

Towards Net-Zero Construction and Demolition Waste

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Introduction

Most of the attention focused on green building seems to be paid to energy efficiency, and perhaps water conservation, if the publicity given to green buildings in the media is used as a yardstick. And while those are necessary and critical components, other equally important issues such as waste reduction should not be overlooked, even though it may not be as 'trendy' as energy efficiency.

In the current economic and environmental market, business owners along the entire value chain are increasingly becoming aware of the necessity for savings and cut backs, but many remain unaware that choosing creative waste management solutions can lead to significant cost savings and add significantly to the triple bottom line.

Waste is defined in the National Environment Management: Waste Act as:

"Any substance, whether or not that substance can be reduced, re-used, recycled and recovered –

- a) That is surplus, unwanted, rejected, discarded, abandoned or disposed of;
- b) Which the generator has no further use of for the purposes of production;
- c) That must be treated or disposed of; or
- d) That is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector; but –
 - (i) A by-product is not considered waste; and
 - (ii) Any portion of waste, once re-used, recycled and recovered, ceases to be waste."

Construction waste, which is classified under general waste, and is defined as "*waste, excluding hazardous waste, produced during the construction, alteration, repair or demolition of any structure, and includes rubble, earth, rock and wood displaced during that construction, alteration, repair or demolition*" (DEA 2012), is just that: a waste of raw and often scarce materials; a waste of energy; a waste of chemicals and additives; and a waste of human resources. In reality, it represents a waste within the three pillars of sustainable development, namely, economic feasibility, social wellbeing, and environmental stewardship.

The purpose of this chapter is to provide information and methods to clients, developers, contractors, and professional service providers of construction and demolition projects to assist in reducing the amount of waste generated during the entire construction and demolition process.

Reducing waste demonstrates corporate responsibility, provides compliance with green building requirements, and ultimately reduces project costs.

Overview of the problem

Municipalities are required to report, inter alia, on their waste management practices in terms of the Waste Act (No 59 of 2008). Waste information must be reported to the National Waste Information System (SAWIS) and must include data on the quantity and type or classification of waste generated, stored, transported, treated, transformed, reduced, re-used, recycled, recovered and disposed of.

The third national baseline study reported that South Africa generated approximately 108 million tonnes of waste in 2011 with 98 million tonnes of this landing up in landfill sites (DEA 2012). Of the total waste generated about 59 million (55%) tonnes is general waste, 48 million tonnes (44%) is currently unclassified, and about 1 million tonnes (1%) is hazardous waste (DEA 2012). Only about 10% of the total waste generated was recycled in 2011 (DEA 2012).

There are five broad categories of municipal solid waste (SAWIS 2014):

- i) Biodegradable waste: food and kitchen waste, green waste, paper, etc.
- ii) Recyclable material: paper, glass, bottles, cans, metals, certain plastics, etc.
- iii) Inert waste: construction and demolition waste, dirt, rocks, debris, etc.
- iv) Composite wastes: waste clothing, polystyrene, waste plastics including toys, etc.
- v) Domestic hazardous waste and toxic waste: medication, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizers and pesticide containers, batteries, shoe polish, etc.

Three types of waste dominate the total general waste stream: non-recyclable municipal waste (35%), construction and demolition (C&D) waste (20%), organic waste (13%), and metals (13%) (DEA 2012).



Figure 1: Example of construction waste on a typical construction site

One of the main impacts of landfilling is air pollution from landfill gas (CSIR 2011). Typically landfill gas comprises of about 50 – 55% methane, 40 – 45% carbon dioxide (both of which are greenhouse

gases) and the remainder to complex organic compounds that do not compose, some hydrogen sulphide and other sulphide compounds (CSIR 2011).

Landfill development, operation and closure can be costly. Poor landfill operations are often ascribed to insufficient resources including funding allocations (CSIR 2011). While the development and operation of landfill sites is costly, there are also costs related to closure and rehabilitation of such facilities. The impacts of a landfill site on the environment do not cease at the end of its operational phase: the landfill needs to be rehabilitated to minimise impacts, while landfill gas and leachate may need to be continually monitored for years after.

Depleting natural resources together with the environmental impacts of waste and the diminishing capacity of landfills is increasing the need for reduced waste generation (CSIR 2011).

