

**SUSTAINABLE CONSTRUCTION:  
REDUCING THE IMPACT OF CREATING A BUILDING**  
**Kelly Taylor, Waitakere City Council & Michael Field, North Shore City Council**

**ABSTRACT**

In 2006 Waitakere City Council's Cleaner Production Team embarked on a Sustainable Construction project utilising the well tested model of industry-based initiatives. So often the emphasis is placed on 'Sustainable Design' and reducing the running costs and therefore the environmental impact of running and maintaining a building – but what about the impact of the construction phase? The mountains of solid waste tossed in a rubbish skip, the concrete wastewater, the paints and other hazardous substances?

Kelly Taylor and Michael Field report on the work undertaken to date drawing on examples from Waitakere City Councils own construction projects as well as commercial construction projects and the current development of North Shore City Council's "Green building."

**KEYWORDS**

Construction and demolition, waste, pollution prevention.

**INTRODUCTION:**

It is apparent that "Green" or "Sustainable" Buildings are getting a great deal of press, both within New Zealand and internationally. There are many frameworks in existence that assess and measure the overall impact of a building, materials used, design aspects and energy efficiency, literally hundreds, but very little emphasis on the process followed to manage the environmental impacts of the construction process itself. Not only is there little focus on this aspect, but there is also a distinct lack of tools, systems or training that enable a construction company to identify, let alone manage these impacts effectively.

With these issues in mind, an industry-based research project was initiated by Waitakere City Council, with support from URS New Zealand, to look at all of the possible issues associated with environmental site management, what the "pain points" were for construction companies and how these could be overcome. This paper lays out the research finding and recommendations, as well as drawing on current difficulties being experienced by North Shore City Council with their upcoming new "Green Building".

**SO WHAT ARE THE ENVIRONMENTAL IMPACTS OF CONSTRUCTION?**

Solid waste is quite possibly the largest environmental impact of the demolition and construction phases in building projects. Construction and demolition (C&D) waste is a significant portion of the New Zealand waste stream, making up 17% (by weight) of waste disposed to landfill<sup>1</sup>. However, of the waste generated by this industry it is in fact estimated that this represents only 20% of the full picture, as 80% of C&D waste is sent to cleanfill. When cleanfill disposal is taken into consideration, C&D waste can be estimated at around 50% of all waste generated in New Zealand. The Ministry for the Environment (MfE) identified C&D as a priority waste in the New Zealand Waste Strategy document (2002) and has set a reduction target of 50% for C&D waste to landfill by 2008 representing approximately 270,000 tonnes per annum; a hefty target for industry and government to aspire to!

The main categories found in the C&D waste stream consist of timber, concrete and rubble and plasterboard, so by no means a highly toxic waste stream, but it is the sheer volumes produced that merit attention to this industry. In Waitakere City C&D waste represents 17% of the waste stream entering the transfer station and of that C&D waste more than 80% of it is destined for landfill.

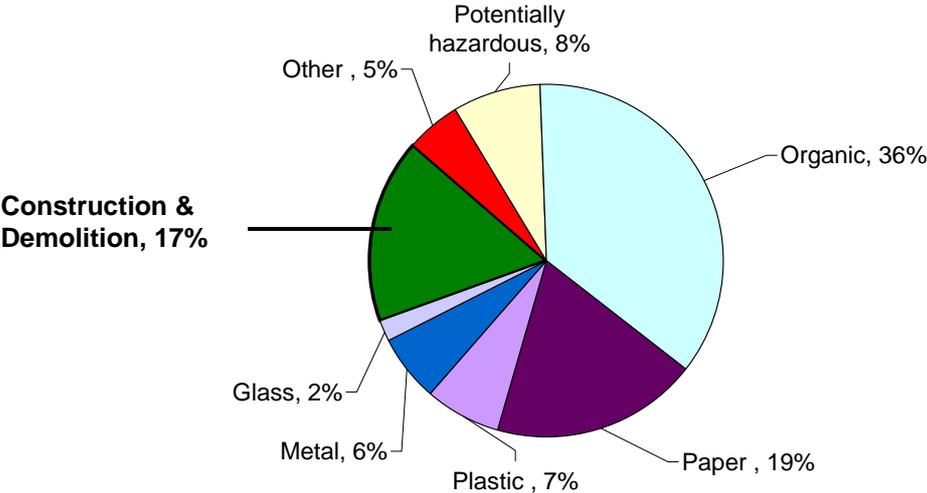


Figure 1: New Zealand Waste Stream Percentages  
 (Source: Ministry for the Environment, National Waste Data Report 1997, [www.mfe.govt.nz](http://www.mfe.govt.nz) )

One of the other key impacts of the construction phase is the potential for pollution, and in particular, water pollution through the stormwater system. The primary risk to water, during the construction phase, is associated with the earthworks and therefore includes sediment pollution and pollution from concreting activities. Secondary risks associated with construction activities include the use of paints and other hazardous substances and materials. Without going into detail here, these activities and substances can have, even in small quantities, significant effects on stream quality and native aquatic ecology; fish, invertebrates and aquatic plants.

