Collection Techniques for Construction, Demolition and Excavation Wastes

An analysis of collection techniques to establish efficiencies for the collection of construction, demolition and excavation wastes for recovery and recycling.
Our vision is a world without waste, where resources are used sustainably.

We work with businesses and individuals to help them reap the benefits of reducing waste, develop sustainable products and use resources in an efficient way.

Find out more at www.wrap.org.uk
Executive summary

The following report was commissioned by WRAP (Waste & Resources Action Programme) to investigate current options for collection containers, to collect and transport construction, demolition and Excavation Wastes (CDEW) off site for further treatment and recycling. The report considers the suite of typical non-inert waste materials generated on site, including packaging, wood pallets, timber, plastics, cardboard, tins, metals, plasterboard, insulation and ceramic materials.

A wide range of factors are driving changes and improvement to waste management practices in the construction industry. Key drivers for change include:

- the Waste Hierarchy;
- legislation and policy;
- rising waste management costs;
- reduced landfill capacity;
- public perception; and
- space constraints on site.

By implementing a robust waste strategy for construction waste the waste management contractor and developer have the potential to significantly reduce the cost of waste management, increase materials resource efficiencies and also to improve the environmental credentials of the businesses through improved corporate social responsibility (CSR) reporting.

In addition to the benefits of enhanced CSR reporting, there are increasingly significant external pressures for construction related businesses to improve their waste management practices which historically have been overly reliant on landfill with little consideration given to the efficient use of natural resources.

Recent legislation and policy documents, such as the Waste Strategy for England 2007 and the Strategy for Sustainable Construction, have targeted waste management improvements in the construction industry. WRAP has developed ‘The Construction Commitments: Halving Waste to Landfill’1 which is a voluntary agreement providing a framework through which the construction industry can publicly support and deliver against the headline industry target of halving waste to landfill by 2012 compared to levels in 2008.

This report has been produced following an extensive desk research study and contact with manufacturers and suppliers of collection containers for managing non-inert CDEW on site. Research revealed that there is a large range of collection container solutions available for collecting construction waste on site, with many options suitable for containing the non-inert waste materials. During the research phase of this project, it was identified that there is, however, little innovation in this area, with no fundamentally different or cutting edge containers available on the market. It is believed that due to the factors highlighted above, the waste management industry and the construction industry will have to adjust their waste management practices to reflect the waste hierarchy. This in turn will require modifications to existing collection containers in order to encourage reuse and recycling and development of new processes to efficiently collect waste construction materials.

Databases containing current container options available for managing non-inert CDEW on site and information about container manufacturers are available from: www.wrap.org.uk/constructionmrf

Case study and demonstration trial reports conducted as part of this project are available as stand alone documents from: www.wrap.org.uk/constructionmrf

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# List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>CDE</td>
<td>Construction, Demolition and Excavation</td>
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<tr>
<td>CDEW</td>
<td>Construction, Demolition and Excavation Wastes</td>
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<tr>
<td>CIRIA</td>
<td>Construction Industry Research and Information Association</td>
</tr>
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<td>CIWM</td>
<td>Chartered Institution of Wastes Management</td>
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<tr>
<td>CSR</td>
<td>Corporate Social Responsibility</td>
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<td>ESA</td>
<td>Environmental Services Association</td>
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<tr>
<td>FEL</td>
<td>Front End Loader</td>
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<tr>
<td>FIBC</td>
<td>Flexible Intermediate Bulk Container</td>
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<tr>
<td>ICE</td>
<td>Institution of Civil Engineers</td>
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<tr>
<td>RCV</td>
<td>Refuse Collection Vehicle</td>
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<tr>
<td>REL</td>
<td>Rear End Loader</td>
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<tr>
<td>RORO</td>
<td>Roll-On Roll-Off</td>
</tr>
<tr>
<td>WMC</td>
<td>Waste Management Contractor</td>
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<tr>
<td>WRAP</td>
<td>Waste &amp; Resources Action Programme</td>
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<tr>
<td>WSP</td>
<td>WSP Environmental Limited</td>
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1.0 Introduction

The following report was commissioned by WRAP to investigate current options for collection containers, to collect and transport construction, demolition and Excavation Wastes (CDEW) off site for further treatment and recovery for recycling. The report considers the suite of typical non-inert waste materials generated on site, including packaging, wood pallets, timber, plastics, cardboard, tins, metals, plasterboard, insulation and ceramic materials.

The report is aimed primarily at the Waste Management Industry, but also would provide valuable information to the construction industry and in particular those involved in waste management decision making. Information contained within this report should be used to support waste management companies and inform the construction industry of the wider options available to assist them in managing their wastes efficiently on site.

Increasingly, legislation and policy is demanding that the construction industry improves its environmental performance, and with regard to waste this is focusing on diversion from landfill through waste reduction, reuse and recycling. Recently published targets include:

- The Waste Strategy for England 2007²:

  “Considering in conjunction with the construction industry, a target to halve the amount of construction, demolition and excavation wastes going to landfill by 2012 as a result of waste reduction, re-use and recycling.”

- The Strategy for Sustainable Construction³:

  “By 2012, a 50% reduction of construction, demolition and excavation waste to landfill compared to 2008.”

WRAP has developed ‘The Construction Commitments: Halving Waste to Landfill’⁴ which is a voluntary agreement providing a framework through which the construction industry can publicly support and deliver against the headline industry target of halving waste to landfill by 2012.

This report has been produced following an extensive desk research study and contact with manufacturers and suppliers of collection containers. The report discusses conventional collection containers in order to understand the best and most practical methods available, keeping in perspective the need to maintain the best possible material quality for recycling.

The report also highlights five types of collection containers through a series of case studies and demonstration trials that took place in early 2009, which are intended to examine in more detail the process, the benefits and the operational requirements of each container. The case study and demonstration trial reports are available as stand alone documents and can be viewed at: www.wrap.org.uk/constructionmrf

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2.0 **Methodology**

2.1 **The Agreed Methodology**

The agreed methodology for the delivery of the project work can be summarised as follows:

- to carry out an extensive desktop research study to identify as many collection containers as possible and provide a comprehensive list of options available to specify;
- place advertisements in appropriate trade literature to ensure that as many collection containers had been identified as possible;
- short list the identified collection containers to identify the top 10, which should be investigated in more detail;
- prepare and issue a product questionnaire to suppliers of collection containers to gather appropriate information relating to the logistics and operational requirements and the materials that can be effectively stored in it;
- review the data provided in the questionnaire to ensure completeness and robustness;
- prepare a directory of collection containers and their suppliers with appropriate contact details; and
- use the information provided to identify a number of case studies and demonstration trials that could demonstrate innovative methods for collection of non-inert CDEW.

2.2 **UK Desk Based Research**

In order to assess current container options and techniques used for the collection and transport of CDEW, a number of techniques were used to obtain data from a range of sources:

- An extensive desktop research study was conducted, utilising both the internet and key industry publications to collate existing information relevant to waste collection containers and techniques.
- Advertisements were placed in ‘Materials Recycling Weekly’ and ‘Recycling and Waste World’ appealing for information regarding innovative solutions from manufacturers and suppliers (Appendix F).
- A range of professional organisations were contacted for their contributions to the project, including the Chartered Institution of Wastes Management (CIWM), the Construction Industry Research and Information Association (CIRIA) and the Environmental Services Association (ESA).
- Container manufacturers were engaged at the Recycling and Waste Management (RWM) Exhibition 2008, held at the Birmingham NEC in September 2008.
- Overseas manufacturers and suppliers were engaged through project associates.

From this information, a comprehensive directory of container options and equipment manufacturers was generated, containing details of each container’s specifications, infrastructure requirements, management practices and additional health, safety considerations and contact details. The directories are available as stand alone documents on the WRAP website: [www.wrap.org.uk/constructionmrf](http://www.wrap.org.uk/constructionmrf)

2.3 **Shortlisting Appropriate Collection Containers**

Following the desk based research phase of the project, WSP identified in collaboration with WRAP the most relevant and appropriate collection containers that should be reviewed in more detail as part of this project using the following key and additional selection criteria.
Key selection criteria:

- Product innovation. (Does the product offer a new way to tackle CDEW collection?)
- Potential for improving collection efficiency. (Does the product or process make waste collection or segregation easier to implement, or help to minimise transportation requirements or vehicle movements?)
- Potential for increasing the source segregation of materials.
- Potential for preserving waste material quality for effective reuse or recycling. (Which materials are to be collected? One material type or many? Likely impact on source segregation efficiency? Opportunities for diversion from landfill?)
- Willingness to be involved in case studies and likely co-operation of clients using their products.

Additional selection criteria:

- Container or collection system flexibility. (Including the range/quantity of materials to be collected)
- Practical application - size, weight, power needs, noise levels and other relevant criteria.
- Integration with current construction waste services
- Proven technology - tried and tested in UK? Existing case study(ies) data available?
- Financial considerations - capital/installation/maintenance/end of life costs, power/fuel costs (if applicable)
- End markets for outputs - does container/collection system aid on site reuse? local or export markets?
- Areas covered in UK - nationwide? regional?
- Environmental impacts - emissions, energy consumption
- The products must illustrate a variety of containers/collection techniques for improving efficiencies, to encourage diverse solutions for differing waste needs

A shortlist of 10 collection containers was identified for further investigation which are listed in Table 2.1 below, and gives their website details.

**Table 2.1 10 Shortlisted Containers**

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Product</th>
<th>Website</th>
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<tbody>
<tr>
<td>Hippowaste</td>
<td>Hippobags</td>
<td><a href="http://www.hippowaste.co.uk">www.hippowaste.co.uk</a></td>
</tr>
<tr>
<td>Contact Attachments Limited</td>
<td>Tipping Skips</td>
<td><a href="http://www.forklift-attachments.co.uk">www.forklift-attachments.co.uk</a></td>
</tr>
<tr>
<td>Bywaters Limited</td>
<td>Constructor Compactor</td>
<td><a href="http://www.bywaterswaste.co.uk">www.bywaterswaste.co.uk</a></td>
</tr>
<tr>
<td>Ecofar UK Limited</td>
<td>Eco Twin 700 Lorry</td>
<td><a href="http://www.ecofaruk.com">www.ecofaruk.com</a></td>
</tr>
<tr>
<td>PRM Waste Solutions Limited</td>
<td>Knapzak Bag</td>
<td><a href="http://www.prmwastesystems.com">www.prmwastesystems.com</a></td>
</tr>
<tr>
<td>Acorn Containers Company Limited</td>
<td>Compartmentalised Roll-on Roll-off</td>
<td><a href="http://www.acorncontainers.co.uk">www.acorncontainers.co.uk</a></td>
</tr>
<tr>
<td>Goubard</td>
<td>Twin Drop Bottom Skip</td>
<td><a href="http://www.goubard.fr">www.goubard.fr</a></td>
</tr>
<tr>
<td>Muck Truck UK Limited</td>
<td>Motorised Mini-Dumper</td>
<td><a href="http://www.mucktruck.co.uk">www.mucktruck.co.uk</a></td>
</tr>
<tr>
<td>Trash Basher</td>
<td>Manual Compactor for Wheeled Bins</td>
<td><a href="http://www.trashbasher.co.uk">www.trashbasher.co.uk</a></td>
</tr>
<tr>
<td>Seller Engineering Limited</td>
<td>Rolling Roof Roll-on Roll-off</td>
<td><a href="http://www.sellersengineering.co.uk">www.sellersengineering.co.uk</a></td>
</tr>
</tbody>
</table>

### 2.4 Preparation and Issuing Questionnaires

A detailed questionnaire was prepared and distributed to the 10 selected container suppliers to gather relevant data to inform a further shortlisting exercise to identify the technologies that would form the basis of the case studies (Appendix G). The questionnaire considered the key factors associated with the use of the containers on site, including description and specification of the equipment, how the container is used, specific materials that
can be stored in the container and logistics associated with delivery and installation, and collection and transport of the full container.

