Alternative Collection Technologies: for Advanced Resource Recovery

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EXECUTIVE SUMMARY

SULO MGB Australia, a leading supplier of innovative waste containment solutions for the past 23 years, has sought to conduct a research project into the Alternative Collection Technologies (ACTs) currently available within Australia and around the world. The focus was to identify the current methods and possible improvements of resource recovery within public places and medium to high density (MHD) residential areas throughout Australia. Further to this, we also investigated the changing needs of market participants that have developed over the years.

Mobile Waste Containers or MGBs as they are commonly referred were found to be the most popular collection containers used for resource recovery within both the domestic and commercial sectors. They have proven to be extremely successful for domestic single dwelling residential collections however they do not always provide the best method of collection for public places and MHD residential collection, in particular multi-unit dwellings (MUDs), due mostly to the varying needs of public place and MHD residential developments. Other industry reports have also highlighted resource recovery within MUDs as problematic. They do suggest, however, that the provision of adequate facilities with several key features can improve the recovery of these resources.

There are numerous ACTs in operation throughout the world with the most common being the Underground or Deep Collection systems, which utilize hidden capacity beneath the surface. Such systems enable greater cost efficiencies whilst reducing OH&S related issues, in particular manual handling. Underground systems vary greatly between manufacturer with the overall design being either ‘mini’, ‘semi’ or ‘fully’ underground. All of these options appear to have a place in the Australian market and have the ability to provide an abundance of benefits that meet the needs of market participants.

Another technology is the waste chute system that is more specifically designed for high-rise residential buildings. There is a variety of designs from the simplistic gravity assisted waste chute where the resources are gathered in large four wheeled MGBs in the basement to the technologically advanced waste chute utilising underground tanks to collect the resources, which are then suctioned through an underground network of pipes to a collection vehicle and in some cases a localised transfer station.

Other less common ACTs that were researched include adaptations to the commercial compaction units and street litter bins that have been adapted to allow for an automatic truck collection. The street litter bin incorporates a gravity lid lock that enables it to be used in much the same manner as the majority of MGBs currently lining public streets in Australia. The emptying process, however, for these litter bins can now be completely automated.

Of all the ACT's and current systems researched, waste systems that are automated and largely underground appear to result in a cleaner more aesthetic residential environment with fewer refuse vehicles and an improved work environment for waste handling personnel. They are also able to deliver real economic benefits to all market participants. The current issues of resource recovery surrounding public place and MHD collection demand attention and these innovative solutions will require a re-think to the current collection methods in place.

INTRODUCTION

SULO MGB Australia has been active within the waste industry for more than 20 years manufacturing, supplying and recycling a variety of waste collection containers commonly known as Mobile Garbage Bins (MGBs). When introduced to the Australian market place during the early 1980's a significant change to the then manual practices of waste removal accompanied the new technology. Since this time advances have been made in both the collection equipment and vehicles used to collect and transport recovered resources.

MGBs are now widely used for resource recovery by both the domestic and commercial sectors. MGBs, however, do not always provide the best solution for public place recycling. This is due to a number of factors including: placement; space; aesthetical appearance; manual handling requirements; limited capacities; littering and over filling; and required collection frequency.

As such the focus of this research paper is on the current collection technologies used within Australia for public place collection of resources, including MHD residential collection.

Further, the NSW Department of Environment and Conservation (DEC) recently commenced a review of the Better Practice Guide for Waste Management in Multi-Unit Dwellings. The first stage of this review found that recycling systems utilized in high-density residential dwellings were less effective than those utilized in single detached dwellings (GHD 2006). This was due in part to:

- Vehicular and pedal traffic disruptions as a result of the frequent stopping and slow movement of collection trucks;
- Pedestrians being forced onto the road by large numbers of MGBs on the footpath;
- Impaired visibility due to a large number of MGBs on the roadside, creating a 'wall';
- Limited access to some collection points through poor design; and
- Overfilling and misuse of residential MGBs by commercial users, often as a result of the two services being closely located.

