

CONSTRUCTION WASTE MANAGEMENT AND RESOURCE EFFICIENCY

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ABSTRACT

Construction activities such as new builds, maintenance and refurbishment have a major environmental impact due to the use of primary resources and the creation of large quantities of waste. Construction sustainability challenges resource efficiency, which means great care must be taken to select the most appropriate material.

Sustainable construction should consider using secondary materials, re-use on-site and off-site where possible, recover the material and reduce disposal of construction materials to landfill.

Using products made from recycled materials in construction projects is becoming common practice. For instance concrete can be produced from recycled aggregates, timber from refurbishment, demolitions and general projects can be used as biomass and recycled into other products such as chipboards, fences, mulches, tables, benches.

This paper highlights the main activities that Gateshead Council is taking to recycle construction wastes, comply with its duty of care requirements, improve its environmental performance and contribute to a sustainable society.

Keywords: Construction waste, Sustainability, Construction waste management

1- INTRODUCTION

Sustainable construction should consider the short and long term of environmental, social and economic impacts of construction. Environmental impact in construction can be reduced by considering sustainable procurement, re-use and recycling of construction materials and reducing waste.

In 2007 DEFRA (Department for Environment Food and Rural Affairs) reported that the construction industry used 400 million tonnes of solid materials in the UK each year, but

only two-thirds of this is added to the building stock, the rest is sent directly to landfill (Defra, 2007)

The construction industry since then has been encouraged to tackle the problems by reducing waste, using material more efficiently, and collecting and recycling the waste in a responsible way e.g., using reliable waste contractors.

Construction Services is part of Gateshead Council's Local Environmental Services. It provides services such as housing improvements, public building repairs, maintenance, highways and street lighting maintenance. The construction service separate their construction and demolition waste at their own licensed waste transfer station before further recycling and final disposal through a waste broker. Only a small proportion of construction waste goes to landfill.

This paper highlights the main activities that this Construction Service is taking to recycle construction wastes, comply with duty of care requirements, improve environmental performance and contribute to a sustainable society.

2- CONSTRUCTION WASTE

Construction and demolition materials are classed as waste until they are fully recovered. Same as the other type of waste, the construction wastes are subject to waste management and must follow requirements of duty of care.

Waste and Resource Action Program (Wrap) report indicates that the volume of non-inert waste (such as cardboard and plastic packaging, plastic products, wood, insulation, ferrous and non-ferrous metals, ceramic materials and bio-organics) disposed to landfill is still high (WRAP, 2009). This could be because the construction, demolition and excavation waste are predominantly inert. According to survey only 4% of the construction and demolition and excavation waste arising in England is non-inert (WTR4, 2011) Due to small quantity compare to inert waste, construction managers often fail to arrange for any type of segregation for non-inert waste on site. This type of waste generally ends up to mixed waste skip and dispose to landfill.

The construction waste may consist of following materials:

- Inert waste such as concrete, bricks, soil, gravel, sand, tiles and ceramics, glass
- Non hazardous waste such as timber, plastic, ferrous and non-ferrous metal, paper, gypsum and tarmac
- Hazardous waste such as asbestos, fire alarms, construction waste contaminated with hazardous materials
- Waste Electrical and Electronic Equipments (WEEE) such as street lightings

The following materials must also be considered as waste:

- Un-used materials and off-cuts
- Damaged materials and products
- Packaging products

3- SUSTAINABLE CONSTRUCTION MATERIAL

Organisations such as BRE (Building Research Establishment) continually research for improvements in the durability and sustainability of commonly used material in construction such as metal, timber and concrete.

Using primary sources (natural source) to manufacture the required products for construction means more and more natural sources are being used. Sustainable construction material challenges the use of secondary (recycled) material instead of primary resources. Where the

end products using secondary material demonstrate the adequate technical specification required by the product liability then natural resources can be reserved for future.

