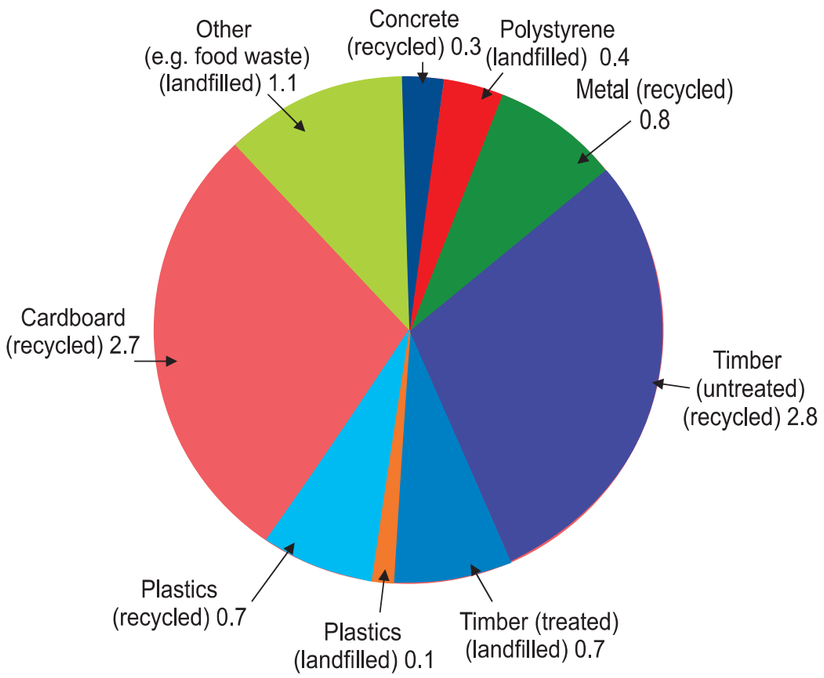
Waste Summary and KPIs

Total waste weight	1.69 tonnes
Kilograms per 100m² floor area	1,182 kg/100m²
Total volume of waste	9.5 m³
M3 recycled/reused per 100m² floor area	5.1 m³/100m²
M3 landfilled per 100m² floor area	1.6 m³/100m²
Percentage recycled/reused/stockpiled for recycling	76%
Percentage to landfill	24%



Future Plans – Golden Homes

- Golden Homes have developed a waste policy to address construction waste from their sites. They have set targets for waste minimisation and are aiming for 85-90% recovery of materials from a new house construction.
- As part of their waste strategy, Golden Homes are developing signs to educate sub-contractors and the public about not putting unauthorised waste in their construction skips.
- Golden Homes are currently reviewing their contracts with their sub-contractors to include waste management goals.
- Golden Homes are talking to their skip provider about providing a lockable lid for the skip.

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Waste

Waste is the unusable part of the manufacture and construction process and occurs with both recyclable and non-recyclable materials and products. According to the Ministry for the

Environment[1], New Zealand disposed of 2.5 million tonnes of waste to landfill in 2011; however, the proportion of metal waste is small and between 2002 to 2004 and 2007 to 2008, the metal content in landfill has decreased from 6 to 4%. In contrast, timber content in landfill amounts to 11%, with rubble amounting to 16% (e.g. concrete, rocks, etc.).

Steel construction leads to minimal waste because:

- All scrap steel in factory production is recycled.
- The quality of the steel is not reduced by the recycling process.
- Globally, 85% of steel in demolition projects is recycled[2].
- Steel is easily recovered by magnetic separation.
- Pre-fabrication of building components means that waste on site is greatly reduced.
- Water use is minimised by 'dry' processes and water is recycled where used in manufacture.

Steel wastage is minimised by the efficient use of materials. In factory production, all steel offcuts and drill swarf are sent for recycling back into new steel components. In comparative studies conducted by the SCI that considered the urban impact of utilizing off-site technologies, it was shown that waste reductions of approximately 70% were possible with off-site light steel modular construction compared to traditional on-site construction.

On some large building projects, off-cuts of plasterboard are collected and returned to the producer for recycling. This is important because steel and plasterboard are used as synergistic materials in many forms of lightweight construction. Steel cladding and steel components can also be disassembled and re-used in the future. An example is in light steel modular construction, where the asset value of the modules is maintained.

Offsite

Construction on confined urban sites presents developers with various challenges including:

- the lack of working and storage space
- the need to minimise the impact of all aspects of the construction work on the local residents
- the shortage of skilled labour for site construction.

Recent experience in the UK with modern methods of construction has demonstrated that these challenges can be met by replacing a high proportion of site-intensive activities with off-site manufactured light steel components. For example, two dimensional panels and three dimensional modules are delivered on a 'just-in-time' basis to suit local conditions and require no storage space on site.

In terms of urban disruption, it was shown[3] that the nuisance and inconvenience caused by construction can be significantly reduced by the use of pre-fabricated light steel and modular solutions. Not only do such methods transfer much of the construction off-site, but they also significantly reduce the construction time, thereby limiting the inconvenience caused by site traffic, deliveries, waste clearance and general construction activities.

[1] Ministry for the Environment, Solid Waste Composition Report Card, *http://www.mfe.govt.nz/environmental-reporting/waste/solid-waste/composition/*, accessed April 2013
[2] Sustainable steel – At the core of a global economy, worldsteel, *http://www.worldsteel.org/*, Brussels, Belgium, 2012, p40
[3] Urban impact case studies – Final project report. SCI RT1098, Steel Construction Institute, Ascot, UK, 2006.

