compact until the beam is not broken, ie) the hopper is empty. As part of the automation, an audio alarm and a flashing light were installed to advise people that the machine will be compacting. Additionally, the timer was to be used to compact during off peak hours to ensure hoppers are empty before residents start using system, and to operate them during the most cost effective electrical rate times.

The initial project scope had also included costs install insulated boxes to house the hydraulic tanks to preserve energy. Staff determined this to be an impractical addition to the compacting system.

The Township worked with the compacting bin supplier Metro Compactors to design and install the photo sensors used to automate the system.

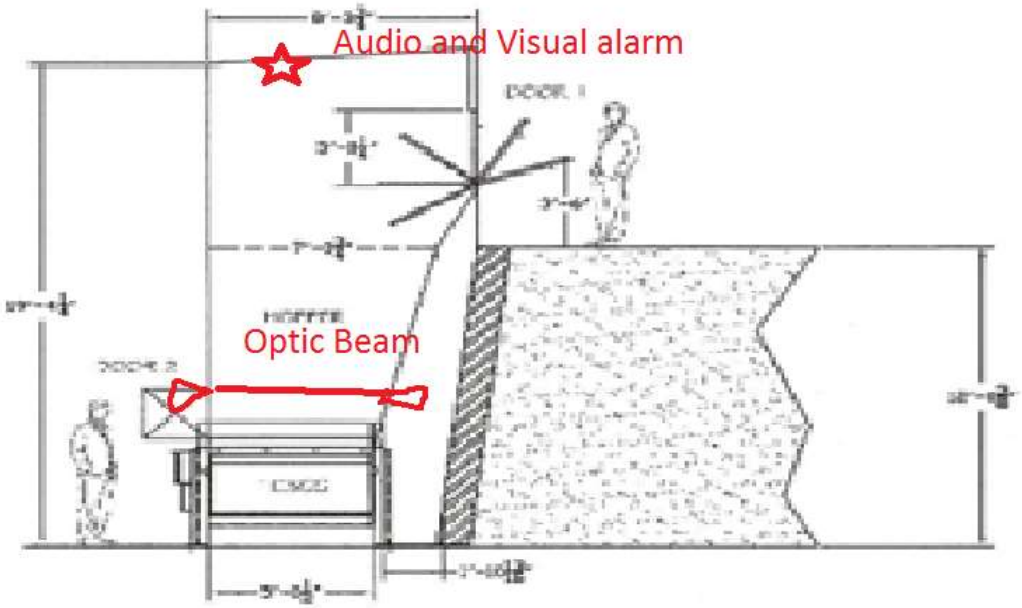

Figure 1: Schematic of project installations

1.2 Project Goals and Objectives

The primary goal of this project was to further improve program performance. Staff targeted the areas of electrical costs and staff time for reduction. The expectation that automation and remote monitoring of the bins would reduce the amount of staffing resources needed for managing the system and allow for more control over when the bins were cycled.

The objectives of this project were to reduce electrical costs 30% or $3,800 and staffing costs of 15 minutes per day or $2,500 annually. The total cost savings were estimated at $6,300 per year.

2 Background

2.1 Community Profile

Seguin Township is a rural municipality located just south and east of the Town of Parry Sound in the Parry Sound district. The Township covers 750 square kilometers and services 4700 permanent residents, and between 15 - 20,000 or more seasonal residents in the summer months. With largely an environmental focus, our community is truly the "*Natural Place to be*".

Seguin was formed in 1998 through the amalgamation of the following Municipalities: Christie, Foley, Humphrey and the Village of Rosseau.

Located approximately 225 kilometres north of Toronto ON, the Township encapsulates the lakes and beautiful outdoor scenery cottage country is renowned for.