4- CONSTRUCTION AND DEMOLITION MATERIALS AT GATESHEAD COUNCIL

Constructions projects including decent homes, public buildings, road repairs and maintenances are the source of construction waste at Construction Service. The Gateshead Council is aiming for all council homes to meet Decent Homes Standard by 2020. To encourage the use of more sustainable transport, the pedestrian needs including disabled user and better roads are prioritised in the Councils sustainability targets at Vision 2030 (Vision 2030, 2012). These will produce continuous construction and highways waste for the coming years and therefore improve the recycling and diverting construction waste from landfills a priority.

4-1 Current Activities

There are two licensed Waste Transfer Station (WTS) available to handle construction and highways waste materials: Shearlegs Road and Cowen Road waste transfer stations. The following waste materials are permitted at Shearlegs Road WTS:

- highways waste such as concrete, brick, tarmac, soil, and street lighting
- Mixed construction waste
- Timber
- Plasterboard
- Window glass
- Cardboard
- Polyethylene
- Metal

Cowen road WTS is only designated to accept concrete, soil, and tarmac waste.

The Construction Services has to ensure that the waste materials are handled, recovered, recycled, and disposed according to the legal rules and regulations.

4-2 Mixed Waste

Separation at source is an efficient way of dealing with mixed construction waste. However, because of space restriction, health and safety reasons, and neighbourhood welfare, this is not always practical.

Where allocating containers at site is not an option, the mixed waste will be removed and delivered directly from sites by Construction Service transport. The arrangement will be made between the project manager and Construction Service for the waste to be collected as soon as practical on the same day. The mixed construction waste will be transferred to Shearlegs road WTS where the mixed waste will be tipped off in the allocated area. The waste later will be segregated into different materials such as timber, metal, electrical, and cardboard and will be transferred into provided containers. The remaining waste will be transferred into the provided mixed waste skip. This skip will be removed by the waste contractor to their own waste transfer station. About 98% of material in the mixed waste container will be retrieved for further recycling, and only 2% will be landfilled. Table 1 shows an example of type and quantity of waste material in a mixed waste container. Figure 1 also shows the percentage of each material in a typical construction mixed waste container.

Table 1. Typical waste materials and quantity in a mixed waste skip.

Waste	Tonnage – May 2012	Tonnage – August 2012
Wood	8.15	9.76
Cardboard	0.3	0.36
Plastic	5.42	6.5
Metal	1.36	1.62
RDF	1.79	2.15
Landfill	0.32	0.38

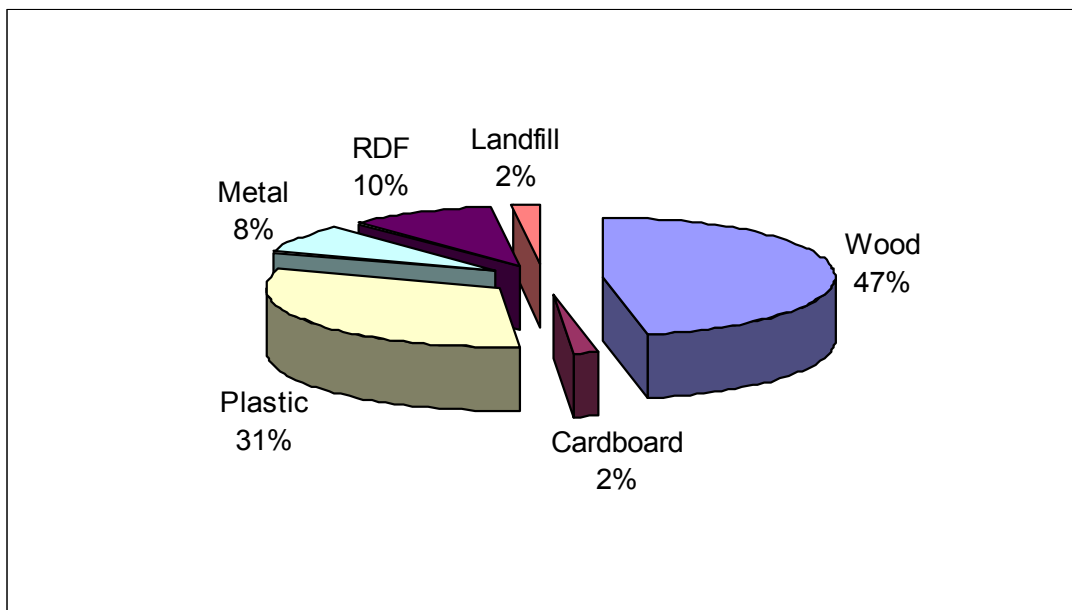


Figure 1. Percentages of waste in a mixed waste skip (May 2012).