Speed of construction

The findings of the SCI study[3] supports the widely-held view that off-site construction is significantly faster than traditional construction. As part of the study the construction of three schools was considered and, through the use of off-site light steel technologies, the construction programme for one school was reduced from 76 to 54 weeks; this is equivalent to a reduction in the total construction period of 29%, which agrees well with a time saving of 25% evaluated from an independent study conducted by the National Audit Office (NAO)[4].

The speed of off-site construction was also highlighted by two light steel modular building projects considered in the study. In these cases, fully-finished modules arranged in sets of five modules per storey per block were utilised. Each set of five modules was installed on site in a single day with, on average, less than a week before the installation of the next storey.

Site activity and transport of labour

The six sites visited during the SCI study were noticeably quieter than traditional construction sites, with fewer people working on site. The comparative study quantified the level of site activity by estimating the total amount of site labour (in weeks). The study suggested that a reduction in site labour of approximately 75% is possible with modular construction (which further confirmed the findings of the NAO report). This is highly beneficial to the local residents in terms of the general level of site activity (less noise, dust and general disturbance) and the number of vehicles travelling to and from the site on a daily basis and needing somewhere to park during the day.

Commercial vehicle movements

Where a construction site is located in a residential area, an important source of nuisance to the local residents is the traffic associated with the construction work. This traffic includes deliveries of materials, collections of waste and deliveries and collections of items of plant. The use of prefabricated panels or modules reduces the number of material deliveries, which can be timed to suit local conditions and construction requirements. For example, in modular construction, modules are delivered at a rate of up to ten modules per day, avoiding peak times. The comparative study conducted by the SCI3 estimated a reduction in commercial vehicle movements of 40% for modular construction, if the modules were fully fitted out prior to delivery to site.

Requirements for working and storage space

A further advantage of off-site construction is the reduction in the amount of storage and working space that is required. This is made possible by the use of 'just-in-time' deliveries and the practice of unloading panels and modules directly off the lorry into their final position on the building. The study found that removing the need for scaffolding on site is extremely beneficial in this respect. The reduction in the required working and storage space is a critical factor when building in urban locations, as it permits new buildings to be constructed on small plots of land, often sandwiched between existing buildings.

Case Study - Target Sustainability House Builders Project – Golden Homes[5]

About the Project

Company: Golden Homes

Project: Dampier St, Christchurch

House size (floor area): 143m²

Building type: Brick cladding, steel frame

Waste contractor: Budget Bins and Tri Bro Bins

Sorting site: Reworks and Becon Canterbury

[2] Using modern methods of construction to build more homes quickly and efficiently, http://www.nao.org.uk/wp-content/uploads/2005/11/mmc.pdf, National Audit Office, 2005, Accessed April 2013

Target Sustainability House Builders Project, http://www.targetsustainability.co.nz/CaseStudies/GoldenHomes.pdf, Christchurch City Council, 2009

Introduction to the Project

Golden Homes signed a Memorandum of Understanding with the Christchurch City Council to participate in the Target Sustainability House Builders Project. The objective of the project was to reduce solid waste going to landfill and cleanfill from new house construction. The project also aimed to test the REBRI (Resource Efficiency in the Building and Related Industries) guidelines and to develop measure-to-manage tools and key performance indicators for new house construction.

Golden Homes chose one construction project on which to identify opportunities to reduce waste to landfill and cleanfill and apply the REBRI Guidelines and measure-to-manage tools. The house was a 3 bedroom, brick clad, steel frame, single storey house.

Waste Reduction Initiatives

The majority of waste was sorted off-site due to limited space on-site for waste sorting. Golden Homes did the following onsite to try to minimise the amount of waste going into the skip and to maximise the amount of waste that could be recovered off-site:

Used 'speedblock' for the foundation. This type of concrete foundation block creates no boxing waste.

- Kept timber off-cuts in separate piles for reuse on-site.
- Used steel framing. Off-cuts of steel framing are currently more easily recycled than treated timber framing.
- Gave three bags of Pink Batts insulation to the house owner who used the Pink Batts to insulate the ceiling of another house.
- Returned brick pallets to suppliers for reuse instead of disposing of them in the skip.
- Left excess bricks on-site for the owners to use for a barbeque.
- Left excess paint on site for the owners.

Waste Sorting

Space on house building sites is often limited. Therefore, the use of skips and off-site waste sorting was considered to be the best option. Budget Bins collected one 7 cubic metre mixed skip, 1/3 full, for materials sorting at Reworks. Tri Bro Bins collected one 7 cubic metre mixed skip for materials sorting at Becon.

The sorting sites recorded the waste composition in the skips by doing a visual assessment when they were emptied at the sorting site. They sent this information to Golden Homes using a simple data collection sheet. The composition and destination of the waste in the skips is shown below .

Once at the sorting sites, the material from the mixed skips are separated (e.g. cardboard, plasterboard, metals and plastic). The sorting sites provided information on the materials that were recovered for reuse and recycling.

The Key Performance Indicators (KPIs) for the house build project are shown below. 76% of the waste material in the skips was reused or recycled. The main material that was landfilled was fly tipped materials, mainly food/green waste (included in the pie chart as "Other")

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