In 2005 Waitakere City Council’s Water Quality Technician proposed that a ‘Cleaner Production: Concrete Industry Project’ be developed in response to the large number of incidents relating to concreting activities in the Waitakere City Council area. This project was undertaken in 2005-2006 with good buy-in from industry, and identified the need for a wider project that combined the concerns

regarding C&D waste with pollution prevention on construction sites. Concrete wastewater, sediment and paints rank in the top five reported pollution incidents in Waitakere City (based on Auckland Regional Council Pollution call-out statistics since 1 January 2003). These concerns coupled with the significant solid waste stream from the industry mean the potential for environmental impacts is large.



*Figure 2: A typical concrete pollution incident on a construction site – Waitakere City 2006*

#### **WHAT IS THE CURRENT SITUATION:**

There are a number of “ad hoc” environmental actions already occurring in the industry within Waitakere City and from our experience with the Sustainable Construction project, we have drawn some broad conclusions about the drivers behind these actions.

**Conclusion 1:** Where an environmental action will make money it will happen.

A good example of this is the recycling of metals. Metals are one of the few ‘wastes’ that is recycled on most sites because they are a valuable and viable recycling resource that provides a financial benefit to the construction company.

**Conclusion 2:** Where an environmental action is highly visible or has political implications it is likely to happen. This explains why a number of construction environmental management case studies, currently available in New Zealand are based on the construction of government or large multi-national companies buildings. This can relate to both pollution prevention and solid waste reduction.

**Conclusion 3:** Where the risks associated with an environmental action not occurring are large and the chances of getting caught are also high, it is likely to happen. For example, pollution prevention initiatives will occur where the risk of fines or prosecution is significant and higher than the cost of preventing the pollution in the first place.

So given those conclusions one might be led to think that there are already some good drivers in this area and a reasonable amount of good practice must already be occurring. This is, unfortunately, not the case and the following discussion around these conclusions identifies why the current drivers are not enough to prompt any significant action.

## **UNDERSTANDING BUSINESS DRIVERS:**

Firstly, it is important to understand business drivers, in order to understand impact responsibilities. Let's look at why businesses exist in the first place. Simply put, businesses exist to provide goods or services in exchange for profit. Sure, it is understood that some have higher values and greater goals than this, but predominantly this is the driving factor. In all fairness, doing business at a loss isn't particularly sustainable.

### **Goods and Services = Profit**

If we consider sustainability or reduced environmental impact as a service and add this to the business model, it will equal profit, so why do we seem to believe we should get this for free?

The simple fact is that not many environmental initiatives in construction make money and most struggle to break even when time and labour are considered, hence conclusion 1 does not prompt significant action. Any costs associated with business initiatives needs to derive income. If this is not acknowledged, current practice will continue. Unfortunately, many construction firms, it has been found, tend to opt for the concept of "what they don't see won't hurt them" and anything that can be hidden on a site tends to be. This can include issues, from real life examples, ranging from the filling in with concrete of uncovered church catacombs to the flushing of concrete spills with large volumes of water to 'hide' the spill; this alone enormously increases the environmental impact of the original spill.

Currently, the only real disincentive in place is fines, but on most construction projects the value of fines received is vastly outweighed by the increase in productivity, early finishing bonuses and the cost to deal with an issue correctly. Conclusion 3 therefore is not a strong enough driver for the industry.

Many organisations, including councils, have opted for working with the construction companies on a voluntary basis, trying to influence them towards best practice without providing them with any monetary incentive to do so. This approach has extremely limited effectiveness and will not 'stick' once the company moves onto the next site, where business as usual will return.

So, with this in mind, we need to understand how we, the consumer, can influence business decisions and delivery.

We think it is, by now, fairly clear that environmental sensitivity requirements need to be built into a construction project from the concept stage. They need to be built into the tender documentation, to allow companies to price these additional requirements and then embed them into the contract requirements. This is, in and of itself, not enough to see these impacts correctly mitigated on site and a truly collaborative approach is required, working closely with the construction company to provide expertise and advice, especially with councils who have environmental and waste specialists available. It is not reasonable to expect that a company, whose main aim is to construct buildings, has this expertise in-house. This approach will allow both the council and the construction company to learn from one another.

## **CONSTRUCTION PROJECT EXAMPLES:**

### **Waitakere City Council's new Civil Defence Headquarters**

Waitakere City Council commenced construction of their new Civil Defence Headquarters in early 2007. Waitakere City Council's standard physical works contract was put in place and the construction company was approached to look at waste reduction and pollution prevention after the construction had commenced. The company was open-minded and had some good initiatives already in place including using broken rubble as backfill around the external walls and recycling of metal. This is, however, common practice and mainly related to the cost savings.

Resources, tools and training were given to the construction company on waste minimisation and environmental management of construction sites. However the company was reluctant to put time into any initiatives, as could be expected when these activities were not included in the contract. It was also stated during the presentation that they were more likely to cover something up and continue with site works if it wasn't clear who was responsible for paying for the downtime associated with stopping work to investigate issues arising. Given the topic of the presentation which the company was receiving, this confirms our earlier thoughts and conclusions.