Turning to other aspects, recent Occupational Health and Safety (OH&S) authorities deemed the practices of operators within the industry to require room for improvement, in particular street and litter bin collection. More specifically WorkSafe Victoria has mandated a 'No Manual Lift' policy and it is understood that other state authorities may soon follow. Other than the current MGB system there is a limited range of collection containment systems that fulfil the customers and operators' requirements whilst maintaining the new standard of safety practice. This research will therefore also look into the changing needs of market participants and the alternative collection technologies available on an international scale that could fulfil these needs.

AUSTRALIA: WHAT TECHNOLOGIES ARE WE USING?

Research into the current systems used for resource recovery within Australian has shown that the most common collection container is the MGB (GHD 2006). This includes two wheeled and four wheeled MGBs, both of which are collected by a vehicle utilizing an automatic lifting arm.

The benefits of using MGBs as a collection container include: their relatively low fleet cost; minimal maintenance requirements; ease of manoeuvrability; compatibility with collection vehicles currently in use; and they are easily recognized by the user as a resource receptacle.

MGBs have proven to be extremely successful in the domestic sector for the collection of residential resources. They have assisted in eliminating the manual handling processes in the majority of areas around Australia and in turn reduced the number of OH&S related issues. WorkSafe Victoria mandated a ‘No Manual Lift’ policy which required that all domestic collection services not utilizing an automatic lifting system must convert within the given time period. This is not an uncommon trend, for instance OH&S regulations in Denmark also prohibit the manual handling of any bins (GHD 2006). New residential developments are specifically designed with a large number of ramps and electrical lifts to prevent manual handling of containers. Furthermore Yongin City, a suburb of Seoul in South Korea, made it mandatory to also install an automated vacuum resource collection system into all new residential apartments (Osaka 2001).

However, the value of MGBs as collection containers for resources in public places and high density residential areas is beginning to come into question. In particular in their review of the Better Practice Guide for Waste Management in Multi-Unit Dwellings, GHD consultants for DEC sited numerous arguments against the use of MGBs. These not only related to the fit of the container but also to the OH&S issues that arise when using larger numbers of MGBs (GHD 2006). One of the key differences between using MGBs for domestic versus public place resource recovery lies in the collection process. Single detached residential collection is operated on an individual basis where the MGBs are picked up one at a time, with distances between each pick-up. Public places and MHD residential areas on the other hand generally entail large numbers of MGBs being picked up at a single collection point. Often this increases the manual handling requirements, for instance MGBs are not necessarily stored at the collection point and are required to be manually moved. Further to this the shear number of MGBs often creates a traffic hazard for other road users and pedestrians, not to mention the aesthetical impact on the streetscape.

GHD (2006) concluded that resource recovery in MUDs continues to be problematic, with the rate of recycling contamination being higher than single detached residential developments. The literature review highlighted the importance of providing adequate access, storage space, and improved amenities to residents. By providing such facilities developers can increase the opportunities for resource recovery.

ALTERNATIVE COLLECTION TECHNOLOGIES: WHAT’S OUT THERE?

There are numerous ACTs available throughout the world. The majority of which have a distinct movement towards larger volume containers with lower collection frequencies and automated emptying thus achieving greater cost efficiencies whilst reducing OH&S related issues. The appearance of the surrounding environment and streetscape is also a common element considered in the development of these new technologies.

The most widely accepted ACTs uncovered by this research were the Underground systems, which utilize hidden capacity beneath the surface. The Underground or Deep Collection systems come in a variety of structures including ‘fully’ underground, ‘semi’ underground and ‘mini’ underground. They were found in a range of countries however were predominately in European settings and positioned in areas such as MUDs, parks and gardens, shore fronts and sporting venues.

Other ACTs uncovered include waste chutes, compactors and litter bins suitable for automated lifting.