Following an extended consultation period five fully completed questionnaires were received. Table 2.2 below outlines the companies that responded:

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Product</th>
<th>Website</th>
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</thead>
<tbody>
<tr>
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<td>Knapzak Bag</td>
<td><a href="http://www.prmwastesystems.com">www.prmwastesystems.com</a></td>
</tr>
</tbody>
</table>

Where required, the information provided in the questionnaires was subjected to a peer review by industry partners to ensure that it was a true reflection of both existing market conditions and complied with current and known future legislation.

The information provided by the respondents listed above in their questionnaires is summarised in Appendix D in the form of fact sheets for each collection container.

### 2.5 Case Studies and Demonstration Trials

Based on the responses provided in the questionnaire and the ability to identify suitable construction sites, WSP and WRAP identified three appropriate container options for further investigation through case studies and two suitable innovative collection techniques for assessment through demonstration trials. The case studies and demonstration trials would provide an opportunity to review the suitability of the collection container or technique, and its impact on site waste management operations.

It should be noted the demonstration trial conducted by Hurleypalmerflatt resulted directly from information provided by WRAP.

Table 2.3 below, summarises which collection containers were to be assessed in case studies:

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Product</th>
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<tbody>
<tr>
<td>Hippowaste</td>
<td>Hippobags</td>
</tr>
<tr>
<td>Contact Attachments Limited</td>
<td>Tipping Skips</td>
</tr>
<tr>
<td>Bywaters Limited</td>
<td>Constructor Compactor</td>
</tr>
</tbody>
</table>

Table 2.4 below, summarises which collection containers formed the basis of demonstration trials:

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRM Waste Systems Limited</td>
<td>Knapzak</td>
</tr>
<tr>
<td>Smartlift Bulk Packaging Limited (via Hurleypalmerflatt)</td>
<td>Flexible Intermediate Bulk Containers (FIBC)</td>
</tr>
</tbody>
</table>
The results and findings of the case studies and demonstration trials have been used to generate stand alone reports which can be found at www.wrap.org.uk/constructionmrf

2.6 Overseas Data Collection

In addition to the collection containers detailed above which focused on the UK, WSP also engaged with colleagues in the USA, Sweden and Italy who conducted additional desk based research and contacted key manufacturers in order to identify further collection container options that could be accessible to the UK market in the future.

This work identified only a limited number of additional collection containers that are used outside of the UK, and are currently not available for use in this country. Generally, the overseas equipment was similar to the equipment already used in the UK, with some additional functionality or a larger scale being applied.

Details of the overseas equipment is summarised in Appendix E in the form of fact sheets for each process.
3.0 Standard Options for On Site Waste Collection

In this section, standard waste collection container options available to the UK market are briefly overviewed. For further details of container specifications, infrastructure requirements, special management practices and health and safety considerations, please refer to the directory of container options, available from www.wrap.org.uk/constructionmrf

For all containers discussed, please refer to manufacturer guidelines as container specifications do vary. Please also consult your licensed WMC regarding the type of materials that may be placed into the container for removal from site. WMCs should ensure that clients are presented with a range of suitable options for managing their waste on site and that container specifications are easily available. The WMC should also ensure that the client fully understands the specific waste streams that may be collected using each container type. These actions will help to improve waste collection efficiencies, minimise contamination and maximise recycling rates.

3.1 Wheeled Bins

A variety of wheeled bins are available for the collection of smaller volume waste streams on site, particularly light, low density, compactable wastes. Although more commonly used for collecting domestic and trade wastes, wheeled bins are increasingly being used on construction sites, improving waste transport and storage on sites with limited space. Wheeled bins are manufactured from both plastic and steel.

Wheeled bins may be used for the temporary storage of certain dry, catering, hazardous wastes, including batteries and fluorescent tubes. Wheeled bins can also be used for temporary storage of both source segregated and mixed waste, depending on the construction sites specific requirements.

Two wheeled bins are available with storage capacities of 60 - 360 litres (maximum loads of approximately 25 - 160kg). Four wheeled bins are available with storage capacities of 660 - 3200 litres (maximum loads of approximately 310 - 1280kg). The smaller, lighter weight bins are easily moved manually on site, whereas the larger or more heavily loaded bins may need electrical tow equipment or need to be positioned by the waste management service provider.

Wheeled bins enable easy segregation of materials on site and their fully closable lids help to preserve material quality for recycling and prevent windblown debris from contaminating the site. They can be emptied using standard Refuse Collection Vehicles (RCVs) or the waste can be transferred to a larger storage container or skip using bin lift equipment.

Wheeled bins are also able to accommodate compaction technologies, such as manual compactors for smaller bins and mechanical bin presses for larger bins. Where light, low density wastes are to be collected, compaction equipment can increase the quantity of material stored, reducing waste collection and transport costs.

Adaptations to standard wheeled bins are available, such as those shown in Fig. 3.1 below. Manual foot pedals can be fitted to lift the bin lid, and various drop-front or drop-back bins are available to enable easier loading.
Wheeled bins tailored specifically towards the construction industry are also available, such as the Starke Arvid Waste Bin (Fig. 3.2). The bin is available with a lockable lid, castors and brakes.

3.2 Front End Loaders

Front end loaders (FELs) are containers used for the storage of light and compactable waste streams. The containers are available with capacities in the range of 4 - 10 cu yd. FELs are available with forklift channels for repositioning on site and have lockable loading doors, which may be top or side hinged. Larger FELs may have both top doors and hinged or sliding side access doors. FELs are emptied using standard, front end loading RCVs. The availability of FELs for particular sites would need to be confirmed with the nominated licensed waste contractor.

These enclosed containers prevent windblown littering of the site and contamination of the materials, preserving material quality for recycling.

Front end Loaders can also be used for temporary storage of both source segregated and mixed waste, depending on the construction sites specific requirements.

---

3.3 Rear End Loaders

Rear end loaders (RELs) are commonly used for the collection of light, compactable wastes. The containers are available with capacities of 6 - 16 cu yd and are emptied using standard REL RCVs. RELs may be open, fully enclosed or fitted with plastic lids, steel lids or PVC sheeting to help prevent water from entering and waste from escaping. RELs may be manually or mechanically loaded via the front or rear access doors. The availability of RELs for particular sites would need to be confirmed with the nominated licensed waste contractor.

Rear End Loaders can also be used for temporary storage of both source segregated and mixed waste, depending on the construction sites specific requirements.

3.4 Traditional Skips

Traditional, open skips are available in a range of sizes, from 2 - 16 cu yd and are used primarily for storing general waste, inert waste, large/bulky items, soil and hardcore and heavy items. Many skip hire companies prohibit certain waste streams, such as asbestos products, electrical goods, household appliances (such as fridges and freezers), hazardous wastes and liquids. It is important to clarify the acceptable waste types with the licensed waste carrier prior to container hire.

Traditional skips can also be used for temporary storage of both source segregated and mixed waste, depending on the construction sites specific requirements. Due to the open nature of skips, light fractions (paper, cardboard and plastics) should be carefully managed prevent the waste escaping.

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Traditional skips are positioned on site and collected using standard skip loader vehicles and may be manually or mechanically loaded. Some skips are available with drop-down access doors to minimise manual handling and enable skip loading using a wheelbarrow or other waste handling equipment (Fig. 3.6). Care must be taken when loading the skip to ensure that any light materials, such as cardboard and packaging that may be segregated for recycling, are properly contained so that they are not susceptible to wind-blow.

Traditional skips are open topped, leaving stored materials vulnerable to contamination and water damage. Contamination commonly occurs through poor waste management on site, with operatives putting incorrect materials into the skips. This can be mitigated by educating operatives and using appropriate signage to aid waste segregation. The Institution of Civil Engineers (ICE) developed a generic colour coding system for different waste streams on site (Fig. 3.7) but simple, clear signs (Fig. 3.8) can also have a positive impact on recycling rates.

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**Figure 3.5**  Traditional Skips - 2 cubic yard and 12 cubic yard

**Figure 3.6**  Mini-skip with drop down door

**Figure 3.7**  ICE Waste Stream Colour Coding

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Contamination of the skip load may also occur in areas where there is a high risk of unauthorised access and fly tipping. Additional care must be taken on these sites to consider the risks associated with fire.

When the container has been filled, the licensed waste carrier will collect the skip on arrangement. Usually an appropriate skip sheeting system will be used to prevent materials from escaping during transport.

Adaptations to the traditional skip are also available, such as the Starke Arvid Waste Skip (Fig. 3.9). This container is a smaller volume waste skip able to hold up to 2.5 tonnes of material and can be lifted and transported using a standard forklift truck.

**3.5 Covered and Enclosed Skips**

Enclosed skips offer a secure alternative to traditional skips, as they are fully covered and have access doors (Fig. 3.10) through which materials can be manually loaded, rather than being open topped. Enclosed skips are available in a range of sizes, from 2 cubic yard mini skips to 40 cubic yard roll on roll off skips. The most commonly available enclosed skip sizes are 8 - 16 cubic yards.

Covered and enclosed skips can also be used for temporary storage of both source segregated and mixed waste, depending on the construction sites specific requirements.

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Enclosed skips are often used in environmentally sensitive areas or sites where wind can be a problem; the enclosed containers prevent stored wastes from escaping, particularly light weight materials such as cardboard and packaging, which may be susceptible to wind-blow. Enclosed skips are also practical for use in areas where there may be a high risk of unauthorised access; fully lockable enclosed containers are available, reducing the possibility of material theft, fly tipping and fire. Under arrangement with the licensed waste carrier, enclosed containers may also be used for the storage of certain hazardous or difficult wastes, such as bonded asbestos. As the containers are enclosed, material placed in the skips is protected from contamination and water damage, preserving material quality for recycling.

Larger enclosed skips can also be used in conjunction with a static compactor.

3.6 Roll On Roll Off Containers

Roll On Roll Off containers are used for storing larger quantities of waste and are positioned on site by being rolled on or off the back of a standard hooklift truck. Once placed on site, these containers are not usually moved until collected by the licensed waste disposal contractor.

Roll on Roll Off containers can also be used for temporary storage of both source segregated and mixed waste, depending on the construction sites specific requirements.