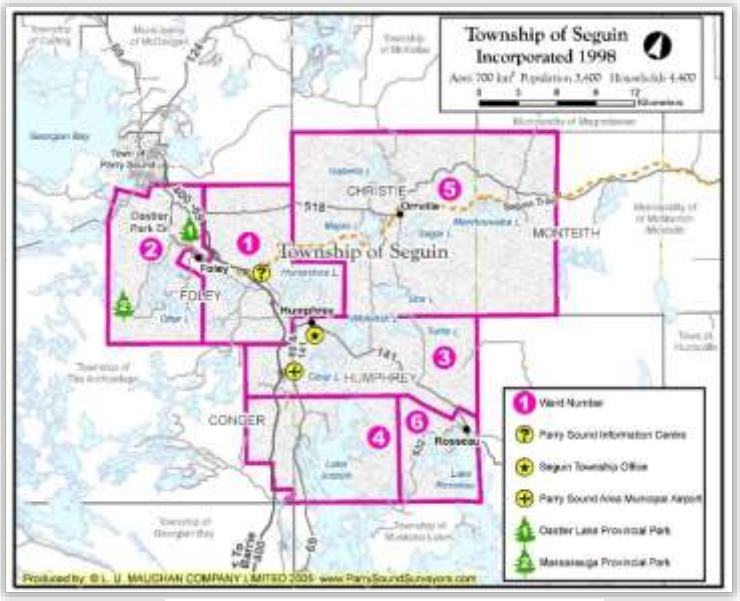

Figure 2: Map of Seguin Township

2.2 Waste Management System

The Township operates 7 unstaffed depot drop off waste transfer stations and 1 landfill site which accept garbage and recyclable materials. 4 of the larger sites have been outfitted with compacting bins.

The Township provides residents with two-stream recycling, which target the following materials:

Containers – Plastic bottles numbers 1-7, glass bottles and jars, aluminum, tin and steel cans, and aluminum foil

Fibers – Newspaper, mixed paper, boxboard and old corrugated cardboard

There is no revenue sharing agreement in place between the Township and Progressive Waste Solutions who transport and process our recycling in Bracebridge ON.

The Township also provides for collection of household hazardous waste (HHSW) through a partnership with the Town of Parry Sound and their landfill operations.

2.3 Current Waste Management Performance

In 2015 the Township collected approximately 564 tonnes of Blue Box recycling which was hauled to the processing MRF in Bracebridge Ontario. One third of which were mixed containers and the remainder mixed fibre products. The annual net costs of the Blue Box program are approximately $290,000.

2.4 Program Challenges

The Township provides Blue Box services over a wide geographic area and are challenged by the distances required to transport this material to the MRF processor. Further, the remote nature of our transfer sites requires significant resources in sending staff out regularly to monitor and maintain these locations. The installation of the compacting bins helped in this regard as there was less involvement by staff in maintaining loose litter and coordinating with the hauling contractor to pick up bins (as there were fewer bins to pick up). The automation and remote monitoring of the compacting bins is the next logical step in continuous improvement of our program.

3 Approach

Township Staff recognized the opportunity in automating the bins and drafted an initial design for the automated system. Metro Compactor was then contacted to refine the proposed modifications to the system and cost the project.

The installations began following Thanksgiving weekend when the weather and conditions in the Township were still good. The installations were completed over a period of 2 days during the fall of 2015 and the automated systems were operational as of January 1, 2016.

3.1 Installations Completed

3.1.1 Optical Beam, Alarm System, and the Telemetric System

The installations on all four sites were completed over a two day period and encountered no difficulties. The technical staff at Metro Compactor were excellent throughout the design and installation of this project. Their staff were able to identify a suitable location to install the optical beam system in the hopper. The height the optical beam was placed at has proved to be appropriate and effective.

Staff have also worked closely with Pragmatech, the company that provides telemetric data through the Pandora system for each of the compactors. Once we had dialed the automation to cycle based on whether the optic beam was broken or not, this provided a clear indication that whenever the ram stroked, it had a full charge. Therefore, Pragmatech could actually count the number of strokes and get a good handle on how full the bin would be with a certain number of strokes. We also calibrated the individual hydraulic pressure sensors in the automation to the manual gages we had installed. We now know that if Pandora reads 1500-1700 PSI, it's time to pick up.

This helps our operation staff maximize the tonnage sent in each load, thereby saving money. In addition to saving money by only shipping full loads to the MRF, we are monitoring the sites remotely saving staffing and equipment costs by not having to travel out to site.

We also had to figure out what a reasonable amount of time for an alarm to come on if there was a blocked sensor. Staff tried a variety of different timer lengths until settling on 10 minutes for the alarm or 5 ram cycles.

Figure 3: Optical Beam Sensor Installation

3.1.2 Insulating the Hydraulic Tanks

Insulating the tanks was reviewed during our operations. In the winter, insulating the tank will help save on some electricity used to heat the oil, but in the summer, the unit cycles frequently and under high pressure, which generates heat. Permanent insulation will prevent oil from cooling in the summer time.

We actually had an insulated box built by the local high school shop class and tried it out, but it became an ideal location for a swarm of wasps to nest in. In the end, staff decided to leave the tanks as they were for ease of maintenance and safety concerns.

Ideally, the tanks would be insulated before they are installed, at the factory or have a fabric blanket made for it. If insulation is anticipated, we recommend the insulation be designed into the fabrication, to make it easy to install and remove as needed seasonally.

Figure 4: Visual Alarm Compaction Indicator

3.2 Monitoring and Measurement Methodology

The Township monitored monthly Hydro One billings and internal labour costs.