Underground Systems

The most common feature of an underground collection system is the effective use of ‘hidden’ capacity, where large collection containers are hidden below ground level (SULO). The general user does not see the container but simply a small portion of the container or a small litter bin above ground (Villiger 2001). The key benefits that this type of system provides include:

- Reduced collection and maintenance costs through low emptying frequencies and single operator management
- Self compaction of resources through natural gravity forces achieving greater volume efficiencies
- Reduced manual handling through automatic emptying at site location
- Improved cleanliness of collection sites through reduced litter
- Aesthetical appearance and integration into the streetscape
- Utilization of cooler underground temperatures to slow the degradation process and reduced odour
- Containers easily customised to suit a variety of resource streams

Underground systems were found to be the most common and widely accepted ACT. There is however a large number of variations on the design between manufacturers. Some of the main differences in the design depend on whether the system is a: ‘mini’ underground; ‘semi’ underground; or ‘fully’ underground system.

The mini underground system (H&G) uses smaller collection containers permanently located underground that are empted using collection vehicles equipped with suction. The drop off point, or above ground collection container, can be designed to suit the local environment. These systems require minimal space and ensure a single person operation that is free of manual handling.

Semi underground or deep collection systems (Molok) use a larger frame that is installed in the ground ensuring that only around one third of the overall container is visible above ground. This section forms the drop off point for users. Different manufactures use different containment methods. Inside the frame it was discovered that two forms of containment can be used; the first using a lax (flaccid or sloppy) collection bag and the other using a rigid collection container. Both options perform similar functions however the bag options generally requires more manual handling to accomplish the emptying process. The semi underground system requires a larger placement area simply because the above ground and the underground component are one in the same (H&G).

Fully underground systems (SULO) use a separate solid underground collection container that is completely hidden from view, except during the emptying process. A smaller drop off container, generally the size of a street litter bin, is positioned above the underground container. By utilizing two separate components the fully underground system can be installed into areas with minimal above ground space (WTS). This type of underground system also allows for numerous customizations to suit local requirements and is equipped with a significant number of safety features. Fully underground systems also allow for a one person automatic emptying process.

All of these systems could have a place in the Australian market. The current barriers to the introduction of such a system surround the modifications to existing collection vehicles required to enable the emptying of containers.

Automated Collection Systems for Residential and Commercial Developments

With automated collection systems resources are collected through a network of pipes to a central location. Such systems are an advancement on the traditional waste chute.

Traditional waste chutes are specifically designed for high-rise residential buildings, in particular apartments and multi storey buildings, however recently have been trialled in commercial settings such as hospitals. They come in a variety of designs from standard gravity assisted collection to advanced vacuum collection. The main feature of any waste chute is that the user deposits the resources at various drop-off points throughout the building where it is then directed to a communal collection point ready for pick-up.

The simplest design will utilize four wheeled MGBs to collect the resources at the end of the chute. These systems also allow for some separation of the streams but can be labour intensive. The more advanced systems, however, are able to completely eliminate manual handling issues by gathering the resources in tanks that are located under the building (Shinmaywa). Collection of these resources then occurs at a docking station where a collection vehicle sucks the resources out of the tanks and into the vehicle via a system of pipes. This can be done from one central location and eliminates the need to give the vehicle access to the property. Compaction vehicles are often utilized in conjunction with such systems to further increase in the overall collection volume.

An adaptation to the standard waste chute is a system called pneumatic waste collection (PneuLogix). This type of system operates in a very similar manner, however instead of the resources being stored under the building and then suctioned out into a collection vehicle they are sucked to a centrally located waste transfer station. To achieve this, an underground network of pipes is required, reaching distances of up to 1.5kms. Resources can be collected from a variety of drop-off points throughout a single building or even a residential development area, including restaurants and shopping complexes (Envac 2003). The deposited resources are temporarily held in underground containers and are then automatically transferred through the underground pipe network at high speeds to a central collection point. Air control valves located throughout the system manage the air flow and suction process. Once at the central collection point the resources can then be compacted ready for a remote vehicle pick up. Such a system can be completely monitored and electronically controlled from a remote location in real time. Systems that are in place throughout Europe allow residents to dispose of their resources at any time, day or night. This inturn assists in maintaining tidy streets within the local area and also eliminates the noise from collection vehicles.