Roll On Roll Off containers are also known as RoRos or Rolonof skips, and are commonly available in capacities ranging from 12 - 50 cubic yards. These containers are only cost effective where large volumes of waste materials are generated. The sites must have sufficient space to accommodate these large containers, which can measure up to 7m long and 2.5m wide.

Low sided RoRo’s may be loaded manually or using material handling equipment. High sided RoRo’s may require additional infrastructure requirements such as access platforms to aid manual loading or excavators. Appropriate health and safety precautions must be taken when loading the containers.

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Smaller RoRos (with capacities less than 20 cu yd) may be used for the storage of heavier waste materials; they are usually used on larger CDE projects for storing inert materials, such as soil and aggregates. Due to vehicle weight limit restrictions, the higher capacity RoRos are used for storing lighter waste materials, including packaging waste, wood, timber and plastics.

Materials stored in open, uncovered RoRos are vulnerable to contamination and water damage. This is particularly important when considering the recyclability of more sensitive materials, such as plasterboard and cardboard/paper. Sheeting may be used to cover the waste during periods of poor weather or when the container is not being filled. More secure coverings are available, such as the rolling roof system shown in Fig. 3.12. The roof is constructed in two sections using lightweight steel skin and hollow box section ribs. The front section is able to roll over the rear section for waste loading, and the rear section can also roll underneath the front section allowing the container to be fully filled. Sheeting systems are also used to prevent the escape of materials during transport.

![Figure 3.12 Rolling roof system](http://www.sellersengineering.co.uk/rollingroof.html)

Standard RoRos are able to accommodate waste processing technologies such as roll packers (Fig. 3.13), which roll forward and back across the waste, compacting the materials. This can increase the quantity of material that can be collected in one load, minimising collection and transport costs, although consideration must also be given to the impact that this has on the recyclability of the materials.

![Figure 3.13 Roll packer used for waste compaction](http://www.kenburn.com/jumbo_waste_roll_packer.htm)

Many variations on standard RoRo containers are available, such as those shown in Fig. 3.14. The curtain sided RoRo enables simple manual loading of materials and also helps to reduce the risk of water damage due to the enclosed container top. The jack lid enables a more secure lid to be fitted to the RoRo when not in use. Mesh sided RoRos are also available for storing large bulky items that are not vulnerable to moisture or contamination.

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Figure 3.14  Curtain sided RoRo\textsuperscript{20}  RoRo with jack lid\textsuperscript{21}

‘Smooth sided’ RoRos are available to the market to provide a more aesthetically pleasing waste container solution.

4.0  Alternative Options for On Site Waste Collection

In this section, alternative and less commonly used waste collection container options available to the UK market are briefly overviewed. For further details of container specifications, infrastructure requirements, special management practices and health and safety considerations, please refer to the directory of container options, available on the WRAP website: www.wrap.org.uk/constructionmrf

For all containers discussed, please refer to manufacturer guidelines as container specifications do vary. Please also consult your licensed waste management contractor regarding the type of materials that may be placed into the container for removal from site.

4.1  Crane Lift Tubs

Crane lift tubs may be used for moving small volumes of dry, light weight, wastes on site. The tubs are manually loaded and emptied and are commonly available in capacities ranging 250 - 1100 litres. These tubs offer no protection from contamination and should only be used for the temporary storage of wastes before transfer to a larger capacity container.

Figure 4.1  Plastic crane lift tub\textsuperscript{22}

4.2  Skip Trolleys

Wheeled tubs and skip trolleys may be used on site for transporting dry, light weight, bulky wastes. The tubs are manually loaded and emptied and heavy duty castors enable use on rough terrain. The variety of colours available would support the segregation of materials on site.

4.3 Waste Bags and Flexible Intermediate Bulk Containers (FIBCs)

Flexible Intermediate Bulk Containers (FIBCs) are increasingly being used as a cost effective alternative to standard skips, particularly for sites with limited space. FIBCs are also known as Builder’s Bags, bulk bags, dumpy bags and one tonne bags, and are used for the storage and transport of loose, bulk materials. Liquids cannot be stored in FIBCs unless a suitable liner is used.

Standard FIBCs are cube-shaped, open topped bags manufactured from woven polypropylene and are capable of holding up to one tonne of materials, although larger bags, such as the Hippobag Megabag shown in Fig. 4.3, can hold up to 1.5 tonnes of material. FIBCs are available with various loop systems to enable easy lifting, most commonly corner loops. Some FIBCs are available with tunnel loops which are designed to stay open for the forklift to engage, eliminating the need to manually hold the FIBC lifting loops open.

Where it is necessary to close the top of standard FIBCs, some form of additional fastener, such as a cable tie, may be required. These can be used to close the top of the bag via the four corner lifting loops. If such ties are used, care must be taken to ensure that the FIBCs are lifted and transported according to the container manufacturer guidelines. By closing the FIBCs in this way, materials may still be vulnerable to water damage, potentially reducing the quantity of material that can be accepted for recycling. Variations on the standard FIBC are also available, including those with covers that can be tied to prevent light materials or waste from creating a windblown litter hazard whilst helping to preserve material quality for recycling. Other adaptations are available with specialised discharge spouts.

In March 2009, WRAP conducted a demonstration trial to investigate the use of FIBCs for segregating waste streams on site, which were then collected in a load with other mixed waste materials. The demonstration trial report can be accessed at: www.wrap.org.uk/constructionmrf

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4.4 Waste Cages

Waste cages can be used for storing segregated waste streams, such as cardboard and paper. Cages such as the 16 cubic yard cage shown in Fig. 4.4 may have fully lockable access doors for improving loading efficiency and security. Cages are picked up using standard hooklift vehicles and can be emptied either on or off site.

Figure 4.4 Waste Cage

If stored outside, waste collected in cages can be vulnerable to water damage and contamination. This can degrade the material quality and may result in potentially recyclable materials being rejected by reprocessors. Ideally, the cages should be covered to preserve material quality, enabling recycling rates to be maximised.

4.5 Drop Bottom Skips

Drop bottom skips are used for the temporary storage and transport of loose, bulk materials, including topsoil, rubble, hardcore, sand, stone, gravel, other heavy materials, green waste, general waste and packaging. After filling, the skips are commonly handled using standard forklift/pallet trucks, but some may also be transported using tower and overhead cranes. The load is then released into a larger skip or container using the automatic release mechanism, which drops the bottom of the skip, enabling complete emptying through the base.

A range of drop bottom skips are available and the customer is often able to specify particular features for standard containers, such as container capacity and finishes, and the fitting of wheels to enable easier manoeuvrability or lids to help prevent material quality degradation. Reinforced drop bottom skips are also available to enable heavier loads to be transported safely.

Some container manufacturers are also able to offer completely customised solutions, such as those shown in Fig. 4.5. The twin drop bottom system allows the segregation of waste streams on site and the discharge of materials into separate containers. The larger drop bottom skip has been designed with two base doors to enable the safe and practical discharge of larger loads.

Figure 4.5 Customised drop bottom skip solutions

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4.6 Tipping Skips

Tipping skips can be used on site to collect wastes near to the point of generation, before transferring the load to a larger skip or compactor. Tipping skips are commonly available with capacities of 0.25 - 2.5m³. A mesh height extension can be fitted to the skip when bulky, light weight wastes are being collected, particularly packaging materials such as paper, card and polythene. The skips are moved on site using standard forklift trucks, though can be fitted with heavy duty castors to enable the skip to be moved manually on site. Some tipping skips are fitted with brackets enabling crane lifting.

Figure 4.6 Tipping skips

Loads are released via full length release handles. Where frequent tipping is required, an auto-release tipping skip may be more suitable; a ‘nudge plate’ is fitted to the front of the skip, releasing the load when contact is made with the receptacle, eliminating the need for the forklift driver to leave the cab.

The skips can also be fitted with lids and are available in heavy duty models, suited to regular use in arduous conditions such as those on construction sites. The skips are also available in a variety of colours and finishes which can be used to aid material segregation on site.

An example of tipping skips being used successfully on a construction site can be viewed in the WRAP case study at: www.wrap.org.uk/constructionmrf

4.7 Motorised Waste Handling Equipment

Motorised waste handling equipment can be used on site to minimise waste transport time and help to improve skip loading efficiencies, as well as ease the burden of transporting heavy materials or wastes on site. The pedestrian operated, motorised mini-dumpers are available with loading ramps enabling waste to be transferred to a skip, or with lifting features to raise the height of the container before tipping the load (Fig. 4.7). The mini-dumpers can be available wheeled or tracked to enable use in arduous site conditions. Other models are also available with interchangeable accessories, enabling skip containers or flatbed fitments to be used for transporting waste.

Figure 4.7 i. Mini-dumper and skip loading ramp ii. Mini-dumper with skip loading feature

The containers are available with common capacities of 6 - 10 cu ft, carrying loads of up to 250 - 330kg. These dumpers are designed for material handling and are only to be used for the temporary storage of wastes. The open container means that recyclable wastes are vulnerable to water damage if used in wet conditions. In addition, care must be taken to reduce the risk of material contamination – for example, recyclable packaging waste should not be placed into the container following the transport of wet soils which may leave residues on the packaging. When using motorised waste handling equipment, appropriate measures must be taken to ensure safe use on site.

4.8 Compactors

4.8.1 Manual

Manual compaction methods can be used to increase the quantity of waste material that can be stored in smaller waste containers, reducing waste collection and transport costs.

An example of a manual compaction device is the Trashbasher\(^{32}\), a manual compactor that clips onto standard wheeled bins and is used to compress general and compactable wastes. On construction sites, this may be appropriate for the compaction of segregated packaging wastes for recycling.

The compaction of waste can also help to ensure that the container is able to close fully. This will help to preserve the quality of segregated materials for recycling by preventing contamination, and also avoid windblown litter hazards on site.

\[\text{Figure 4.8} \quad \text{Trashbasher manual compactor}\(^{33}\).\]

4.8.2 Mechanical (Low Capacity)

Mechanical compaction methods can be used to increase the quantity of waste material that can be stored in smaller waste containers, reducing waste collection and transport costs. The bin press shown in Fig. 4.9 can be used to reduce the volume of compactable wastes, such as packaging materials.

**Figure 4.9** i. 240 and 360 litre wheeled bin press\(^{34}\) ii. 1100 litre wheeled bin press\(^{35}\)

The compaction of waste can also help to ensure that the container is able to close fully. This will help to preserve the quality of segregated materials for recycling by preventing contamination, and also avoid windblown litter hazards on site.

### 4.8.3 Portable

Portable compactors are essentially containers and compactors in a single unit, and can be used when there is no concrete base available for a static compactor. Smaller, portable compactors with capacities of 12 - 16 cubic yards may be positioned on site using skip lift vehicles and are useful where large quantities of compactable wastes are generated on sites with limited space. Larger RoRo (or 'rolonof') compactors with capacities ranging from 24 - 34 cubic yards are positioned on site using hooklift vehicles.

Reducing the volume of waste materials by using a compactor can reduce the number of waste collections required, saving on waste collection and transport costs.