3.2.1 Labour Costs

The Township has a labour code for recycling which was assigned for when operators had to push the button or deal directly with the compactors. Staff monitored the costs of labour using this labour code and compared it to the full year costs of 2015 prior to automation and the full year costs of 2014 prior to the installation of the compacting units.

Initial labour cost savings were estimated at 15 minutes per day of a 6 day work week at $32 / hour = $2,496 / year.

3.2.2 Hydro One Billings

The Township is provided with monthly billings from Hydro One. The billings provide two important metrics for monitoring: electricity use rates (kWh) and cost ($).

Our baseline for this project is an estimated annual cost of $16,700.

3.2.3 Monitoring Challenges, Limitations and Solutions

The Township has encountered inconsistencies in the information received from Hydro. We continue to work with Hydro One to sort out issues surrounding measuring the actual amount of use.

4 Project Results and Analysis

4.1 Project Results

The results of this project look to compare the costs of electricity use as indicated by Hydro One Billings and labour costs tracked internally.

4.1.1 Labour Costs

The Township tracks the time spent by staff on site managing the compaction units using a specified labour code for recycling. The labour costs for completing this activity are presented below in Table 1. The labour costs for 2014 were for managing the previous system's un-compacted 40 yard bins. Full year labour hours and costs have been used for the years 2014 and 2015, whereas the 2016 year is represented by 10 months of data available (January 1 to October 31, 2016) and forecasted to arrive at an estimated annual number of labour hours and costs.

Table 1: Annual and forecasted compactor operation labour costs

Cost item	Rate	Hours	Months	Actual / est. Hours	Total
2014 labour costs	$32.00 /hr.	948	12 mo.	948 hr.	$ 30,336.00
2015 labour costs	$32.00 /hr.	480 hr.	12 mo.	480 hr.	$ 15,360.00
2016 labour costs*	$32.00 /hr.	125 hr.	10 mo.	150 hr.	$ 4,800.00
Annual estimated labour savings					**$ 10,560.00**

*Note: 10 months of data for 2016 have been used to forecast the full year costs

The annual estimated labour savings achieved by automating the compacting bin system has been estimated at approximately $10,560.

4.1.2 Hydro One Billings

Total monthly billings have gone down more than 50%, due to efficiencies in the ram cycling and work with Hydro on meeting the specifications of our sites. The estimated total electrical cost savings amount to $8,171.

Tables 2 and 3 on the following page detail the change in hydro use and hydro costs between the year 2015 prior to automation and the year 2016 with automation.

Table 2: Hydro use at compacting bin sites (kilowatts)

2016	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg Use (kWH)
HUMPHREY	34	31	34	31	30	35	31	32	31	32	9	-	33
CHIRISTE	63	23	31	42	19	22	26	21	20	21		-	53
FOLEY / BROOKS	1,765	1,295	1,141	810	636	270	1,746	574	489	501	546	-	1,253
TURTLE A	28	33	32	36	36	22	19	24	21	24	22	-	32
2015													
HUMPHREY	1,930	2,530	2,480	2,760	2,230	1,860	2,390	2,400	2,550	2,840	2,800	2,980	2,479
CHIRISTE	829	1,750	1,964	1,965	3,936	3,029	562	1,459	1,467	1,663	1,629	423	1,723
FOLEY / BROOKS	568	1,664	2,572	2,540	1,698	982	204	179	165	203	226	2,887	1,157
TURTLE A	290	1,190	1,240	1,330	1,130	620	330	290	290	290	300	320	635

Table 3: Electrical costs at compacting bin sites

2016	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg Cost	Est Annual Cost
HUMPHREY	$101	$99	$107	$101	$99	$111	$92	$94	$106	$103	$55	-	$102	$1,165
CHIRISTE	$305	$0	$380	$257	$134	$143	$168	$127	$128	$121	-	-	$314	$2,116
FOLEY / BROOKS	$339	$311	$316	$220	$202	$85	$484	$183	$147	$143	$159	-	$297	$2,825
TURTLE A	$127	$110	$108	$121	$137	$87	$84	$88	$83	$86	$85	-	$116	$1,217
														$7,323
2015														**Actual**
HUMPHREY	$377	$484	$473	$523	$429	$379	$504	$506	$536	$594	$586	$631	$502	$6,021
CHIRISTE	$228	$645	$376	$377	$713	$165	$418	$337	$341	$384	$372	$117	$373	$4,471
FOLEY / BROOKS	$156	$334	$460	$507	$279	$208	$78	$73	$70	$77	$82	$876	$267	$3,200
TURTLE A	$98	$240	$253	$264	$212	$156	$104	$96	$96	$95	$93	$95	$150	$1,802
														$15,494
Estimated annual cost savings														**$8,171**

4.2 Analysis of Results

4.2.1 Labour Savings

Staff are still required to travel out to and complete some work at each depot transfer site daily. However, by tracking the actual amount of activity (hours) spent on site using our labour code we are able to identify savings of approximately $10,560 annually. This is nearly a 70% reduction in the amount of staffing resources the Township needs to dedicate to recycling activities at our sites and will provide consistent savings year after year.

