



Assessment of initiatives to prevent waste from building and construction sectors

Sustainable consumption and production, Environment

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Preface

Waste prevention has been a highly prioritised issue in both national and international waste management policies for a long time. Attention has been focused on the prevention of the main waste streams in society, and since building and construction is considered to be the largest single waste producing sector, waste prevention in this sector is prioritised. However, limited progress has been made when implementing waste prevention objectives and transforming them into practical action.

The intention of this study has therefore been to produce a catalogue of the best practices for waste prevention in the building and construction sector, and to introduce new ideas and concepts within the sector. A reference group consisting of more than 20 people (participants are listed in Appendices D) was set up for the purposes of this study. The reference group took part in all stages of the study, especially during the mapping of initiatives and presenting new ideas for future waste prevention measures.

The initiatives presented in this report can form the first step in a practical implementation of waste prevention methods and measures.

Acknowledgements

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And finally, special thanks to the reference group, without their contributions it would have been impossible to conduct the survey.

Johan Sidenmark, on behalf of the working group

Summary

The present report has identified and evaluated waste prevention initiatives for the building and construction sector. In total 32 initiatives have been identified and grouped into seven categories. The categories are:

- Reuse of building materials
- Information and awareness campaign
- Waste prevention guidelines
- Voluntary agreements
- Identification of hazardous substances
- Tools for registration of non-hazardous building materials
- Certification schemes

Seven case studies, one from each category, have been described and assessed individually. The study has shown that waste prevention measures only to a limited extent appear to be an integrated part of the building and construction sector. Most of the activities named waste prevention by the stakeholders are in fact established in order to reduce landfilling. The main focuses of the activities identified by this study are related to recycling, whereas actual waste prevention is a minor part of the initiatives only.

However, there were a lot of good ideas for future actions discussed among the stakeholders (such as building and construction companies, contractors, public purchasers, designers, distributors, research organisations and governmental agencies). Hence, a chapter is dedicated to present these ideas for waste prevention practices that were identified during the mapping of initiatives.

The main part of the described initiatives is based on information tools such as guidelines, handbooks, calculation tools and checklists. The target group is primarily the building and construction sector.

Waste prevention activities that include measures to reduce the content of harmful substances in materials and products are an important aspect of waste prevention as we aim to reduce the exposure to these substances in our daily environment. Also preventing hazardous substances in materials will entail a cleaner waste fraction, which in some cases are more suitable for recycling or result in less of an environmental impact if landfilled. These activities are often integrated in other initiatives e.g. in sustainability certification schemes for buildings.

The evaluation of data and statistics turned out to be a difficult and time consuming task. Even though the quality of reported data has im-

proved a lot during recent years, data is still too fragmented to allow for a comparison between different countries due to differences in reporting systems and definitions of waste, for example the inclusion or not of soil. Prevention of soil waste is not within the scope of this report; however for Finland it is not possible to separate it from the other fractions. The data issues imply that one barrier towards waste prevention is that it is difficult to document and therefore evaluate. A combination of resource efficiency and cost saving arguments would have an effect on waste prevention especially during construction. Further work is needed on performance indicators for waste prevention from the particular industry, so that the baselines for the calculation of the effects are well defined.

The case studies demonstrate that presently voluntary measures play a leading role in waste prevention within the construction and building sector. Most of the voluntary measures are related to the elimination of hazardous substances from building and construction waste. Respondents in the study have emphasised the need for education and information amongst all actors, from the early planning stage, right through to the implementation and execution of the projects themselves.

1. Introduction

1.1 Background

Preventing waste is the action that has the highest priority under the EU's recently revised framework directive on waste¹. The Directive requires Member States to establish national programmes for waste prevention.

National waste strategies and instruments to prevent waste in the Nordic countries are compiled in a published report by the Nordic Council of Ministers (NCM, Copenhagen 2009): "Instruments for Promoting Waste Prevention and Materials Efficiency – A Nordic Review". While the report shows that there are many examples of tangible actions, it can be seen that not many of them focus on construction and demolition waste.

The construction and demolition sector is often the largest single sector waste producer with a generation of 30 % to 50 % of the total waste produced. Many successful initiatives have focused on increased recycling; hence in some countries recycling rates are up to 90-95%. However, there have not been many initiatives to prevent waste from the construction and demolition sector while there has been some focus on hazardous substances in buildings.

Waste prevention programmes range over a large variety from information campaigns to regulatory framework. However, for actual waste prevention to have a considerable effect there is clearly a need for increased awareness of waste prevention opportunities in the sector in addition to the successful recycling initiatives that exist today.

1.2 Aim of the study

The present study has the aim of identifying and prioritising initiatives that lead to waste prevention in the construction and demolition (C&D) sector.

The aim of the project is to:

- Produce a catalogue with best practices and background information
- Analyse existing prevention initiatives
- Disseminate new ideas and concepts throughout the sector
- Inspire and engage all actors within the sector

The construction and demolition sector includes in the context of this report all stakeholders that have an interest in the sector. That means

¹<http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:en:PDF>

that manufacturers of construction products, designers, users of products as well as building owners can prevent waste that is related to construction and/or demolition.