### 4.8.4 Static

Static compactors are fixed in place to a concrete base and rather than the whole unit being taken by the waste collection contractor, only the waste storage container is removed. Static compactors are available in a range of sizes and compaction forces to suit the characteristics and volume of the waste stream. These compactors are suited to high volume waste producers.


Static compactors generally have a higher compaction performance, a greater range of loading options and handle a larger volume of waste. A static compactor does not travel to the landfill site as it is bolted to its base but the container is exchanged instead which reduces costs and ensures that the compactor

4.9 Mobile Waste Collection Schemes

4.9.1 Trailers

Trailers can be used on site to minimise waste transportation time and help to ease the burden of transporting heavy materials on site especially where the waste facilities are remote from the working area. The trailers shown in Fig. 4.10 below are powered by an electric motor which allows heavy loads to be moved effectively and safely. They can be configured to either handle bulky items or to transport full bins and bespoke configuration can be easily manufactured, including secure locking, ability to carry 1,100 litre wheeled bins, tipping and so on.

The trailer will require a smooth surface to enable safe operation, and will need ramps or lifts to move between levels or floors on a construction site. There is a need to provide appropriate charging points to recharge the batteries at regular intervals.

Figure 4.10 Waste collection trailers

In addition to site based trailers discussed above, there are also options to use trailers on both Roll-on Roll-Off and skip vehicles. These trailers will allow the waste contractor to double the waste containers that can be collected and transported on the same journey.

These types of trailers are especially beneficial where the waste is being transported long distances for treatment or disposal.

Figure 4.11 Roll on Roll off Trailer

4.9.2 Wait and Load

Wait and Load services are especially useful for construction projects where waste storage space is limited, such as in city centres and in areas where skips cannot be parked. Typically, a caged truck will stop at the site for waste collection and removal, negating the need for skip hire and associated permits.

Wait and Load services are particularly suited to shop-fitters, property developers, builders and contractors working in busy, urban locations and for the collection and disposal of light, bulky waste items, and can be used on a one-off basis or through short and long term service contracts. These services are also suited to ‘milk round’ waste collections, where segregated waste streams are collected from multiple sites within a region.

**Figure 4.12** Wait and Load trucks

Wait and Load trucks (as shown in Fig. 4.12) commonly have a waste storage capacity of 18 - 24 cubic yards (many accepting loads up to 3 tonnes), although some companies offer smaller, transit based waste collection services with storage capacities of approximately 10 cubic yards. Many of the companies also offer 'Labour Assisted Services' where the authorised waste collector will also provide labour to assist with manual loading.

### 4.9.3 Take Back Schemes

Some material providers offer waste take back schemes, where any material that is not used on site and would otherwise be disposed of, is collected by the material provider for recycling. These schemes offer the opportunity to reduce waste handling, transport and disposal costs. When participating in a take back scheme, it is essential to clarify the types, quantity and quality of materials that will be accepted through the scheme. Frequently, companies operating take back schemes will only accept waste materials from their own products and have stringent requirements regarding contamination.

Examples of take back schemes currently in operation in the UK for non-inert CDEW materials include:

- **Plasterboard**: British Gypsum, Knauf Drywall and Lafarge offer plasterboard recycling services for their customers, where clean, uncontaminated plasterboard and gypsum waste can be segregated on site for collection and recycling.

- **PVC**: Recovinyl provides financial incentives to support the collection of PVC waste from the non-regulated PVC waste streams, with the aim of ensuring a steady supply of post-consumer PVC waste for recycling in Europe.

- **Carpet**: Interface are a carpet manufacturer who, through their ‘ReEntry 2.0’ scheme, are able to accept their customer’s clean off-cuts for recycling into new carpet tiles.

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Mineral Wool: Rockwool Ltd are a major supplier of mineral wool products for thermal, fire and acoustic protection. The company operate a take back scheme for clean, uncontaminated waste from their customers.

In March 2009, WRAP conducted a demonstration trial to assess the feasibility of collecting waste mineral wool on site using the Knapzak container system (refer to Appendix D). Mineral wool waste generated on site was returned to the Rockwool facility in South Wales for recycling through their customer returns scheme. The trial report is available at: www.wrap.org.uk/constructionmrf

4.10 Customised Solutions

Many waste container manufacturers are able to produce customised solutions to meet specialist requirements, and can also offer container adaptation and refurbishment services to suit specific needs. As well as being able to customise container dimensions, some manufacturers will also enable the specification of additional details, including finishes and treatments (painted, galvanised or stainless steel) and tipping mechanisms (manual or hydraulic).

The 40yd³ semi-enclosed, compartmentalised Roll On Roll Off container shown in Fig. 4.13 was a customised solution produced by Acorn Containers Ltd, for the transportation of flowers and plants and each compartment was painted a separate colour. Similar designs are yet to be used on construction sites, although there is scope for the development of more innovative containers for the management of construction wastes on sites.

Figure 4.13 40yd³ semi-enclosed, compartmentalised container produced by Acorn Containers Ltd

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5.0 Pre-Treatment Options

This section of the report outlines the various types of pre-treatment that can be used to reduce the volume of waste generated on a construction site and to maximise the amount of waste that can be placed into the selected collection container. To maximise the volume of waste placed into a collection container, it is necessary to:

- use a suitable pre-treatment process to reduce the physical volume of the waste;
- ensure that the container is suitable for the materials being produced on the site (i.e. size);
- ensure that the waste materials are loaded into the container to avoid bridging and voids being created; and
- ensure that the container is the correct size and type of construction.

WRAP has recently completed a report entitled ‘Mobile Waste Processing Options for Construction, Demolition and Excavation Wastes’\(^{40}\). This report reviews the types of mobile processes that can be used to pre-treat the suite of non-inert construction waste streams to maximise the amount of waste that can be placed in each container and therefore minimise the number of collection containers required by a site.

Detailed below is a summary of the types of mobile processing technologies with examples that can be used to pre-treat wastes on construction sites prior to them being placed into collection containers.

5.1 Types of Mobile Processing Technologies

The types of pre-treatment processes that can be used to manage construction wastes can be broadly grouped into the following generic types:

- waste screening;
- shredders, chippers and grinders;
- compactors;
- balers; and
- multifunctional equipment (usually incorporating a number of the processes listed above).

A brief description of each type of process is detailed below. Where appropriate website links have been provided to the short-listed manufacturers identified from the desktop study and short-listing process.

5.1.1 Waste Screening Equipment

A waste screen can be used on site to separate materials into different sized particles, depending on the material speciation required. They are widely used within materials recovery facilities to sort segregated and mixed recyclable materials collected as part of a kerbside collection process from municipal solid wastes and for processing demolition wastes on construction sites to crush and grade concrete materials.

An example of screening equipment that could be used to pre-treat waste:

5.1.2 Shredders, Chippers and Grinders

Shredders, chippers and grinders may be used on site to reduce the size of waste materials, and help to increase the volume of materials able to be stored in skips on site. This in turn can help to reduce waste collection and transport costs, as fewer collection containers may be necessary.

A large number of these products are currently used in the agriculture, landscaping and forestry industries which could be used to support the processing of green waste and clean timber on site. More robust equipment is necessary to process certain wastes, for example, pallets contaminated with nails could damage equipment not designed to process this waste stream.

Examples of Shredding, Chipping and Grinding Equipment that could be used to pre-treat waste:

5.1.3 Compactors

Compactors reduce the volume of waste by applying pressure to the waste to reduce voids. Compactors have traditionally been used to reduce the volume of waste streams including those from catering, household, supermarkets and light industry. These waste streams generally include food, plastics, paper, cardboard and light metals. A compactor comes in two variants, mobile and static and in varying sizes from 14 cubic yards to 40 cubic yards. They can reduce the volume of waste by a ratio of up to 6:1, depending on the materials being
Compacted. Once compacted the material is collected by an appropriate vehicle and transported to the appropriate licensed waste facility where it is emptied and returned to site.

The traditional type of compactor should not be used for materials that cannot be compressed such as wood, metal, glass and demolition wastes. These types of wastes will damage a compactor and could result in significant Health and Safety concerns/incidents arising.

For rigid materials such as wood, it is recommended that a roller type compactor is used. This type of compactor will consolidate wood in open RoRo containers on site by applying direct pressure through a roller attached to an articulated arm such as an excavator or specifically designed vehicle.

Examples of compactors that could be used to pre-treat waste:

**Figure 5.4** Portable Waste Compactor 44

**Figure 5.5** Minimyza 36045

**Figure 5.6** Mobile Rotokrush 46

**Figure 5.7** Styromelt Thermal Compactor 47

### 5.1.4 Balers

Bailers are similar to compactors, in that they apply pressure to a material to consolidate it to allow more efficient use of storage space. They come in two main variants, hydraulic and compressed air, and a range of sizes which produce bales from a few kilos to half a tonne. Bailers are generally used to manage a specific segregated waste stream such as packaging materials (including paper, cardboard and plastic) and in some cases they can bale cans to allow efficient storage and transportation to an appropriate recycler/re-processor. The product is placed into the baler chamber and compressed. A bale is formed which is secured by an appropriate twine or wire. The bale is then discharged from the baler and stored for collection by an appropriate re-processor.

Balers are much smaller than compactors and usually remain on site for the duration of the project. An example of a baler that could be used to pre-treat waste:

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5.1.5 Multifunction

A multifunctional process is likely to incorporate one or more of the processes described above and may also process multiple materials. These facilities generally need to be configured for the specific site and materials that they are going to handle and will remain on site for the duration of the project. They have the benefit of centralising all waste management processes into one location, which in effect creates a waste management zone or area. This could also allow the developer to employ either individuals or a team to proactively manage all waste streams to maximise reuse and recycling and ensure that wastes streams are segregated effectively to maximise any income potential.

An example of a multifunctional processes that could be used to pre-treat waste:

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6.0 Conclusions

It is clear from the research that there is a large range of collection container solutions available for managing construction waste on site, with many options suitable for containing non-inert waste materials.

It is surprising that given the range and volume of waste materials produced during construction and demolition projects and the increasing requirements to segregate and recycle wastes as well as the increasing cost of waste disposal, that there appears to be little innovation in this area, with no fundamentally different or cutting edge containers being identified during the research phase of this project.

This is likely to be due to the following factors:

- The traditional nature of the waste management industry which has historically only used wheeled bins, front end loaders, rear end loaders, skips and roll-on roll-off containers which are compatible with a small number of vehicle types. Therefore any new collection container introduced to the market would have to be compatible with these current vehicle types used within the waste industry which will limit innovation.
- The construction industry has always tended to use the standard suite of collection containers procured for or offered by their waste management service providers, and has historically been resistant to new innovations as they are difficult to introduce to a site due to training and awareness requirements.
- In the past, the cost of waste management has not been a significant driver for instigating change in CDEW collection practices on site.

It should also be noted that while many of the container manufacturers do actually offer services to either customise or produce bespoke containers on request, few have actually been manufactured. On reflection with the manufacturers, the vast majority of adaptations have been cosmetic.