Segregation of all recoverable materials, reuse and recycle them will help maximise efficient use of resources. For instance wood can be reused as floorboards, fences, benches, etc, or recycle to panel products or biomass by chipping the timber.

Processing ferrous and nonferrous metal scrap into secondary raw material and then into new products is a £5.6 billion industry in the UK alone (BMRA, 2012).

In the UK over 5 million tonnes of plastic are used each year (BPF, 2012). Recycling plastic materials provide a suitable source of raw material to plastic industry, it consume less energy than producing a new polymer, and significantly reduces the environmental impacts caused by plastics being sent to landfill sites. Plastics from construction projects can be recycled to new products such as pipes, plastic pallets, fence, damp proof membranes, plastic rails, and traffic cones and bollards.

The material suitable for RDF (Refuse-Derived Fuel) from construction waste provides valuable source of combustible components. These materials which also called residual waste used to be landfilled in the past and are mainly biodegradable waste such as paper, wood, plastic, and food waste. The residual waste now will be shredded and dehydrated to produce RDF as waste to energy source.

Cardboard are produced on construction site as packaging materials. Cardboard packaging can be recycled at paper mills to new paper and cardboard, can be composted, or shredded into animal bedding, and use as fuel at waste to energy facilities.

4-3 Plasterboard

Plasterboard is commonly used construction material made from the gypsum and paper. Due to contribution to acid rain by producing hydrogen sulphide gas, plasterboard and gypsum products are banned from mixing with biodegradable waste in the UK. However instead of disposal in a separate cell at landfill sites it can be recycled in the manufacture of new plasterboard or for agricultural soil treatment (WRAP, 2012). To get 100 % of plasterboard recycled the Construction Service separates the plasterboard in a designated skip at the Shearlegs Road waste transfer station. The nominated waste contractor removes the skip and transfers it to the plasterboard recycling facilities.

4-4 Inert Waste

Inert material makes up the bulk of construction and demolition waste. Correct handling and reducing contamination will enable the high grade application of inert waste materials. Segregation of all inert materials will help maximise efficient use of these bulk materials. Inert materials will be delivered to Construction Service waste transfer stations facilities and will be kept segregated before collected by waste contractor. The following inert materials are accepted:

4-4-1 Concrete

Concrete waste mainly is from resurfacing the concrete roads, maintenance of pavement, and drainage works. The concrete waste will be bulked up in the designated area of the waste transfer station before collected by the waste contractor. Concrete will then be crushed into different aggregate sizes. Large crushing machines with adjustable jaws can grind concrete to small pieces of aggregates (Figure 2). The crushed materials will be used as sub-base, as aggregate for new concrete, or as gravel for landscaping.

The British Standards Institution has created dedicated National Guidance Documents European Standards. These recommend ranges and limiting values of categories for UK use. They also provide information for most general uses of aggregates in the UK and make additional requirements and recommendations for particular end uses. Copies of the National Guidance Document can be ordered from the British Standards Institution website (BSI, 2012).

Construction Service purchases crushed concrete as sub base aggregate from the waste contractor in a reduced price as part of the contract. Figure 3 shows the amount of concrete waste delivered to Shearlegs Road waste transfer station in period of one year. In total, 2000 tonnes of recycled aggregate are used by the Construction Service for the same period of time.

4-4-2 Tarmac

Tarmac waste will be produced during resurfacing the roads and other related works. Tarmac waste will be bulked up at designated areas of waste transfer stations. The waste then will be removed by the appointed subcontractor for further recycling. The recycling process is to crush down the tarmac waste to be used in a product called “bitufoam”. This is a blend of carefully combined recycle aggregates bound together by a “foam” of bitumen and water. This is a controlled physical and chemical process providing high quality products suitable to be used on road network (Roadston Group Ltd, 2011).