1.3 Definition of waste prevention

The waste framework directive (2008/98/EC) defines waste prevention as:

- “Prevention means measures taken before a substance, material or product has become waste that reduces:
 - a) the quantity of waste, including through the re-use of products or the extension of the life span of products
 - b) the adverse impacts of the generated waste on the environment and human health; or
 - c) the content of harmful substances in materials and products”

The definition focuses both on quantity reduction and on improvement of the quality of the generated waste. In this report waste prevention follows the definition laid out in the framework directive. The main focus is, however, on part a) and c) of the definition, namely on prevention initiatives that promote waste volumes reduction in the construction and demolition sector or that reduce the hazardous content of waste. See figure 1 for an illustration of the definition of waste prevention that has been used for the scope of this study. The scope of waste prevention includes the point of material extraction and manufacturing till the point of use and possibly reuse of the product. When the product is discarded for waste treatment, including possible recycling, waste prevention no longer applies as this is part of the waste management system.

This means that waste prevention does not include measures to divert waste from landfills or waste treatment facilities for the purpose of increasing the recycling rate. However, if materials are directly reused (e.g. doors and flooring) these materials will not be regarded as waste, but will be seen as waste prevention through extended product use.

The definition for waste minimisation is broader and includes reducing waste amounts but also recycling and other forms of waste recovery. The OECD defines waste minimisation as:

“Preventing and/or reducing the generation of waste at the source; improving the quality of waste generated, such as reducing the hazard, and encouraging re-use, recycling, and recovery.”

This report focuses on waste prevention defined in the waste framework directive, and therefore does not include waste management activities of which recycling is a part of.

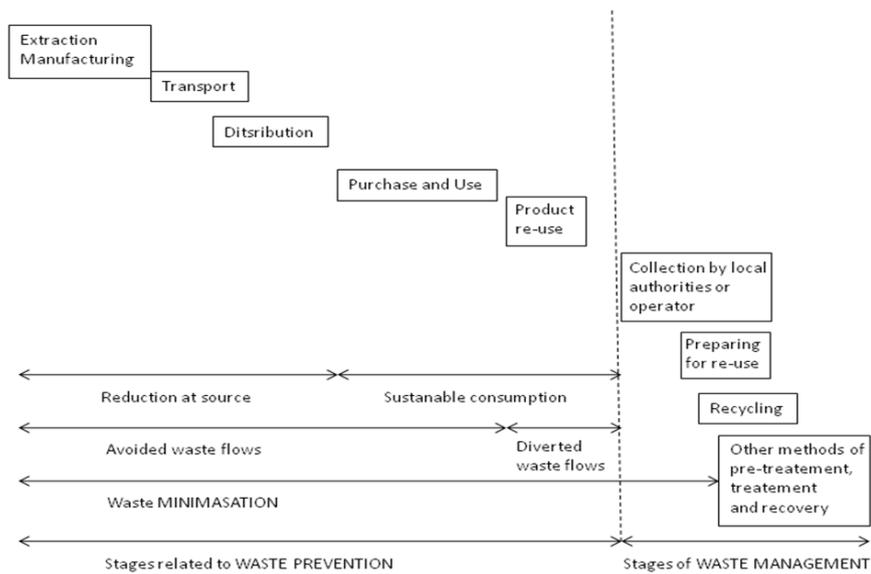


Figure 1. Illustration of definition of waste prevention. Adapted from BIO Intelligence Service, 2009.

2. Building and construction waste in the Nordic countries

2.1 Data on waste amounts and composition

Data on building, construction and demolition waste (hereafter referred to as C&D waste) for the Nordic countries are quite limited. The reporting obligations for waste producers and treatment companies are different for each country and so is the statistical system in place. This fact combined with the limited obligation to report to the EU creates a very diverse picture for the different Nordic states. Another factor that affects this is the different interpretation of the definition of this waste stream.

C&D waste generation in the Nordic countries varies a lot, see Table 1 below, starting from around 70 kg per capita in Iceland up to more than 4.5 tonnes per capita in Finland. Finland, however, also includes soil in the generation data, so the range should be much smaller since soil is (in most cases) the largest C&D waste fraction.

The differences can be explained partly by the diverse reporting or definition used (e.g. including or excluding soil), but also by waste quantities escaping the official waste management. Especially in Iceland, waste producers themselves dispose of the waste in unofficial sites or *in situ* on the construction sites. Other possible reasons are the different economic status of the countries or different construction methods and materials used: the use of more concrete or wood in construction affects the waste generated in the demolition stage.

Table 1. Generation of total C&D waste (excluding soil) in the Nordic countries in 2008.

	Total generation in 1000 tonnes 2008	Per capita generation 2008
Denmark	4048	739
Finland ²	24979	4713
Iceland	21	68
Sweden	3310	357
Norway	1500	317

Sources: ISAG from the Danish EPA, Statistics Finland, personal communication with Statistic Iceland, Swedish EPA, and Statistics Norway.

