

Case studies to demonstrate how building design dictates waste management efficiency

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Abstract

It is widely accepted in the property industry that many facets of a building that determine sustainability and operational efficiency are set at the design phase. This paper looks in detail at the design aspects of commercial mixed-use buildings that can affect operational efficiency as costs associated with waste and recycling. Case studies are discussed comparing Green Star rated buildings in Perth, Western Australia.

In many buildings, waste management consultants are not involved in the design team or are brought in later when construction is well underway or has even been completed. Several examples of design flaws are provided in this paper to demonstrate the various operational considerations that are very commonly overlooked during building design. These common design flaws impact upon the efficiency, cost, safety and cleanliness at which waste management systems can operate within a building.

Commercial buildings contribute a high proportion (approximately 40%) of waste to landfill in developed countries. Achieving good recycling rates in buildings can represent a significant win in environmental terms; diverting large quantities of material from landfill, saving valuable resources and preventing the energy intensive extraction of new raw materials.

Waste management within buildings is generally controlled by the facilities management team. Increasingly, building owners are ensuring that efficient waste systems are not 'designed out' of their building and are requiring facilities managers and relevant consultants to be involved during the design phase.

To design a building that will have smooth-running and inexpensive waste management systems consideration will need to be given to: quantity and type of waste and recyclables that will be generated (i.e. looking at building use, hours of operation and local options for recycling of different waste streams), flow of materials through the building to the waste storage area, space requirements for infrastructure and access by collection vehicles.

When waste is not considered early in the building design, there is a loss of flexibility and a strong chance that the waste systems put in place will be more expensive and less efficient than systems that have been thought through from the start.

Building design and waste

Commercial buildings in developed countries generate approximately 40% of waste going to landfill (OECD, 2003)¹. Commercial buildings are generally centres of a relatively high density of people. Mostly, buildings have quite specific functions, generating at least a few waste streams which have the potential to be recycled relatively simply. In commercial buildings, offices generally produce 50 – 70% paper; the hospitality sector often produces over 50% food waste and a variable but generally high proportion of packaging/beverage containers (particularly glass).

Since buildings are responsible for generating relatively large quantities of waste, they have the potential to have a significant environmental impact. Waste that is generated from buildings can make up a large quantity of material going to landfill which in turn represents a loss of many resources. Organic material such as paper, cardboard and food will decompose slowly, without air in landfill which results in the production of methane, a powerful greenhouse gas.

Waste management in large residential buildings such as apartment blocks presents several challenges, particularly in terms of space. Current mixed use or residential building design focuses on: aesthetics, tenant amenity, car access, optimising the lettable area as a proportion of the gross floor area of the building and sometimes (but not always) operating costs and efficiencies. Unfortunately, building owners spend only a small amount of time thinking about operational efficiency which can ultimately damage the look and amenity of a building. Waste management is a good example of something that is generally only given a cursory consideration but which can have numerous knock-on impacts upon building operations and aesthetics.

Case study: mixed use luxury building, Perth, Western Australia

A good example of the disconnect between operational efficiency considerations and building design is given by the example of a high profile, luxury mixed use building in Perth that Encycle were asked to provide advice on in autumn 2010. Encycle were asked to develop a waste management plan as part of the Development Application for the local council. The building consists of apartments, hotels, restaurants and retail.

For the residential part of the study building, a series of general waste chutes had been designed into the building which is a great idea as this can be an efficient way of removing waste from the apartment floors. Unfortunately there was no room on the floor plate to include either a chute for recycling or space for a recycling bin store. Tenants were expected to manually take their recyclables to the basement recycling bin store.

In principle the concept of tenants taking their recyclables to the basement where they might keep their car anyway may not appear to be an imposition. However, when you apply a few of the considerations of basic human behaviour, the outlook becomes less positive for recycling within the building. Generally, people like to spend as little time as possible either thinking about or handling waste. The recyclables requiring transport to the basement are likely to be garbage bags filled with stubbies, wine bottles, paper, plastic bottles and metal cans. The bags are likely to be heavy, potentially have broken glass in

¹ Organisation for Economic Co-operation and Development (2003), Environmentally sustainable buildings: challenges and policies

them and are very likely to contain some residual liquid. Having established that the bags are likely to be heavy and probably leaking unknown residual liquid, the expectation that the tenants of multi-million dollar apartments will carry these down to the basement seems less likely. Manual handling incidents or bills to the building management for the replacement of stained clothing items are likely outcomes of tenant-transported recyclables.

In the event that the tenants do make the effort (or expect their cleaner to make the effort) to take the recyclables manually to the basement, the chances are that there will be a trail of dribbled "liquid" going through the plush carpeted corridors and in the lift along their path causing either odour and stain issues or a slip hazard on polished floors. Stains, smells and general poor aesthetics can quickly affect the rentable value of a property.

