

Practical Demonstrator 7

Demolition of 4 buildings in the UK

IDEA

The main idea is to demonstrate continuous improvement towards resource efficiency in UK demolition projects by tracking progress towards sustainable best practice on six individual demolition sites from different eras. The purpose of selecting buildings from different eras is to identify the relative recyclability of materials and the capture of resources from building products used at the time of construction.

RESULTS

- Reduction of GHG emissions: 100%
- Reuse and recycling of waste: 99%
- Reduction of freshwater utilisation: 100%

PARTNERS

Remade South-East Ltd. (UK)

Centro de Estudos, Informação e Formação para o Ambiente (PT)

Bauserve (DE)

Wilding Butler Construction Ltd. (UK)

University of Southampton (UK)

About ZeroWIN

Project Motivation

Waste prevention has been assigned the highest priority under European waste management law. However, the initiatives which have been taken so far have not reduced the regular increase in total waste arisings across Europe.

Goals

The ZeroWIN project develops innovative approaches and effective strategies for the prevention of waste in industrial networks based on industrial symbiosis. Expected results are a reduction of at least 30% of greenhouse gas emissions, 70% of overall re-use/recycling of waste and 75% of fresh water utilisation.

Consortium

The ZeroWIN consortium has 30 partners from 11 countries (AT, DE, ES, FR, HU, IE, PL, PT, RO, UK, TW), dominated by industry – 6 large companies (one of which is the electronics cluster in the Basque region) and 10 SMEs.

Project Facts

Coordination: SAT

Consortium: 30 partners from 11 countries

Duration: May 1, 2009 – April 30, 2014

Budget: 9.5 Mio. €
1. Introduction

Practical Demonstrator 7 is intended to demonstrate continuous improvement towards resource efficiency in UK demolition projects by tracking progress towards sustainable best practice on six individual demolition sites. The resulting improvements will be measured to demonstrate that the ZeroWIN project targets for the reduction of water, energy and materials use have been met.

This practical demonstrator has been divided into two delivery stages:

- Gathering baseline data from practical examples of demolition practices
- Implementing improvements that will meet the ZeroWIN targets through innovative best practice

For each stage baseline data will be collected from three building eras:

- Pre 1950
- 1950s to 1980s
- 1980s to present day

The purpose of selecting buildings from different eras to conduct the two delivery stages of practical demonstrator 7 is to identify the relative recyclability of materials and the capture of resources (materials and embedded carbon) from building products used at the time of construction.

2. Implementation

Five Prevention Practices – From the company to the network level

Process design vs. network design

In terms of process design practical demonstrator 7 has focused on the deconstruction process undertaken to dismantle buildings. The recyclability of buildings depends on three main factors: the era the building was built, the care and time taken to deconstruct the building and the availability of local end markets to recycle and reuse waste materials.

The two factors that relates the most to this practice is the care and time taken to deconstruct the building and the availability of local end markets. To maximise the process design for deconstruction the demolition contractors have been assisted to undertake pre-demolition audits to identify materials that are easily reusable or recyclable. This has changed the way the building is deconstructed to gain the most reuse and recycling value.

Work has also been undertaken to identify end markets for difficult to recycle materials from demolition sites. These tend to be co-bonded materials that fuse metals, plastics and insulation materials. So companies have been brought into the network that can recycle PVC plastics and insulation material.

Input substitution vs. primary resources substitution

There is a great reuse potential for waste materials generated from demolition projects that can assist other construction project to reduce their primary resource use. The careful deconstruction of a building can result in bricks, blocks, metals, ceramics and wood being made available to reclamation, salvage and reuse operations who then supply those materials to the construction industry.
Plant improvement vs. network infrastructure improvement
The use of efficient and sustainable plant can reduce carbon emissions and resource use on site. For example there are generators and machinery like forklifts and diggers that run on bio fuel instead of diesel. This reduces the depletion of fossil fuels and reduces the emissions from the generator. The use of large mortar mixing silos on site instead of mixing by hand can reduce the amount of water consumed and reduce the amount of waste produced.

Good housekeeping vs. cooperative network responsibility
The same training modules from practical demonstrator 4 "Resource Efficiency Construction Networks in the UK" are being applied to this practical demonstrator.

Regular training should be provided to subcontractors working on site to make them aware of the objectives of the industrial network and how they can help meet its targets. Health and safety tool box talks are already provided when each subcontractor starts work on site. Additional training should be provided during these sessions to explain their role within the network and to provide them with guidance about meeting "zero waste" targets.

A short 5 minute training module has been created for subcontractors involved in practical demonstrator 7 to highlight best practice in reducing energy and water usage on site. This includes advice on controlling generators, efficient use of construction plan, turning off lights and equipment when not in use, turning off taps when not in use and the use of water efficient/recycling plant on site. Also guidance is provided on waste disposal and recycling. This includes highlighting the waste materials that are being segregated, where they are being stored and the penalties for contaminating segregated waste.