The key lesson from this project was that the construction companies need to allow the time required for environmental protection when tendering for contracts. It is to be expected that a similar outcome would be experienced if these initiatives are introduced after the tender process, as a request, rather than a requirement that can be allowed for. As the old adage states "time is money" and it certainly holds true for the construction industry.

### **Waitakere City Council approaches to Residential Building Companies**

Over a period of three months in late 2006 the Waitakere City Council Cleaner Production team and Eco-Design Advisor visited seven residential building companies that operate in Waitakere City. These were informal meetings to gauge interest on eco-design and sustainable construction ideas, and were followed up with the provision of information on the areas of interest.

It was found that there was an openness to these ideas within the industry and a number of the companies had good initiatives in place already such as sorting of waste materials at a central yard, use of low toxicity paints and provision of environmental protection during high risk activities such as earthworks and concreting. A joint presentation was developed on eco-design and sustainable construction in response to a request from one company wanting their key staff to hear these environmental messages. This was presented and then offered to the other companies that had been visited; however only one other company took this offer up.

Generally, although there was an openness on the part of the building companies, they did not see a demand for eco-design principles to be offered as 'standard'. They believed they were already doing what was necessary for pollution prevention and did not fully understand, or see the opportunities in waste reduction.

The key lesson here is that although there is a willingness in the industry to look at environmental considerations, the key drivers are not yet in place for this to occur automatically. Additionally there is still a lack of understanding in some key areas such as solid waste.

### **North Shore City Council Example**

North Shore City Council has specified a minimum 4 Star New Zealand Green Building Council 'Green Star' rating for the new Council building annex due to start in 2008. This was specified during the tendering process, which is a good start, although as the author of the tender documents was unsure of wording, it was actually specified as "Green Building 4", which I'm sure led to some confusion.

It has been found, however, that a very close working relationship must be formed with the construction company in order to move forward and achieve the specified standard. Unfortunately, as the Green Star tool is relatively new to New Zealand, there is a lack of expertise and understanding within the construction industry on how to effectively use this tool. This can lead to a number of problems, one of which is price hikes, where a contractor, having no experience to base pricing on, may price items far above their actual cost.

It has also been found that some items, that would be expected to be included within an original quote, such as construction environmental management planning, are often put forward as a variation to contract and additional funds sought and although it is fair and reasonable to expect an increase in cost, for meeting this standard, it is important to closely manage what you are being charged additionally for.

Often Green Star assessment tools are also only used after the design process has finished to assess how well it did, rather than being used in assisting the architect or designer in how they go about the design process itself, as the tool is designed to do. It has been found, through these initial stages, that offering our own internal expertise, from waste minimisation to sustainable construction, is likely to greatly increase the overall outcome of this project.

### **A WAY FORWARD:**

As a result of recent experiences Waitakere City Council is currently focussing on how to incorporate 'Sustainable Construction' into its own construction contracts through a formalised system. Although there will be no gains in the short-term from this approach it is hoped that once this system is in place every construction project funded by Waitakere City Council will show good gains in the areas of construction waste reduction and pollution prevention.

There are a number of key elements to this approach, firstly is a requirement for the Tenderer to complete an environmental assessment at tender stage for the council to gain an appreciation of the understanding and willingness of the tenderer to consider sustainable construction initiatives. This would be evaluated in the assessment of tenders along with other factors such as price. Next is a requirement for the successful tenderer to submit a Construction Environmental Management Plan (CEMP) for approval. The successful tenderer would be given a CEMP template which is heavily

weighted towards waste reduction and pollution prevention. The CEMP would then be monitored through the existing processes such as regular site visits by Waitakere City Council's representative. The performance of the contractor in relation to the CEMP would then be reported on contract completion.

## **CONCLUSION:**

As has been demonstrated through our experiences, it is extremely important to follow some basic rules when looking to reduce the impact of construction and demolition projects.

Rule 1: Make sure that sustainability requirements are included in all tender documentation, allowing those tendering to allow for any costs required and that the successful contractor understands these requirements and is willing and able to meet them.

Rule 2: If contractors do not have the relevant internal resources, which is more likely than not, there are two options open to you; either the contractor will need to subcontract a relevant professional or internal resources must be made available to them.

Rule 3: It is important to make sure a close working relationship is possible with the successful contractor, allowing issues to be openly raised and discussed and solutions found.

Rule 4: A CEMP is essential to identify all impacts associated with the site and this should be collaboratively developed.

With these basic areas being covered, the ability to run a construction or demolition site in a sustainable manner is quite possible. The contractor will be contractually obliged to engage in the process, but more importantly, will have known this was a key performance indicator for the client from day one, allowing them the opportunity to not tender for the work, should this not appeal to them. It also sends a clear message to the industry, "sustainability is important to us" and this, especially within the government and public sectors can significantly drive change in the way projects are undertaken, as well as up-skilling the industry to meet this growing demand.