The cost of sending waste to landfill in Perth has roughly doubled in the past 3-4 years. With decreasing space available for new sites and an increasing political recognition of the effectiveness of landfill levies, it seems that costs for waste will continue to rise steadily. In buildings where it is easy to dispose of mixed general waste and difficult to recycle, it is very probable that the buildings operational costs will rise as landfill costs increase.

Access and waste collection

The exterior of the luxury mixed-use building in Perth is one of clean lines and glittering glass frontages and of high-end retail stores flanking neatly paved plazas. The exterior of this building is not one that was intended for rows of 240 L wheelie bins to be lined up for collection each day. To avoid collecting bins from the exterior areas of a building, the collection will need to take place in the basement. The design team had provided a roof height of 2.2 m for entry to the basement which is easily high enough for any of the sports utility vehicles their residents may choose to drive. The crunch comes when it is identified that most waste collection vehicles exceed 3 m in height. The inability to collect from a building basement is a surprisingly common design flaw due to inadequate access and turning circle provisions.

The local Perth council where this study building is located had already discovered over the past few years that many building design teams had not considered waste management. Consequently, the council had been required to purchase a small waste collection vehicle that can gain access to waste storage areas in awkward, space-limited locations but which is more expensive to run. Nevertheless, the council has still encountered problems with accessing building basements due to safety concerns relating to pedestrians moving around car park areas and insufficient load-bearing ramps for their vehicles, which means that their current operating procedures forbade entry to basements for the collection of waste. Even if the council did enter the basement of the study building, the design team had efficiently filled the space with rows of car parking bays which left insufficient turning circle of any long vehicle. The waste trucks could get into the building but not out again. The council told Encycle that they had tried reversing out of some buildings in the area to get around the turning circle problem but this had caused complaints about 'bleeping' reversing sirens at 4.30 am and could cause problems with traffic congestion around the building.

Operational costs

Building managers are always on the lookout for the best price for the services to their building. Waste management cost efficiencies are largely gained by collecting the greatest

quantity of material in one place and, if this is a recyclable material, with as little contamination as possible. Waste service providers generally agree that the best way to implement a cost effective and efficient system into a building is to consider equipment such as compactors, balers and large bins. Large bins or compactors require space for storage and more importantly often adequate roof height to allow vehicles to collect or empty them. Without designing for the most efficient collection systems, it is likely that multiple small bins which take up valuable space and are charged by the collection companies on a lucrative 'per lift' basis will be placed in the building.

Planning, monitoring and continuous improvement

Although the operational systems of a building will not require monitoring until they are actually up and running, it is still important to plan to measure and monitor the quantities and costs of waste from the outset. Most buildings have inefficient waste systems simply because no-one has any idea how much is being spent on waste or what the recycling systems are (or aren't) achieving. It is fairly common for waste costs to be seen as 'fixed' and that nothing can be done to reduce the budget required for waste. However, there are often various ways of improving waste and recycling spending through both behaviour change campaigns and equipment or system changes.

Communication: staff, tenants, clients, public

Whether tenants in a building are commercial or residential, there is always the challenge of effective communication and establishing systems for simple, intuitive use. Building managers often feel that with a few bin labels, it is so obvious how to use the bin system, that they don't need to communicate with the people who are intended to actually use the waste disposal and recycling systems.

Classic examples of unhelpful signage include:

- "Recycling" – which is all very well, but there is no indication about what actual materials this includes or doesn't include!
- "Plastics only" – does this include cling wrap, milk bottles, computer keyboards, paint tubs?

There is an aspect of behavioural psychology that needs to be considered when planning types, 'look' and locations of bins. The first rule is that people will generally place materials in the closest bin to them. It is important to make sure that the closest bin to through traffic is a general waste bin. When people put items into bins they are thinking about: their meeting in 5 minutes, the report they're writing for the boss, what they're going to have for lunch, whether the girl/guy in accounts was making eyes at them, is it going to rain later or any number of things *other* than the act of putting something in the bin. Placing an item in the correct bin generally isn't a priority in someone's thought process. If people will give up 5 seconds of their thought processes to placing something in the correct bin then the chances are that they will probably move an extra metre along to the correct recycling bin; but only if it's blindingly obvious that they should choose to do so by having clear, accurate and meaningful signage.

Placing recycling bins singly in areas where any other sort of waste might be generated will mean that the bin gets seen and used as a bin. Having the word 'recycling' on the front of it

will not encourage most people to keep hold of their rubbish until they hunt down a general waste bin.

Summary

Efficient operation of a building needs:

(Depending on waste streams generated)

- Access to basements or back of house bin stores – clearance heights (both travel and operational), adequate weight bearing floors and turning circles for collection vehicles
- Options for suitable collection of materials in a cost effective, safe and efficient way (e.g. compactors for cardboard – can save space and probably get a rebate for the material)
- Local government collection – often cost already included – will they enter basements/ have a set of keys to access lockable areas

By not really considering the full impact of how waste is managed in a building it is likely that the design team will inadvertently wreck their beautiful building by ending up with rows of bins lined up by the front door.