Reuse, recovery & recycling vs. exchange of resources
As mentioned in the "process design vs. network design" the separation of materials on site is important to support the move towards a zero waste approach on demolition sites. This is heavily influenced by the eras the building being deconstructed was built. For example buildings constructed around 1900, up to 95% of materials are reclaimable. By 1930 the use of cement mortar, asbestos, bakelite plastics and linoleum was widespread and product re-use and recycling from these buildings is reduced to 85%. Subsequent eras saw the introduction of plastics such as PVC, co-bonded materials and plasterboard as well as more destructive demolition methods (ball and chain) which has resulted in a present day recycling rate of approximately 65%.

Metal, wood and brick

The higher the recycling rate for the eras of building the more opportunity there is to develop reuse opportunities for the materials (exchange of resources) (for example the reuse of bricks as bricks and the reuse of timber).

Industrial symbiosis is not considered in construction currently and it wasn't considered during the eras of buildings being explored in this practical demonstrator. The main issue is that companies concentrate on maximising recycling rates and profit margins from their demolition project than looking to identify local opportunities for industrial symbiosis.
Five Resource Productivity Themes – From the company to the network level

Effective resource utilization and materials efficiency
Efficient resource utilisation can be achieved by using plant and machinery that reduces the amount of water and electricity used on site. This is covered under the headings of "Reduction of water use and impacts" and "Reduction of energy consumption and greenhouse gas emission".

Reduction of process waste and enhancement of by-product values
The key to reducing process waste and enhancing by-product values is a long lead in time and sufficient time on site. On many demolition sites there is often pressure from the client to deconstruct the building as quickly as possible so the construction contractor can start the build phase of the project. A reclamation led approach should re-programme the project to allow for the increased time required for reclaiming elements of the work. While clients often require the demolition work to proceed quickly they are frequently unaware of the benefits of reclamation and the ways in which careful planning can enable it to still fit within a construction programme.

Time is also needed to identify suitable reuse, recycling and disposal routes prior to demolition starting on-site. This is important as the contractor must identify the end markets that will generate the highest income or lowest disposal cost. This lead in time is not always available due to time pressures from the principle contractor and client to remove the existing building as quickly as possible.

The more time a demolition contractor has on site the more methodically they can work to remove all the high value materials and components to achieve a high recycling and reuse rate. The introduction of pre-demolition audits will also increase the identification of waste materials that can be reused and recycled. This will reduce the amount of waste sent to landfill and increase the value of by-product materials.

Reduction of water use and impacts
The on-site training programme aims to highlight simple practices and measures to reduce the amount of water wasted on site. The effectiveness of the training is being measured during phase 2 of the practical demonstrator. There is also specific machinery available that reduces the amount of water used during dust suppression and recycles water used to wash vehicles wheels. The practical demonstrator is exploring the savings that can be achieved from using this machinery on site.

The use of recycled water and/or grey water is difficult to achieve because there needs to be a sufficient and local supply of water that can easily and cost effectively be transported to site or harvested on site.

Reduction of energy consumption and greenhouse gas emission
As above the on-site training programme aims to highlight simple practices and measures to reduce the amount of energy consumed on site.

Improvement of control of minor elements and toxic materials
As with practical demonstrator 4 the availability of space is a key barrier that prevents the segregation of waste materials on demolition sites. Many demolition sites that have limited space for waste storage prefer to use mixed waste skips as all non-hazardous waste materials generated can be placed in one skip. The skip is then taken to a materials recycling facility where it is sorted by hand or mechanically to separate the recyclable fractions. Although mixed waste skips tend to cost more than segregated skips site manager tend to prefer them as there is less handling and sorting of waste on-site.
The best way for a demolition contractor to reduce the amount of contamination in their waste materials is to segregate key materials on site. This also allows them to gain the most value from their waste to reduce disposal costs and generate income for materials like aggregates and metals.

3. Assessment

To find promising measures for waste as secondary resource for the production of basic construction materials on the one hand and the use of waste flows from demolition as secondary resources have been the core tasks of the construction and demolition studies of which practical demonstrator 7 is a part of.

Nearly all targets could be reached by the construction and demolition case studies. Especially the reuse and recycling rate was the first achieved goal by all case studies. Proper waste management strategies on and off-site enable the success on this indicator.

Most challenging was the reduction of fresh water utilisation. Direct on-site water consumption has negligible influence on the life cycle water consumption. Thus, improvements can only be achieved through material exchange or very thorough selection of products. EOL (end-of-life) related case studies could achieve the goal of reduced fresh water utilisation due to the avoided primary production caused by recycling and reuse.

Finally the most promising measures for the improvement of C&D projects in terms of greenhouse gas emissions and reduced fresh water utilisation are:

- Reuse: Reuse avoids waste as well as the production of new product. Thus, reuse is the best option to significantly reduce the environmental burden of a building.
- Metals have the highest environmental burden: Separate collection on-site is the best solution for high recycling rates
- Aluminium recycling: Common C&D waste sorting plants have a low sorting efficiency of aluminium. This must be changed as aluminium has the highest environmental burden of all investigated metals.
- Timber and paper recycling: Timber shall be recycled instead of thermally treated. Recycling leads to storage of biogenic CO₂.
- Transport efficiency: Volume reduction on-site has to be investigated in the future to reduce the transport impacts.

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