Further, if we compare to the un-compacted 40 yard bin set up we had prior to the compacting bin system, the amount of labour required at our sites has been reduced nearly 85%. Likely we are nearing optimal use of our staffing resources considering staff still need to be on site daily to ensure cleanliness of the location and safety for residents.

4.2.2 Electrical Use and Costs

The data presented in Table 2 and 3 above has been pulled from past Hydro One invoices. The Township has been working with Hydro One to ensure the electrical use for each site is representative.

Brooks is a single phase site with only enough power to run one compactor at a time. This site appears to require a far greater amount of electricity than the other sites and is also the most costly to operate. The site has 2 compactors, 3 Transtors and 2 streetlights. The Transtors uses very little power and are powered by a wet line on the compacting trailer. Hydro has been asked to look into the high power consumption at this site. Christie is also a single phase site with one streetlight and 3 Transtors in addition to the compacting bins and has the second highest electrical costs.

Turtle and Humphrey were installed with 3 phase power. Humphrey has 2 compacting bins, one streetlight and no Transtor, so this power is the cleanest data we have for compactor power consumption. The Turtle site has 2 compactors, 4 Transtors, and one streetlight.

The comparison of the sites noted above identifies a difference of approximately $1,000 in annual costs to operating similar compaction systems on 3 phase vs single phase power sources.

The compacting process was dramatically improved. The cost savings for these sites presented in Tables 2 and 3 above are representative of this improvement and our work with Hydro in sorting out actual usage which has been an ongoing process. Total year over year electrical cost savings have amounted to approximately $8,100.

4.3 Lessons Learned

The electronic eye system does get jammed up. When this happens, Pragmatech sends us an email that the eye is blocked. This only happens if the ram has cycled for 5 times and the eye still indicates that material is at height in the hopper. This is usually caused by a large piece of cardboard or box that is not falling into the ram chamber. Or a piece of wet paper stuck over the optic sensor. When we receive this message, an operator goes out and cleans it up. This is the main reason for the remaining labour costs as shown in 2016. It really does work well.

Developing the correlation between the hydraulic pressure data received and actual bin weights or compaction of material takes a little work, because every mechanical system is not identical. Like with anything, it gives you a good starting point, but you can dial it in to get better numbers with each specific site. We now know that if Pandora reads 1500-1700 PSI, it's time to pick up.

In the original grant submission, timers were to be installed in the oil heater controls to turn on power only during the low cost off peak hours and to insulate the oil tanks. The timers worked as planned, however the Township of Seguin entered into a LAS electrical contact agreement, which sets a fixed cost for electricity, regardless of when used.

5 Project Budget

The budget for this project submitted with the funding application was estimated at $16,000. Total actual project costs were under budget and amounted to $15,515.

The budget included the purchase of 8 of the following units for the Township's compacting bin setups: electric 'eyes', tower alarm lights, electronic transmitters, programmed controllers, motor contactors for telemetrics, and other miscellaneous shop supplies, cables, and equipment.

6 Conclusions

The automation of the compacting bins at the 4 transfer sites in the Township has been a major success, with a payback on total project costs of less than 2 years. Staffing resources and electricity to run the compactors are significant costs to the Township in providing Blue Box service over such a large geographical area.

Automatically cycling the compactors once materials reach height in the hopper has effectively reduced the staffing resources spent managing the compacting bins 60%. Also, the efficiencies we've achieved in cycling times and energy use have been tremendous.

Staff have also worked closely with Pragmatech, the company that provides telemetric data from each of the compactors. After time spent validating data collected with actual weights from our recycler, staff have developed a strong correlation of telemetric data with real weights. Now, emails from Pragmatech indicating that our bin is full and ready for pickup is accurate. This helps our operation staff maximize the tonnage sent in each load, thereby saving money.

Timers used to cycle the compactors during off-peak hours will work very well in townships that do not have a blanket contract for electricity, and are on time of use rates.

The part of this project geared towards insulating the hydraulic components of the compacting bins was not a success. We recommend that other municipalities look into having these components pre-insulated before installation at site.