Overview of the South African policy environment

Waste in South Africa is currently governed by means of a number of pieces of legislation, including:

Table 1: Legislation impacting on waste management in South Africa

Legislation impacting on waste management in South Africa	Impacts on construction
South African Constitution Act (No 108 of 1996)	Right to an environment that is not harmful to health or well-being, and to protection of the environment by preventing pollution and ecological degradation, promoting conservation, and securing ecologically sustainable development and use of natural resources
Hazardous Substances Act (No 5 of 1973)	Controls substances which may cause injury or ill-health or death because it is toxic, corrosive, an irritant, or strongly sensitising or flammable
Environment Conservation Act (No 73 of 1989)	Provides for the protection of the environment, control of environmental pollution, and control of activities which may have a detrimental effect on the environment
Occupational Health and Safety Act (No 85 of 1993)	Provides for the health and safety of persons at work and the health and safety of persons in connection with the activities of persons at work
National Water Act (No 36 of 1998)	Contains a national water resource strategy including for the classification of water resources and resource quality objectives, pollution prevention, the general use of water and permissible water use
The National Environmental Management Act (No 107 of 1998)	Provides for co-operative environmental governance and for the enforcement of environmental management laws
Municipal Systems Act (No 32 of 2000)	Provides for the core principles, mechanisms and processes that are necessary to enable municipalities to move progressively towards the social and economic upliftment of local communities including, inter alia, access to essential services

Air Quality Act (No 39 of 2004)	Provides for the protection of the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development, providing national norms and standards regulating air quality monitoring, management and control
National Environmental Management Act: Waste Act 2008, (No 59 of 2008)	Adopts a waste hierarchy, promotes cleaner production, waste minimisation, re-use, recycling and waste treatment, with disposal seen as a last resort

Table 2: Policies impacting on waste management in South Africa

Policy impacting on Waste Management in South Africa	
White Paper on Integrated Pollution and Waste Management for South Africa (1998)	Proposes a shift towards pollution prevention, waste minimisation, cross-media integration, institutional integration, and involvement of all sectors
National Waste Management Strategy (2011)	Sets goals and targets for the promotion of waste minimisation, re-use, recycling and recovery; ensuring the effective and efficient delivery of waste services; growing the contribution of the waste sector to the green economy; creating awareness; achieving integrated waste management planning; ensuring sound budgeting and financial management; providing measures to remediate contaminated land; and establishing effective compliance

Towards Zero Waste: Waste management strategies

Zero waste is based on the concept that everything can be redesigned and repurposed for use by someone or something else (Environmental Expert 2014).

Table below indicates the average composition of construction and demolition waste¹.

Table 3: Average composition of C&D waste

Type of material	Percent of total solid waste
Wood	27.4
Asphalt/concrete/brick/dirt	23.3
Drywall	13.4
Roofing	12.0
Miscellaneous mixed	11.9
Metal	8.8

¹ World Wastes Magazine International Edition, publication number and date unknown

Paper	2.7
Plastics	0.5

From the above table it can be seen that the disposal of C&D to landfill sites is unnecessary.

The project below, the construction of low income houses in Kleinmond, illustrates the use of modular construction to reduce construction waste: all the dimensions of the building are based on the modular dimensions of the hollow concrete masonry block used, thereby reducing the need for cutting.