However, as outlined in Appendix A, there are now a number of factors that are influencing the way that waste is managed on construction site including:

- the need for large businesses to regularly report on their CSR performance;
- increasingly the influence of EU and UK legislation and policy and drivers such as The Construction Commitments: Halving Waste to Landfill;
- the increasing cost of waste disposal; and
- the diminishing landfill capacity in the UK.

These factors, amongst others, will mean that over time, the waste management industry and the construction industry will need to change their waste management practices to reflect the waste hierarchy. This will result in increasing modification and adaptation of existing collection containers and development of new processes in order to facilitate and encourage reuse and recycling.
Appendix A - Context For Study

Context

The construction industry is a major waste generator in the UK and currently a significant quantity of this waste is disposed of directly to landfill without any form of recovery or reuse. Much of this waste could be reused or recycled if appropriate waste treatment processes and collection facilities were provided on construction site that promoted diversion from landfill. In addition to landfill diversion, it has been shown that good practice waste management leads to significant cost savings for the construction contractors involved.

In order to put the impact of the construction industry into perspective and to quantify what could be achieved if appropriate waste management techniques were adopted an overview of available data relating to construction waste arisings in the UK and key drivers for change are discussed below.

Total UK Construction Waste

The construction industry is responsible for some 120 million tonnes of construction, demolition and excavation waste every year – around one third of all waste in the UK. An estimated 25 million tonnes of this waste ends up in landfill without any form of recovery or reuse.50

Construction Waste Composition

The waste composition of construction waste will depend on the type of project and the materials and construction methods being used. Table A.1 below shows the average waste composition for the main materials in the construction waste stream, and has been extracted from the WRAP report ‘Current Practices and Future Potential in Modern Methods of Construction’51.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Modal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaging Incl. wood pallets, plastics, cardboard, tins</td>
<td>25–35%</td>
</tr>
<tr>
<td>Plasterboard</td>
<td>5–36%</td>
</tr>
<tr>
<td>Rubble (broken bricks, blocks, tiles etc)</td>
<td>25-40%</td>
</tr>
<tr>
<td>Timber (excl. pallets)</td>
<td>15-25%</td>
</tr>
<tr>
<td>Cement and plasters</td>
<td>10-17%</td>
</tr>
<tr>
<td>Insulation</td>
<td>6-15%</td>
</tr>
<tr>
<td>Metal</td>
<td>3-9%</td>
</tr>
<tr>
<td>Dry concrete products (blocks, slabs etc)</td>
<td>2-12%</td>
</tr>
<tr>
<td>Plaster products (excl. packaging)</td>
<td>1-11%</td>
</tr>
<tr>
<td>Ceramic materials</td>
<td>1-8%</td>
</tr>
</tbody>
</table>

The data clearly shows that the two most significant non-inert construction waste streams are packaging and timber. These waste streams are also relatively simple to segregate on a well managed site and have significant potential to be processed on site to reduce volume.

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Key Drivers

By implementing a robust waste strategy for construction waste the waste management contractor and developer have the potential to significantly reduce the cost of waste management, and also to improve the environmental credentials of the businesses through improved corporate responsibility and environment (CRE) reporting.

In addition to the benefits of enhanced CRE reporting, there are increasingly significant external pressures for construction related businesses to improve their waste management practices which historically have been overly reliant on landfill with little consideration given to the efficient use of natural resources.

Detailed below are the major drivers that are currently, and will continue to instigate changes and improvements in waste management practices in the construction industry.

The Waste Hierarchy

The waste hierarchy (Fig. A.2) is a five stage process that prioritises the various steps to sustainable waste management, starting with as the most important, waste minimisation and finishing with the least favoured, disposal to landfill.

This is the model for sustainable waste management that has been adopted by both the European Union (EU) and United Kingdom (UK) policy makers, and is enshrined in both EU and UK law.

Figure A.2 The Waste Hierarchy

Implications of the Waste Hierarchy

The waste hierarchy is a clear and easy to understand prioritised list of waste management actions that if fully embraced and implemented will significantly reduce the amount of waste sent to landfill. The collection containers discussed in this report and trialled in the case studies and demonstration trial reports will, amongst other options, enable construction contractors and WMCs to successfully implement procedures to divert from landfill the waste that has been generated.

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The Waste Strategy for England 2007 is the Government's strategy to manage waste for the period 2007 to 2020. This includes statutory targets for municipal waste and non-binding targets for construction waste. The construction waste target is:

“Considering in conjunction with the construction industry, a target to halve the amount of construction, demolition and excavation wastes going to landfill by 2012 as a result of waste reduction, re-use and recycling.”

The Strategy for Sustainable Construction

The Waste Strategy for England 2007 identified construction waste as a priority sector for action and in 2008, ‘The Strategy for Sustainable Construction’ was published to identify target areas for improvement within the industry. The strategy is a joint industry and government initiative intended to promote leadership and behavioural change, as well as delivering benefits to both the construction industry and the economy53. The strategy set out the actions required of national bodies to help the construction sector to deliver against the headline target to achieve:

“By 2012, a 50% reduction of construction, demolition and excavation waste to landfill compared to 2008.”


Waste strategy for England 2007 provides a clear policy statement relating to waste management in the UK, and the actions that need to be taken to minimise the impacts of waste on the environment. Currently, the targets for construction waste included in the strategy are non-binding, however it has been indicated that the government would consider making them mandatory if significant progress is not made. As a result, WMCs and developers need to be considering how they can reduce waste during the design and construction phases of the development and improve waste management practices on site to maximise reuse and recycling and minimise waste to landfill. The collection containers discussed in this report and supporting case study and demonstration trial reports will, amongst other options, provide information to enable WMCs and developers to successfully implement procedures to divert waste that has been generated from landfill and therefore be informed if or when binding targets are introduced.

WRAP has developed ‘The Construction Commitments: Halving Waste to Landfill’54 which is a voluntary agreement providing a framework through which the construction industry can publicly support and deliver against the headline industry target of halving waste to landfill by 2012.

The agreement is a simple statement of intent:

‘We commit to playing our part in halving the amount of construction, demolition and excavation waste going to landfill by 2012. We will work to adopt and implement standards for good practice in reducing waste, recycling more, and increasing the use of recycled and recovered materials.’

Legislation

The majority of UK environmental law is now a response to EU directives. There are several key pieces of legislation and policy that have had a significant effect on the waste management and construction industries:

- The Waste Framework Directive
- The Landfill (England and Wales) Regulations 2002
- Site Waste Management Plan Regulations 2008

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The Waste Framework Directive

The current Waste Framework Directive was recently revised and was officially signed on the 19th November 2008, and the UK government now has until 12th December 2010 to transpose the amendments into UK law.

The Directive aims to set a framework for waste management in the EU, promoting both reuse and recycling, including energy recovery as a recovery activity within a revised waste management hierarchy and dealing with ‘end of waste’ classification as well as at simplifying current legislation.

Chief among its requirements is a 70% target for reuse and recycling of non-hazardous construction and demolition waste, which must be reached by the UK by 2020.

The Landfill (England and Wales) Regulations 2002

The landfill regulations have made drastic changes the way the UK handles waste. The UK has implemented the EU directive (1999/31/EC) in a phased approach, which has included prohibiting the following activities:

- Co-disposal of Non Hazardous and Hazardous wastes (July 2004)
- Pre-treatment of all non-hazardous waste either by a physical, thermal, chemical or biological process (Since 2007)
- Banning the following materials from landfill:
  - Tyres (July 2006)
  - Liquids (October 2007)

The ban relating to co-disposal of non hazardous and hazardous wastes has meant that landfill sites must now be registered as inert, non-hazardous or hazardous. A direct impact of this change has been to significantly reduce the number of landfills in the UK which can accept hazardous wastes, which has had significant financial implications including increased transportation costs and landfill gate fees.

To comply with the Landfill Regulations developers must put robust processes in place to segregate the waste streams listed above at source and dispose of them through appropriate licensed waste contractors and treatment facilities.

Site Waste Management Plans Regulations 2008

In 2008 the government introduced the Site Waste Management Plans Regulations 2008 which requires any construction project with a value over £300,000 to have a site waste management plan (SWMP). The primary purpose of the SWMP is to ensure that the client and the principle contractor have processes in place to effectively manage the disposal of waste, to prevent fly tipping and other waste related crimes.

However, a SWMP also requires the client and principle contractor to consider the waste generated by a project from the earliest design stages to ensure that construction waste is ‘designed out’ wherever possible.

A SWMP also has to assess the likely waste arisings from the project, to monitor waste generation and to set targets for reuse and recycling. The SWMP has to be monitored regularly and at the end of the project an assessment of actual and estimated waste arisings and reuse and recycling performance has to be completed. The assessment should also include a statement of why there were any variances in performance levels.

Implications of Legislation

The introduction of new policies and laws is the most direct and influential tool that the government has to drive change and improve current waste management processes. The legislation listed above is already having a significant effect on the waste management and construction industries and it is likely that the current suite of legislation will be enhanced and additional directives introduced. This will accelerate and drive changes to current waste management practices.

The introduction of the Construction Commitments: ‘Halving Waste to Landfill’ provides the opportunity to explore the benefits and opportunities of reducing waste to landfill and is applicable to all parts of the supply
chain, from clients through to manufacturers and contractors. The collection containers discussed in this report and trialled in the case studies and demonstration trial reports will contribute to a selection of options to enable construction contractors and WMCs to select the most appropriate processes that currently exist in order to improve the management of waste and to ensure that they have the skills and knowledge to allow them to react to future legislative changes.

**Cost of Waste Management**

The cost of disposing of waste in the UK has significantly increased in the last few years, due to a number of statutory and non-statutory interventions, including:

- landfill tax – currently £40/tonne (2009) increasing at £8 per tonne per annum;
- landfill gate fees – this is the fee paid to the landfill operator (see landfill capacity below);
- fuel costs; and
- labour costs.

This has meant that the cost of waste disposal is rapidly increasing and becoming a significant financial burden on construction projects. The increase in cost has enabled more proactive waste management practices to be considered and implemented on construction sites and has promoted the implementation of processes in line with the waste hierarchy.

**Implications of Cost**

Historically disposal of construction wastes to landfill has been an ‘easy and cheap’, with an abundance of cheap landfills able to take untreated wastes. However, the imposition of landfill tax, and the general increases in landfill gate fees, fuel and labour costs has meant that the cost of waste management has increased significantly in the past five years and it is likely to continue doing so. This means that waste is now and will continue to be a significant financial burden for construction projects. However the implementation of a robust waste strategy utilising some of the processes discussed in this report and other innovative solutions for collecting waste on site may deliver overall cost reductions for most projects and in some cases may generate an income depending on the materials being recycled.

**Landfill Capacity**

The landfill capacity in the UK is rapidly diminishing in the UK. As landfill becomes scarcer it is likely that the cost of waste management will increase further as waste materials will have to be transported further and supply and demand will dictate landfill gate fees.