Automated collection systems minimize worker labour, assure convenience to the user and improve the aesthetic scenery and hygiene of an area. The simple equipment ensures maintenance and control costs are also kept to a minimum. Given that simple waste chutes are already a requirement in high rise apartments throughout Australia, the introduction of more advanced technology that can further reduce or even eliminate manual handling requirements would be a significant step, even though infrastructure is required to implement.

Reverse Vending Machines

A reverse vending machine (RVM) is designed to accept used and empty beverage containers and provide a refund in the form of a receipt or cash. RVMs were primarily created for areas that incorporate container deposit legislations (High Technology). Using two dimensional and three dimensional image processing these machines have the ability to correctly identify an empty container and issue the appropriate refund.

Countries such as Finland introduced RVMs during 2000 to great success. Some of the benefits of these machines include their compact size, ease of use, variety of containers collected, large built in storage, easy emptying and maintenance and their relatively low cost. One of the major benefits, however, is the efficiency of some of these machines, with the ability to process up to forty-two containers per minute. Further to this machines can be modified to flatten or shred plastic bottles and crush cans reducing the overall volume by up to 95%. Containers can also be colour sorted and stored in separate collection areas for emptying. In addition to all of this, machines can also be fitted with an internal modem allowing online connectivity that can provide recycling reports back to systems administrators.

RVMs are ideal for schools and universities, shopping centres and Council buildings; however their success appears to be highly dependent upon the area of implementation. For instance areas that provide a refund for the return of recyclable containers will achieve greater collection volumes. These machines can now be found in some of the world's largest retail outlets such as Wal-Mart and Tesco with a single unit expected to handle more than a million containers per year (Tomra).

Compactor

The technology advances in the development of the common compaction unit have lead to dramatic reductions in size. Self sufficient compactors, operating off solar power, can now be found on the street for use by the general public. These allow for large volumes of resources to be collected and compacted into easy to handle products. Further to this some compactors can also be fitted with transmitting devices that alert the collection company when the container is ready for collection. Standard compactors are often used in conjunction with other systems to further increase collection efficiencies, for instance incorporated within the collection vehicle.

Automated Litter Collection
One particular company has simply automated the collection process for the standard street litter bin (Toter). This is achieved by manufacturing the litter bin in such a way that it can be automatically lifted by a collection vehicle in the same manner as an MGB. The litter bin however requires a much smaller placement area and is a stand alone unit that does not require a bin stand. To ensure the litter bin remains closed, preventing unauthorised opening, a gravity release lid lock is also fitted to the litter bin. Once the bin is inverted the gravity lock automatically releases and the bin can be emptied into the collection vehicle. The ability to collect street litter bins where they stand with an automated arm reduces the potential for workers injuries and increases the productivity (Toter). Both of which allow for a more efficient emptying process that in turn reduces the disruption to day-to-day traffic.

CONCLUSION

Waste systems which are automated and largely underground appear to result in a cleaner more aesthetic residential environment with fewer refuse vehicles and an improved work environment for waste handling personnel. They also appear to deliver an increased opportunity for the community to recover resources in MHD developments and public place precincts without the issues related to vast amounts of MGBs obscuring vision, blocking access and requiring manual handling.

They also deliver economic benefits through less frequent collection cycles, less cityscape cleanups and litter runs, more durable containers requiring less replacement, larger volumes of resources collected and available for sale and lower risk to the worker through improved OH&S systems.

These innovative solutions will require a re-think to the current method and some persuasion to move to the fully integrated underground collection and/or vacuum systems, however the current issues of resource recovery surrounding public place and MHD collection demand that we consider options outside the box.

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