4-4-3 Soil

Waste soil, if is not contaminated, can commonly be used as topsoil, for landscaping, at quarries and landfill industries, and agriculture. The waste soil will be removed by waste contractor and after screening will be re-used at various projects.



Figure 2. Concretes crushed in to different size of aggregates.

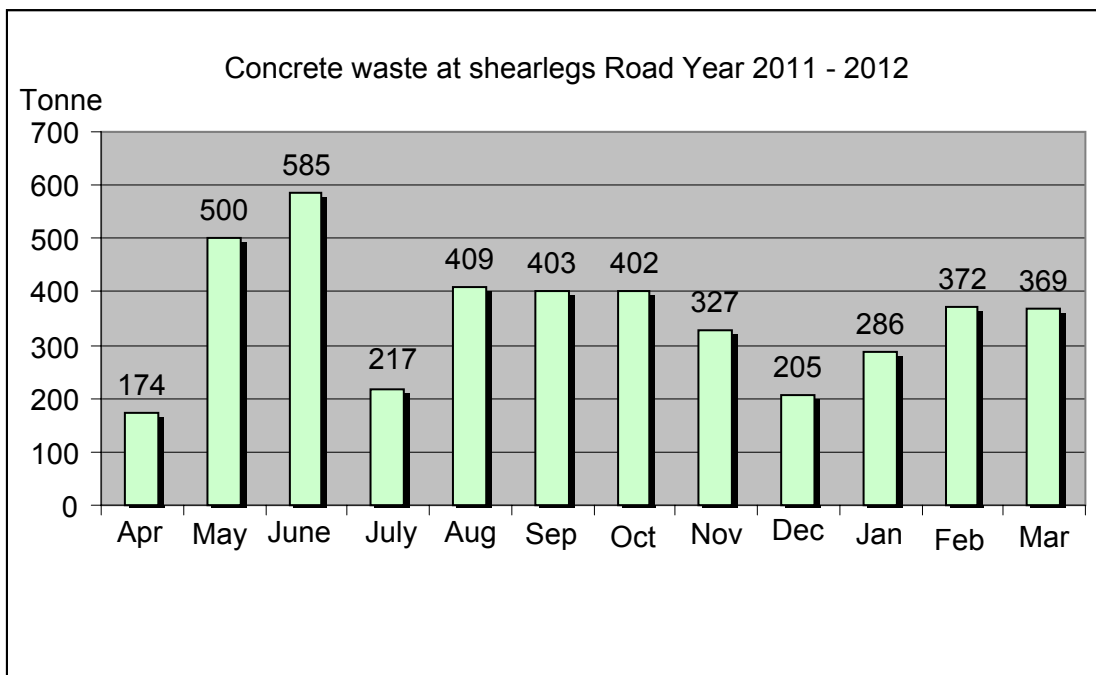


Figure 3. Waste concrete

4-4-4 Glass

Glass waste can be crushed and used as sand or cement replacement. It can also be melted to be used in new glass production. At Construction service waste transfer stations window glasses from construction will be collected in a skip and will be sent for recycling process. Figure 4 shows that recycling rate at Construction Service Shearlegs Road WTS increased from 68% in year 2000 to 98% in 2012, which shows 30% improvement.