**Implications of Landfill Capacity**

In the short term, as landfill void capacity reduces in the UK it is likely that landfill gate fees and the distance to the nearest appropriate landfill will increase which will have significant financial implications to all construction developments.

In the medium to long term, it is possible that landfill could become an unviable option for mass waste disposal, and that in addition to the financial consideration associated with increasing prices, it will be necessary to minimise waste during design, reuse materials on site and to maximise recycling. This will significantly reduce residual wastes requiring disposal to either landfill or an alternative disposal method which will enable to the developer to minimise costs. This need to maximise reuse and recycling will also be driven by legislation or national strategies.

By utilising some of the processes discussed in this report and other innovative waste management options it would be possible to make considerable improvements in reuse and recycling of materials while not requiring additional space to store segregated wastes on site. The quantity of material that can be stored in a standard waste container may be increased significantly through the use of on site waste processing equipment, such as shredders, grinders or balers. In March 2009, WRAP conducted demonstration trials to investigate the benefits of using mobile processing equipment on site for managing non-inert CDEW. Further information regarding this study can be found at [www.wrap.org.uk/constructionmrf](http://www.wrap.org.uk/constructionmrf)
Public Perception

Public perception is an important consideration for all large companies, especially PLCs, and can often influence policy decisions implemented by these companies. Currently, the public are acutely aware of the implications of waste through the introduction of household recycling services by local authorities and some public awareness campaigns that have been implemented by WRAP. Waste is also a significant point of issue during planning applications, public enquiries and other statutory processes, with developers expected to produce detailed waste management strategies for managing both construction and operational wastes which has to include consideration of the waste hierarchy and how the developer will limit the impacts of their project.

Implications of Public Perception

The construction industry is a highly visible to the public due to the scale and location of sites and associated traffic movements and noise nuisances which can not be avoided during a development. By considering and implementing alternative methods for managing waste on site and publicly committing to targets relating to improved waste minimisation, recycling and traffic management, developers can enhance their public reputation. This can help to improve relations and ease the planning process. Alternative options for managing waste on site and information about how to develop a robust waste management strategy can be obtained through WRAP.

Space Constraints

Construction sites, especially in city centres, have tended to become much more space constrained which means that less space can be allocated to site waste management activities. Indeed, some sites now have so little space that they can not maintain a skip or container on site for the storage and management of waste.

Implications of Space Constraints

By implementing a suitable waste management strategy on site and using some of the collection containers discussed in this report and trialled in the case studies and demonstration trial reports, amongst other innovative options, it would be possible to manage the waste in a more effective and robust manner which will allow source segregation of wastes and also volume reduction and ultimately possible cost savings.
Appendix B - Directory of Collection Containers

The complete directory of waste collection containers reviewed as part of this work is available on the WRAP website at: www.wrap.org.uk/constructionmrf

The directory contains details of each container's specifications, infrastructure requirements, management practices and additional health, safety considerations.
Appendix C - Directory of Manufacturers

The directory of waste collection container manufacturers and suppliers reviewed as part of this work is available on the WRAP website at: www.wrap.org.uk/constructionmrf

NB. This directory is not an exhaustive list but aims to be as comprehensive as possible.
## Appendix D - Fact Sheets (Shortlisted Collection Containers)

<table>
<thead>
<tr>
<th>No.</th>
<th>Product</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Hippobags</td>
<td>Hippowaste</td>
</tr>
<tr>
<td>2.</td>
<td>Tipping Skips</td>
<td>Contact Attachments</td>
</tr>
<tr>
<td>3.</td>
<td>Constructor Compactor</td>
<td>Bywaters</td>
</tr>
</tbody>
</table>
Collection Techniques for Construction, Demolition and Excavation Wastes

**COLLECTION CONTAINER FACT SHEET**

Reproduced from: www.hippowaste.co.uk

**Product Name** Hippobag

**Manufacturer/Supplier** Waste Management Systems Limited (t/a HIPPOWASTE™)

**Contact Name** Amanda King

**Position** Marketing Manager

**Address**

HIPPOWASTE™
Titchfield House
Pegham Industrial Park
Laveys Lane
Fareham
Hampshire PO15 6SD

**Telephone Number** 01329-840194

**Website** www.hippowaste.co.uk

**Was a Case or Demonstration Completed?** Yes – Case Study

**Description of the Process**

HIPPOBAGs™ are a form of Flexible Intermediate Bulk Container (FIBC) manufactured from virgin, woven polypropylene and provided by the waste management company HIPPOWASTE™. The bags provide an alternative to traditional skips for collecting and segregating waste materials on site. Due to their small size, the bags are ideal for applications where a skip or larger container is not appropriate, such as when waste needs to be segregated at source or when working across several storeys or in awkward locations. The bags are also effective when used on sites with limited space, or sites that are producing smaller, irregular volumes of waste.

**Operation of the Equipment**

Wastes (either segregated or mixed) are placed into the HIPPOBAG. When full, HIPPOWASTE collect the HIPPOBAG using one of their fleet of trucks with a vehicle mounted crane. The HIPPOBAG is then transported to an appropriate waste management facility for processing and disposal.

**How is the Process Used on Construction Sites**

The HIPPOBAG are delivered to site flat packed. When required they are taken to the site and opened where they self support as they are loaded with waste. To move them around site, they can be placed on pallets and moved with a suitable pallet truck or forklift truck.

**How is the Container Collected**

HIPPOWASTE collect the HIPPOBAG using one of their fleet of trucks with a vehicle mounted crane.

**Segregated or Mixed Wastes**

The HIPPOBAG system can be used for both segregated and mixed waste streams. They have significant potential to enable effective waste segregation on site due to their size and portability.

**Dimension**

<table>
<thead>
<tr>
<th>Size</th>
<th>Length (l)</th>
<th>Width (w)</th>
<th>Height (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midibag</td>
<td>0.9m</td>
<td>0.9m</td>
<td>0.9m</td>
</tr>
<tr>
<td>Megabag</td>
<td>1.8m</td>
<td>0.9m</td>
<td>0.7m</td>
</tr>
<tr>
<td>Mightybag</td>
<td>2.1m</td>
<td>1.65m</td>
<td>1.00m</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>Midibag: 1 tonne (max)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Megabag: 1.5 tonnes (max)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mightybag: 1.5 tonnes (max)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Available to Purchase?</strong></td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Available on Short Term Hire?</strong></td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Available on Long Term Hire?</strong></td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Variance of Equipment Available/Adaptability</strong></td>
<td>Various sizes of HIPPOBAG can be purchased. (See dimensions and capacity details above).</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Infrastructure Requirements</strong></td>
<td>• Level surface</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Clear space around container.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Materials that can be Collected</strong></td>
<td>• Ceramics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Carpet/textiles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Electric cabling</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fibreglass</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Paper/cardboard</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Metal (ferrous)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Metal (non-ferrous)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Plasterboard</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Plastics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Polystyrene</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pallets (wood)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• PVC piping</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Roofing felt</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tarmac/asphalt</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Timber</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Vegetation/organics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mixed construction wastes</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Materials that can't be Collected</strong></td>
<td>• Liquid wastes</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Materials Degradation</strong></td>
<td>Materials are not degraded by the HIPPOBAG process.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pre-treatment options</strong></td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Any other Information</strong></td>
<td>• Can be used to segregate small volume waste streams</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Collection schedules can be tailored to remove waste from site as promptly as required to avoid degradation by external factors such as rain, fly tipping etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• HIPPOBAG’s are a single use product. They are made from virgin woven polypropylene which is recycled by HIPPOWASTE once they are removed from site and emptied.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Collection Container Fact Sheet

<table>
<thead>
<tr>
<th><strong>Product Name</strong></th>
<th>Auto Release Tipping Skip</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manufacturer/Supplier</strong></td>
<td>Contact Attachments Limited</td>
</tr>
<tr>
<td><strong>Contact Name</strong></td>
<td>Desmond Phillips</td>
</tr>
<tr>
<td><strong>Position</strong></td>
<td>General Manager</td>
</tr>
<tr>
<td><strong>Address</strong></td>
<td>Contact Attachments Mochdre Industrial Estate Newtown Powys, SY16 4LE</td>
</tr>
<tr>
<td><strong>Telephone Number</strong></td>
<td>01686-611200</td>
</tr>
<tr>
<td><strong>Website</strong></td>
<td><a href="http://www.forklift-attachments.co.uk">www.forklift-attachments.co.uk</a></td>
</tr>
<tr>
<td><strong>Was a Case or Demonstration Completed?</strong></td>
<td>Yes – Case Study</td>
</tr>
<tr>
<td><strong>Description of the Process</strong></td>
<td>A forklift mounted skip that can be tipped to enable the contents to be stored in a larger container</td>
</tr>
<tr>
<td><strong>Operation of the Equipment</strong></td>
<td>The tipping skip is placed on site at the desired location. When full the skip is picked up by a forklift truck using the integrated fork channels and transported to a larger waste container. When at the container, the tipping skip is positioned and the skip is tipped to empty it using the auto tipping mechanism.</td>
</tr>
<tr>
<td><strong>How is the Process Used on Construction Sites</strong></td>
<td>The tipping skip is used to collect and/or store small quantities of waste from multiple working areas on site and then used to transport the waste to a central waste bulking facility for recycling/disposal.</td>
</tr>
<tr>
<td><strong>How is the Container Collected</strong></td>
<td>By forklift truck</td>
</tr>
<tr>
<td><strong>Segregated or Mixed Wastes</strong></td>
<td>The tipping skip can be used for both segregated and mixed waste streams. They have significant potential to enable effective waste segregation on site due to their size and portability.</td>
</tr>
<tr>
<td><strong>Dimension</strong></td>
<td>1.71m (l) x 1.30m (w) x 1.00m (h)</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>1,200 litres</td>
</tr>
<tr>
<td><strong>Available to Purchase?</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Available on Short Term Hire?</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Available on Long Term Hire?</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Variances of Equipment Available/Adaptability</strong></td>
<td>The equipment can be purchased or hired as standard and heavy duty models and can be manufactured from mild steel, galvanised steel, stainless steel and polyethylene.</td>
</tr>
<tr>
<td></td>
<td>The tipping skip is available in a range of sizes as follows:</td>
</tr>
<tr>
<td></td>
<td>- 250 litre</td>
</tr>
<tr>
<td></td>
<td>- 400 litre</td>
</tr>
<tr>
<td>Collection Techniques for Construction, Demolition and Excavation Wastes</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td></td>
</tr>
<tr>
<td>The following options are available:</td>
<td></td>
</tr>
<tr>
<td>- 800 litre</td>
<td></td>
</tr>
<tr>
<td>- 1,600 litre</td>
<td></td>
</tr>
<tr>
<td>- 2,000 litre</td>
<td></td>
</tr>
<tr>
<td>- Standard castors</td>
<td></td>
</tr>
<tr>
<td>- Braked castors</td>
<td></td>
</tr>
<tr>
<td>- Heavy duty castors</td>
<td></td>
</tr>
<tr>
<td>- Lifting lugs</td>
<td></td>
</tr>
<tr>
<td>- Fork clamps</td>
<td></td>
</tr>
<tr>
<td>- Drain taps</td>
<td></td>
</tr>
<tr>
<td>- Mesh side panels</td>
<td></td>
</tr>
<tr>
<td>- Locks</td>
<td></td>
</tr>
<tr>
<td>- Metal lids</td>
<td></td>
</tr>
<tr>
<td>- Plastic covers</td>
<td></td>
</tr>
<tr>
<td>Other modifications can be made according to users specific requirements.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructure Requirements</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- A suitable forklift</td>
<td></td>
</tr>
<tr>
<td>- An on site container to empty the waste into</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials that can be Collected</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- All types of waste can be placed in the tipping skip.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials that can't be Collected</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Liquids</td>
<td></td>
</tr>
<tr>
<td>- Hazardous wastes</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials Degradation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The tipping skip is used as a temporary storage for materials before transfer to a larger container, so no degradation occurs. Some degradation may occur when the waste is tipped into the larger container on site.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre-treatment options</th>
<th>N/A</th>
</tr>
</thead>
</table>

| Any other Information | Contact Attachments are currently developing a tipping skip to segregate wastes. |
## COLLECTION CONTAINER FACT SHEET