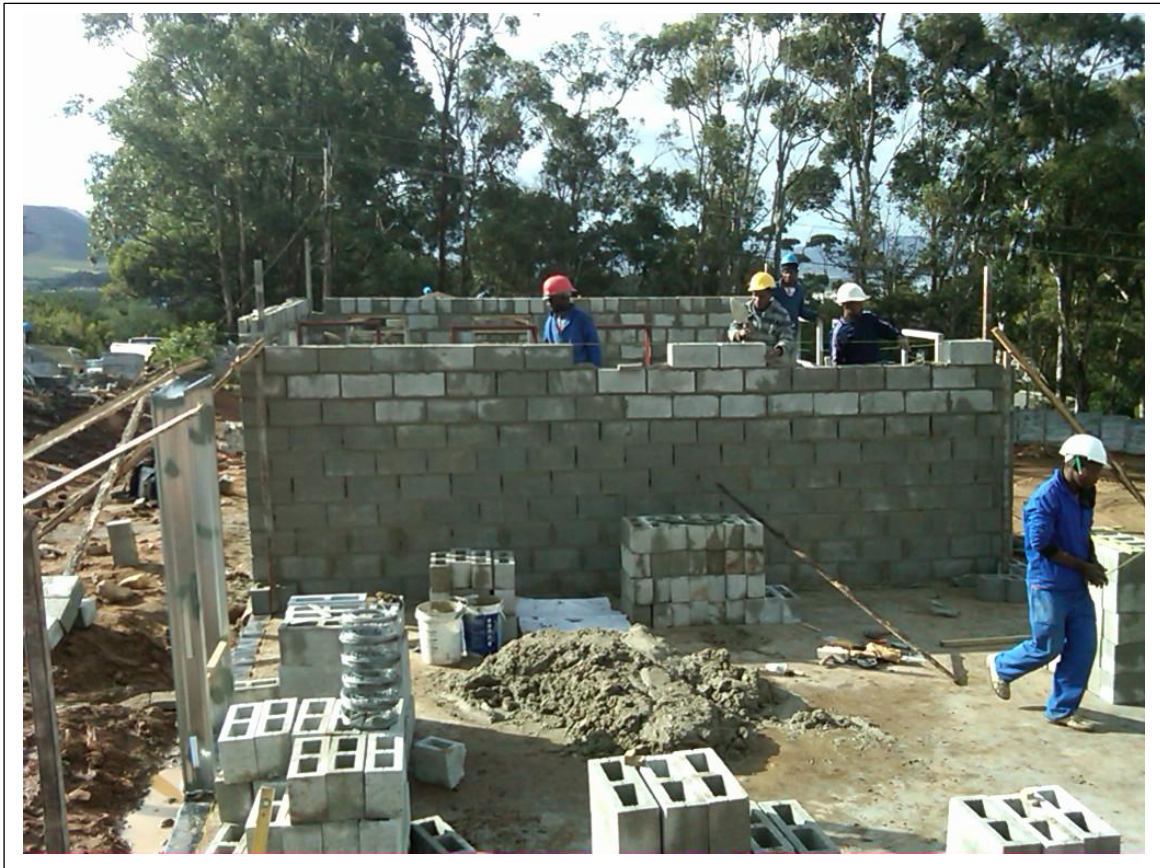


Figure 2: Use of modular construction to reduce waste

The waste management hierarchy comprises five waste management categories (SAWIS 2014):

- i) Waste prevention (reduction);
- ii) Minimisation
- iii) Re-use;
- iv) Recycling and energy recovery; and
- v) Disposal.

This hierarchy can be graphically represented as follows:

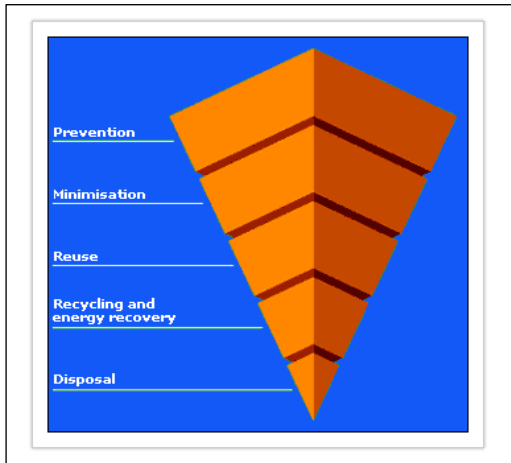


Figure 3: Waste hierarchy²

Ideally every construction project should have a waste management plan (WMP) to avoid high disposal costs, reduce the amount of material consumption, and to reuse and recycle as much of the discarded material as possible.

Waste can add to a building's cost in five areas:

- i) Original cost of material delivered to site
- ii) Labour cost associated with cutting of material
- iii) Labour cost associated with collection and storage of waste on site
- iv) Cost of removal from site
- v) Cost of managing the landfill site included in the rates account from the municipality

Implementing a waste management strategy will reduce these project costs in the short term and ultimately the environmental costs in the long term.

The following table provides goals and strategies for the building sector.

Table 4: Waste management goals and strategies for the building sector

Goals	Strategies
Prevention	Rethink design: construction materials come in shapes and sizes and any use of the material that does not work with that shape and size will result in waste. Use a modular approach to design based on the materials to be used in the construction (see Figure 2)
	Consider the use of prefabrication as greater accuracies can be achieved in a controlled, factory environment
	Wherever possible use standardised components and avoid 'one-off' product design
	Specify asphalt paving with recycled content
	Specify concrete mix containing fly ash
	Specify materials without a finish if possible: for example, epoxy coating aluminium or steel requires that material to be removed before it can be

² SAWIS, <http://environment.gov.za/>

	recycled or re-used.
	Accurate estimating and ordering will reduce waste on site
	Reduce packaging: have the material delivered wherever possible, without packaging. Where this is not possible, ensure that the packaging is collected and re-used by the supplier
Minimisation	Implement efficient material saving construction techniques
	Prepare a waste management plan for each construction project
	Store materials so they are not damaged
	Utilise excess concrete for parking stops, gutters, signage bases, etc.
	Keep Polyvinyl Chloride (PVC) cut-offs for use as drainage pipes in retaining walls
	Order materials having a recycled content
Re-use	Source salvaged materials wherever possible, and ensure that any work requiring alteration is done through deconstructing rather than demolition
	Re-use bricks, crushed concrete and asphalt as aggregate, sub-base material or fill
	Processed (chipped) wood can be used for mulch, composting bulk agent, animal bedding, and fuel
	Carpets and underlay can be re-used in the furniture industry as stuffing for sofas and chairs
Recycle	Establish an in-house recycling programme based on waste separation
	Make subcontractors responsible for their own waste
	Separate and recycle asphalt and concrete
	Separate and recycle rebar and other materials
Disposal	Make disposal the last resort for waste management

Conclusion

Construction and demolition waste is just that: a waste. The construction industry has within it the ability to significantly reduce the amount of C&D waste that lands up in landfill sites through implementing waste management strategies along the entire value chain.

The benefits of doing so will not only accrue to the project, but ultimately to generations still to come.

References

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