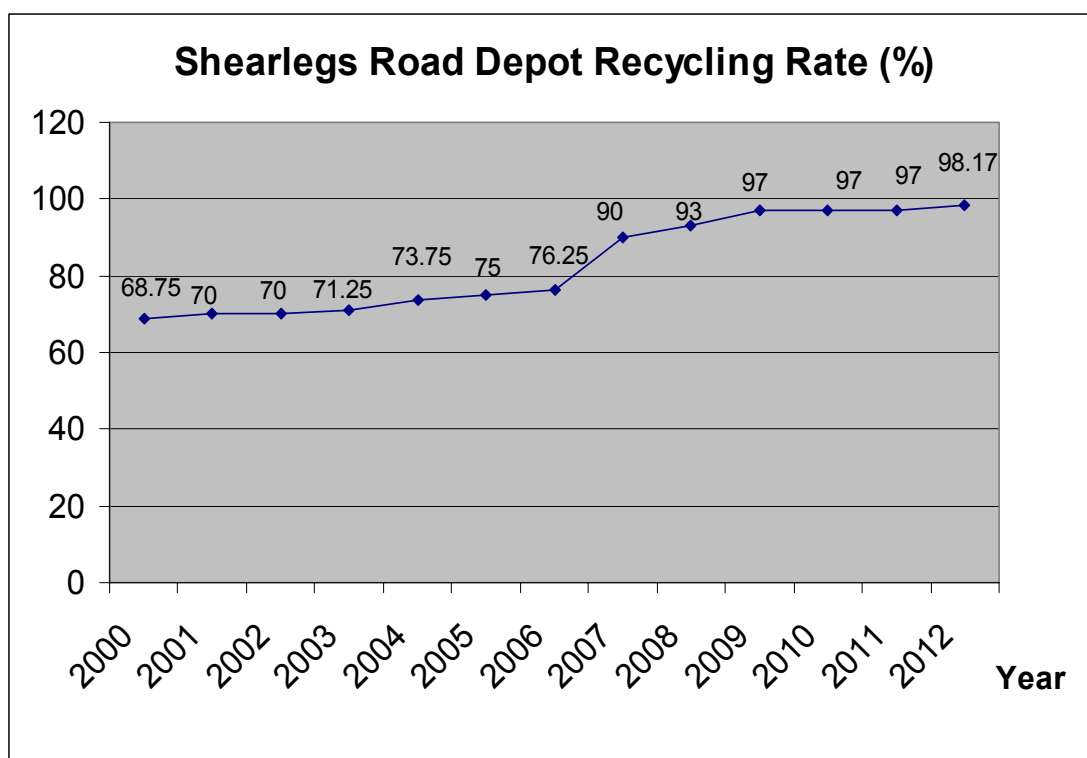


Figure 4. Overall recycling rate for construction waste at Gateshead Council – Year 2000 to 2012.

4-5 Construction Materials Recycling Rates

Increasing recycling and re-use within construction industry will help resource efficiency, maintain sustainability and recover some burden on landfill sites. Various methods have been developed for recycling building materials, from concrete to most common recyclable material such as scrap. The current recycling rate for different construction and demolition material at Shearlegs Road WTS is shown on Table 2.

Table 2. waste materials and recycling rate at Shearlegs Road WTS

Waste Material	Allocated facilities	Recycling rate
Mixed construction and demolition	Skip	98%
Soil and stone	Bay area	100%
Concrete	Bay area	100%
Tarmac	Bay area	100%
Timber	Skip	100%
Metal	Skip	100%
Plasterboard	Skip	100%
Glass	Skip	100%
Cardboard	Container	100%
Polyethylene	Container	100%

5- CONCLUSION

Reducing construction waste is a goal which supports sustainable construction in England. The successful prevention, improved recovery and recycling is a key to achieve government target to halve the construction waste to landfill. It is expected that waste and recycling sectors, with support from the government, employ advanced technology and equipment, and invest on automated equipments to provide cheaper recycling services. They also are required to improve health and safety in waste and recycling centres, and continuous effort on good practices.

The Construction Service will continue to improve its performance by encouraging the motivation of staff, promote and training, continues awareness, and seeking competitive market for better recycling.

To decrease amount of non-inert waste to landfill the following measures could be considered by construction sectors:

- To segregate non-inert waste on site where possible
- To prepare Site Waste Management Plan (SWMP) or similar documents as a requirement for better waste management on site.
- To get advice from regulatory and advisory sectors and other organisations to improve their waste management and resource efficiency.
- To comply with producers responsibilities and requirement of duty of care.
- To adopt take back scheme for surplus material and certain type of packaging such as pallets.
- To avoid purchasing over packaged materials.
- To reclaim and reuse of non-inert materials such as timber
- To select waste facilities which are handling and recycling non- inert waste as well as inert waste.

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