Reproduced from: [www.bywaterswaste.co.uk](http://www.bywaterswaste.co.uk)

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Constructor Compactor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer/Supplier</td>
<td>Bywaters Limited</td>
</tr>
<tr>
<td>Contact Name</td>
<td>Keith Baillie</td>
</tr>
<tr>
<td>Position</td>
<td>Marketing Communications Manager</td>
</tr>
<tr>
<td>Address</td>
<td>Bywaters Limited</td>
</tr>
<tr>
<td></td>
<td>Lea Riverside</td>
</tr>
<tr>
<td></td>
<td>Twelvetrees Crescent</td>
</tr>
<tr>
<td></td>
<td>Bow</td>
</tr>
<tr>
<td></td>
<td>London E3 3JG</td>
</tr>
<tr>
<td>Telephone Number</td>
<td>0207-001 6000</td>
</tr>
<tr>
<td>Website</td>
<td><a href="http://www.bywaterswaste.co.uk">www.bywaterswaste.co.uk</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Was a Case or Demonstration Completed?</th>
<th>Yes – Case Study</th>
</tr>
</thead>
</table>

### Description of the Process
A heavy duty waste compactor designed specifically for construction waste.

### Operation of the Equipment
Waste is loaded into the enclosed hopper of the compactor. The compactor doors are then shut and the start button is pressed. The compactor then safety interlocks the doors and compresses the waste into the compactor container. Once the cycle has finished the safety interlocks release and the doors can be opened and the compactor is ready to receive more waste.

### How is the Process Used on Construction Sites
The constructor compactor replaces the traditional skip or roll-on roll-off container for compactable materials including paper, cardboard, insulation etc. The non-compactable wastes such as rolled steel joists (RSJ’s), pallets etc should not be placed in the compactor.

### How is the Container Collected
The constructor compactor is collected using a standard roll-on roll-off vehicle operated by all licensed waste management contractors.

### Segregated or Mixed Wastes
The constructor compactor can be used for both segregated and mixed waste streams.

### Dimension
6.55m (l) x 2.49m (w) x 2.67m (h)

### Capacity
32 cubic yards

### Available to Purchase?
No (Bywaters are a waste management company, not the manufacturer)

### Available on Short Term Hire?
Yes

### Available on Long Term Hire?
Yes

### Variances of Equipment Available/Adaptability
Bywaters are a waste management company that offers the constructor compactor to developers on a rental basis. It was not made clear who manufactured the compactors, though there are several UK manufacturers including Pakawaste Limited and Thetford International.
### Infrastructure Requirements
- A suitable hardstanding
- A suitable power supply (depends on the compactor)
- Clear space around the container including access.

### Materials that can be Collected
- Ceramics
- Carpets/textiles
- Electric cable
- Fibreglass
- Glass (non sheet)
- Paper/cardboard
- Metal (ferrous)
- Metal (non-ferrous)
- Plasterboard
- Plastics
- Polystyrene
- PVC piping
- Timber
- Vegetation/organics
- Bricks/rubble/soil

### Materials that can’t be Collected
- Hazardous Wastes
- Liquid wastes

### Materials Degradation
Compactors compress and crush waste to reduce their volume. This will alter the wastes properties in the compactor and will mix wastes if collected as mixed construction waste. This could affect the ability of the waste management contractor to maximise recycling potential from the waste stream.

### Pre-treatment options
N/A

### Any other Information
N/A
**Product Name**
Knapzak Collection System

**Manufacturer/Supplier**
PRM Waste Systems

**Contact Name**
Paul Hughes

**Position**
Sales Manager

**Address**
Unit 5 Monument View
Summerfield Avenue
Chelston Business Park
Wellington
Somerset  TA21 9ND

**Telephone Number**
01823-665541

**Website**
www.prmwastesystems.com

**Was a Case or Demonstration Completed?**
Yes – Demonstration Trial with Rockwool Limited

**Description of the Process**
The ‘Knapzak’ is a strong perforated bag made from low density polythene hung in the ‘Knapholder’ which is a tubular steel frame which is available freestanding, with wheels or as a frame that can be hung on skips, bins etc.

**Operation of the Equipment**
The selected Knapholder is positioned with the Knapsak fixed into the frame. The waste is then placed in the sack until full, the bag is removed from the frame, sealed and taken to the main waste area/facility.

**How is the Process Used on Construction Sites**
The Knapzak Collection System is portable so can be easily positioned on site to allow convenient collection of appropriate waste materials.

**How is the Container Collected When full**
The Knapzak is removed from the frame, sealed and taken to the appropriate waste collection facility on site.

**Segregated or Mixed Wastes**
The Knapzak system has been designed to allow segregation of waste streams. However, it could be used for the collection of mixed wastes where space is limited.

**Dimension**
N/A

**Capacity**
Knapzak - 200 - 2500 litres

**Available to Purchase?**
Yes

**Available on Short Term Hire?**
No

**Available on Long Term Hire?**
No

**Variance of Equipment Available/Adaptability**
N/A

**Infrastructure Requirements**
- Freestanding and wheeled versions
  - Level surface
- Hanging system
  - Appropriate location to hang the system, including skips, RoRo’s, wheeled bins etc.

**Materials that can be Collected**
- Specifically designed for the collection of plastic films including LDPE and LLDPE.

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**Reproduced from:** www.prmwastesystems.com

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**Collection Techniques for Construction, Demolition and Excavation Wastes**
| Materials that can't be Collected | Can also be used for other lightweight materials such as insulation, polystyrene and paper.  
| Heavy items including wood, pallets, metal, carpets, glass, plasterboard etc. |
| Materials Degradation | The system does not affect the properties of the materials collected and the material is not vulnerable to damage during compaction (recyclable mineral wool is ground at the factory prior to reprocessing). |
| Pre-treatment options | N/A |
| Any other Information | N/A |
# Appendix E - Fact Sheets (Collection Containers Identified Outside of the UK)

<table>
<thead>
<tr>
<th>No.</th>
<th>Product</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pro-Roll Off System PROS-14</td>
<td>Pro-Tainer</td>
</tr>
<tr>
<td>2.</td>
<td>Pro-side Dump PRH-20</td>
<td>Pro-Tainer</td>
</tr>
<tr>
<td><strong>Product Name</strong></td>
<td>Pro-Roll Off System PROS-14</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Manufacturer/Supplier</strong></td>
<td>Pro-Tainer</td>
<td></td>
</tr>
</tbody>
</table>
| **Address** | Pro-Tainer  
P.O. Box 427  
Alexandria MN 56308  
Egypt |
| **Telephone Number** | 1-800-248-7761 |
| **Website** | www.protainer.com |
| **Type of Process** | A multi purpose trailer Roll-on Roll-off system that can be used to transport waste and recycling containers, storage sheds and flat beds. |
| **Description of the Process** | A hydraulic trailer system (self contained and mounted on the trailer) that operates in a similar way to traditional RoRo waste vehicle. This system is much smaller than traditional RoRo’s and can be towed behind a conventional pick-up or other similar vehicles. The Pro-Roll Off Trailer can operate various types of RoRo systems including flatbeds, waste and recycling containers and other bespoke applications up to 6.35 tonnes. The trailer can accommodate containers up to 20 cubic yards. |
| **Operation of the Equipment** | Using the self container hydraulic system, the Pro-Roll Off can drop off and collect RoRo type containers onto a site. The system is operated by one person using a remote, wireless control panel. |
| **Dimension** | Not available. |
| **Materials that can be Processed** | Pro-Trainer are not explicit about the materials that could be placed in the container. However, the trailer can accommodate a payload of up to 6.35 tonnes which would imply that it could be used for all construction related materials. With the heavier materials, such as timber and metal, users would have to ensure that the system is not overloaded. |
| **Other benefits** | - The Pro-Roll off System is smaller than traditional RoRo’s and will be able to access space constrained sites.  
- Can be used for multiple types of containers and uses.  
- Able to empty the contents of containers for treatment and disposal.  
- The collection and emptying process is controlled via a handheld wireless remote control.  
- Can be fitted with a autosheeting system to cover containers. |
| **Other information/comments** | - Pro-Tainer offers a wide range of waste collection systems.  
- Compliance with UK Highways Regulations would need to be confirmed prior to use in the UK. |
<table>
<thead>
<tr>
<th><strong>Product Name</strong></th>
<th>Pro-side Dump PRH-20</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manufacturer/Supplier</strong></td>
<td>Pro-Tainer</td>
</tr>
</tbody>
</table>
| **Address**         | Pro-Tainer  
P.O. Box 427                          
Alexandria MN 56308  
Egypt               |
| **Telephone Number** | 1-800-248-7761                                   |
| **Website**         | www.protainer.com                               |
| **Type of Process** | A trailer mounted waste collection system with up to 8 compartments to store wastes. The compartments can be emptied individually. |
| **Description of the Process** | Each waste compartment can be loaded with varying waste streams. Once full, the trailer can be towed to a central waste collection point on the site, or to a licensed waste facility where each compartment can be emptied independently. Each compartment is 5 cubic yards. |
| **Operation of the Equipment** | Each compartment is loaded through the appropriate door. When the trailer is full the trailer is hitched to an appropriate vehicle and towed to its final destination. The trailer can be used as a static interim waste facility on site or moved between work areas to collect waste on a milk round basis. |
| **Dimension**       | Not provided.                                    |
| **Materials that can be Processed** | Due to the need to ensure that the chassis is not overloaded, and to comply with road transport regulations, the Pro-side Dump would be used for the light waste fractions, including:  
- Paper/cardboard  
- Plastics  
- Glass (in small volumes) |
| **Other benefits**  |  
- Each compartment is emptied independently of the others, to prevent cross contamination.  
- Each compartment is emptied using an integrated hydraulic system, avoiding manual handling issues.  
- The emptying process is controlled via a handheld wireless remote control. |
| **Other information/comments** |  
- Pro-Tainer offers the Pro-side dump in various configurations including up to eight compartments.  
- Pro-Tainer offers various other containers and trailer systems that may be suitable for construction waste.  
- Pro-Tainer should be contacted to discuss specific requirements.  
- Compliance with UK Highways Regulations would need to be confirmed prior to use in the UK. |
Construction Waste – Call for Information

Identification of current options for the collection and on-site processing of site waste

- Do you want to highlight your construction waste, collection or processing systems in front of key potential customers?
- Could you use the opportunity to take part in two major research studies that will form essential reference documents for the Construction and Waste Management Industries?

WSP Environmental Ltd has been commissioned by WRAP (Waste & Resources Action Programme) to research and report on currently available options for mobile waste processing systems and collection containers focusing on non-inert construction, demolition and excavation waste. Research will include the identification of existing options, followed by a number of demonstration trials and case studies that will critically appraise and highlight selected equipment.

The reports will be widely publicised, representing a significant marketing opportunity for equipment manufacturers and waste management companies to achieve high level recognition of their products by decision-makers.

With the ever-rising cost of waste disposal becoming an ever-increasing burden to all construction contractors and more clients and specifiers needing to comply with requirements for on-site waste management processes, these reports will form a crucial early part of their planning operations.

If you want to take part, please contact Michael Berney now on 0161 886 2682 or email details of your products to Michael.Berney@WSPGroup.com
Appendix G - Questionnaire

Innovative Collection Techniques for Construction, Demolition and Excavation Wastes

WSP Environmental Ltd. has been commissioned by the Waste and Resources Action Programme (WRAP) to investigate containers for the collection and transport of Construction, Demolition and Excavation (CD&E) wastes for processing off site. In particular, the study aims to highlight innovative containers and collection techniques that promote efficiency and minimise material degradation.

The report will be widely publicised, offering a significant marketing opportunity for equipment manufacturers and waste management companies wishing to show-case their products. The project also offers the opportunity for four exemplar products to be selected for detailed case studies, which will be publicised alongside the final report.

WRAP has selected your company as a supplier of relevant waste collection containers, and we would be grateful if you could complete the following questionnaire in order to outline the capabilities of your product.

SECTION 1: Company Details

<table>
<thead>
<tr>
<th>Company Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year Company Established:</td>
</tr>
<tr>
<td>Name of Contact:</td>
</tr>
<tr>
<td>Position in Company:</td>
</tr>
<tr>
<td>Telephone No.:</td>
</tr>
<tr>
<td>Email Address:</td>
</tr>
</tbody>
</table>
SECTION 2: Waste Collection Container Details

2.1 Product name: _______________________________________________________

Product dimensions: Length (metres) __________________________________________

Width (metres) ___________________________________________

Height (metres) ___________________________________________

Product weight (tonnes): ________________________________________________

Waste storage capacity (m$^3$): ____________________________________________

Compaction ratio (if applicable) ____________________________________________

2.2 Please detail the materials that the product is made from:

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

2.3 Which of the following waste materials can be placed into the container? (Please tick all that apply)

- Ceramics
- Metal (Ferrous)
- PVC Piping
- Carpet/textiles
- Metal (Non-ferrous)
- Roofing felt
- Electric cabling
- Plasterboard
- Tarmac/asphalt
- Fibreglass
- Plastic
- Timber
- Glass
- Polystyrene
- Vegetation/organics
- Paper/cardboard
- Pallets (wood)
- Brick/rubble/soil

(Please include details if the container is particularly suited to the storage of specific materials):

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

![WRAP Logo](image)
2.4 Which of the following waste types must not be put into the container? (Please tick all that apply)

- Heavy materials [ ]
- Hazardous wastes [ ]
- Inert waste [ ]
- Light materials (paper etc.) [ ]
- Liquid wastes [ ]
- Non-inert waste [ ]
- Bulky materials [ ]
- Vegetation/organics [ ]
- Other (Please define other waste types/specific materials):
  ____________________________________________
  ____________________________________________

2.5 Does your product enable the segregation of waste streams on site? If so, how is this achieved? (Please tick one and comment if appropriate) YES [ ] NO [ ]

Comment: ____________________________________________________________
  __________________________________________________________

2.6 How does your product preserve the quality of waste materials for recycling? For example, how are materials protected from water and other contamination?

________________________________________________________
  __________________________________________________________

2.7 Please explain any additional measures that could be taken to help preserve the quality of materials placed into the container? (For example, can you fix plastic covering, sheeting, doors or roofs to the container to prevent contamination? Is sheltering the container the only option?)

________________________________________________________
  __________________________________________________________
  __________________________________________________________

2.8 Is the container able to accommodate any pre-treatment machinery (such as a shredder, compactor or waste separation equipment)? If so, please give details of how this can be achieved.

_______________________________________________________________________________
SECTION 3: Your Product in Action

3.1 Has your product been used previously in the UK? (Please tick one) YES □ NO □
(If ‘No’, please go to question 3.4. If ‘Yes’, please continue)

3.2 Please provide details of completed projects where your product has been used previously in the UK. (Please add any additional details, comments or further examples in Section 7, if applicable)

<table>
<thead>
<tr>
<th>PROJECT NAME</th>
<th>DATES WHEN PRODUCT WAS USED (MM/YY – MM/YY)</th>
<th>LOCATION (TOWN, COUNTY)</th>
<th>MATERIALS COLLECTED</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

3.3 Do you have case study information regarding the performance of your product during previous UK projects? (Please tick one) YES □ NO □

3.4 Is the collection container or system currently being used in the UK (please tick)?
   YES □ NO □ (If ‘No’, please go to question 3.6. If ‘Yes’, please continue)

3.5 Please give details of projects where your product is currently being used in the UK:
(Please add any additional details, comments or further examples in Section 7, if applicable)

<table>
<thead>
<tr>
<th>PROJECT NAME</th>
<th>DATES WHEN PRODUCT WAS USED (MM/YY – MM/YY)</th>
<th>LOCATION (TOWN, COUNTY)</th>
<th>MATERIALS COLLECTED</th>
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</tbody>
</table>
3.6 Would you be willing to show-case your product through a case study? (Please tick one)

(Please Note: WSP Environmental will require access to an active site using your product to review the container process) YES ☐ NO ☐

SECTION 4: Practical Aspects of Collection Technique

4.1 Is your product available for: (Please tick all that apply)

Sale ☐ Short term rental (<1 month) ☐ Long term rental (> 1 month) ☐
Lease ☐ Other (please define): ____________________________________________

4.2 Please indicate the fee charged to customers for purchase/rental of your product: (Please state the fixed price if appropriate, or the range of prices usually charged)

Cost to Purchase Product: £ _________________________________
Cost of Short Term Rental: £ _________________________________ per week
Cost of Long Term Rental: £ _________________________________ per week
Cost of Lease: _____________________________________________
Other: ____________________________________________________

4.3 Please indicate how the container is transported to the site (specific vehicle requirements) and how the container can be moved whilst on site (specific vehicle requirements).

Transport to site: __________________________________________
Movement on site: _________________________________________

4.4 Please indicate the necessary infrastructure requirements for the installation of your product at the construction site: (Please tick all that apply and add details if possible)

Level surface ☐ Power cables ☐ Drainage facilities ☐
Shelter from weather ☐ Protection from soil/dust ☐ Space around container ☐
Ladders/ramps/raised platforms for placing materials ☐
Additional requirements/details: __________________________________________
___________________________________________________________________
4.5 Please detail the following logistical costs associated with your product: (Please add comments if you would like to expand on your answer)

- Logistical cost of container transport for installation: £/mile __________________________
- Logistical costs associated with maintenance: __________________________
- Logistical cost of container transport for removal: £/mile __________________________
- Comments: _____________________________________________________________________

4.6 For mechanised products, please provide details of the necessary fuel/power requirements for operation of your product:

- Fuel Type: __________________________
- Fuel Consumption per tonne of input materials processed: _______________________
- Electricity Requirements (Specify required current/voltage): _______________________
- Recommended power source: __________________________
- Electricity Consumption per tonne of input materials processed: _______________________

4.7 How many people in total are required to install your container, and over what period of time? _______________________________________________________________________

4.8 Is any training needed or skill required to install the container on site, and if so, what?

____________________________________________________________________________

4.9 Please indicate the labour costs associated with installation of your product:

- Training Cost per Person: __________________________
- Labour Cost per Person for Product Installation: __________________________

4.10 How many people are required in total to operate your product?

________________________________________
4.11 Please indicate if there are any unusual techniques necessary for using the container or collection technique effectively on site? (For example, specific mechanisms to release loads or particular ways of loading the container to maximise efficiency or ensure appropriate weight distribution) ________________________________________________________________  
__________________________________________________________________________

4.12 Is any particular training needed or skill required to operate the container on site, and if so, what? ________________________________________________________________  
__________________________________________________________________________

4.13 Please indicate the labour costs associated with the operation of your product:  
Training Cost per Person: ________________________________________________  
Labour Cost per Person for Product Operation: _______________________________

4.14 Please detail the likely maintenance costs to the user during the lifetime of your product:  
(Please add comments if you would like to expand on your answer)  
Maintenance costs (£/tonne input material processed): _________________________  
Comments: _______________________________________________________________

4.15 If applicable, please outline any other specific/unusual requirements associated with the installation, operation and maintenance of your product:  
__________________________________________________________________________  
__________________________________________________________________________

SECTION 5: Additional Product Quality Aspects

5.1 In which situations does your waste container and its collection system excel? For example, is the system suited to small sites with confined space? Does the container deal best with certain waste streams? ________________________________________________________  
__________________________________________________________________________  
__________________________________________________________________________
5.2 Please outline the key health and safety risks to users whilst installing, operating and removing your container, and how these risks are to be minimised.

Installation risks: _____________________________________________________________
____________________________________________________________________________
How can this risk be minimised? _________________________________________________
____________________________________________________________________________

Operation risks: _______________________________________________________________
____________________________________________________________________________
How can this risk be minimised? _________________________________________________
____________________________________________________________________________

Removal risks: __________________________________________________________________
____________________________________________________________________________
How can this risk be minimised? _________________________________________________
____________________________________________________________________________

SECTION 6: Decommissioning

6.1 How long is your product guaranteed for? (Please tick one)

Less than 3 months □  7 - 12 months □
3 - 6 months □  13 - 18 months □
Other: (Please specify) ________________________________________________________

6.2 Is this guarantee dependent upon the operators agreeing to certain conditions of use? (Please tick one) YES □  NO □  (If ‘No’, please go to question 6.3. If ‘Yes’, please give brief details of the conditions) _____________________________________________
____________________________________________________________________________

6.3 What procedures are in place to ensure appropriate decommissioning and disposal of your product? _____________________________________________________________
6.4 What costs are associated with the decommissioning of your product? (Please include details of the labour, transport and disposal costs)

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Many thanks for taking the time to complete this questionnaire.

SECTION 7: (Optional) Please use the space below to add any additional thoughts, comments or suggestions that you feel would be beneficial to this project.
www.wrap.org.uk/constructionmrf