² Finland's data include soil

2.2 Data on waste treatment

The data sources used in this report include the Eurostat database and data from the countries' national Statistical Offices and Environment Protection Agencies. Moreover, during the survey we have contacted relevant people in these institutions in order to obtain additional data or specific information on C&D waste generation and treatment.

In general, the Nordic countries recycle most of the C&D waste. The inert waste has limited environmental impacts when landfilled, but the benefits of recycling are substantial especially on land use and raw material extraction avoidance. The large size of this waste stream signals that the benefits of recycling are substantial. On the other hand, recycling is promoted via fiscal measures such as a landfill tax.

The level of recycling in the Nordic states should therefore in part be ascribed to economic incentives and in part to environmental ones: taxes on landfilling are in place in the Nordic countries, although there are differences among them. However, so far no concrete indication has been developed for the type or quality of recycling to be applied. The quality of recycling depends on the environmental value of the recovered product. For example, since a significant part of C&D waste is soil, landscaping, soil cover for landfills or use on site in building foundations are considered as recycling activities, although the benefits for displacing virgin soil are not very high. On the other hand, recycling of metals yields high environmental benefits stemming from the high burdens associated with the production of virgin metals.

Less information is available regarding other treatment options. However, it seems that landfilling is preferred mainly for fractions such as asbestos and soil that cannot be recycled easily. On the other hand, although incineration is applied widely in most countries, there are not many combustible fractions in C&D waste, hence incineration is limited.

Detailed data and statistics on the amount of waste and the type of treatment applied can be found in Appendices B and C.

3. Waste prevention in the building and construction sectors

3.1 Review of literature on waste prevention

The revised waste framework Directive requires the Member States to create national waste prevention programmes by December 2013. Therefore, waste prevention of construction and demolition waste is high on the agenda. However, several countries and regions have been working with waste prevention plans for C&D waste for a number of years including Austria and Finland (BIO Intelligence Service 2009).

The EU Commission has developed guidelines on waste prevention programmes and published in 2009 a number of good practises for waste prevention (BIOIS, 2009). Some of these focus on C&D waste.

In the UK, WRAP (Waste & Resources Action Program) has developed a guideline to eliminate or design out waste (EU2009a). An NGO in Hungary has developed a website that allows users to exchange and resell used construction materials (EU2009b). WasteCap Resource Solutions (a nonprofit organization that helps companies reduce and recycle nonhazardous solid waste and buy recycled-content products) in the USA provides planning, technical and educational assistance during construction and demolition projects (EU2009c). These initiatives will be further described in section 4.5.

The Danish EPA published in 2010 a catalogue of ideas for waste prevention. The catalogue focuses on the initiatives different stakeholders can take and includes 6 initiatives that could be taken by the stakeholders in the building and construction sector. Furthermore, a number of more general initiatives concerning the prevention of C&D waste can be undertaken by the municipalities or the state. A number of relevant initiatives will be described further in section 4.2. The catalogue also links to the earlier discussions in Denmark on waste prevention in 1999-2000. Waste prevention was a main target in the national waste management plan 1998-2004 (Affald 21) (Miljø- og Energiministeriet 1999).

In Sweden stakeholders in the building and construction sector (Bygg-sektorns Kretsloppsrad) voluntarily agreed on an environmental programme ("Byggsektorns Miljöprogram") in 2003. One of the main focus areas was to reduce hazardous substances in building materials to a minimum (Boverket 2004). In the long run this initiative will prevent

generation of hazardous waste. Another focus area is efficient use of materials (Kretsloppsrådet 2010).

The Swedish authority for urban planning, urban development, construction and housing (Boverket) recommended focusing more on waste prevention through better planning and design in the sector by, for example, using pre fabricated elements in the building sector to avoid spillage (Boverket 2004).

3.2 Mapping of initiatives to reduce waste volumes

The first part of the definition of waste prevention provided by the revised Waste Framework Directive refers to reducing

- *the quantity of waste, including through the re-use of products or the extension of the life span of products*

The mapping of initiatives was mainly conducted via a desktop study. In addition, stakeholders in the Nordic countries were asked to provide information on waste prevention initiatives in their own countries.

In total 32 initiatives have been identified, which are presented in a list in Appendix A. The initiatives come mainly from Europe, but a few initiatives from USA and Australia are included. Waste prevention initiatives comprise a minor part of the list (e.g. number 13, 14, 17, 19, 2, 24, 25 and 31 in Appendix A). Many of the initiatives are focused on recycling and waste management and are established in order to reduce landfilling of construction and demolition waste.

Waste prevention may also be integrated into other initiatives e.g. in lean construction or green building certification schemes like BREEAM and LEED. However, waste prevention will only be a minor part of such a scheme. This is also the case for the green initiative of Skanska which integrates waste prevention in the company's overall environmental activities. For example, the calculation method developed by Veolia and SITA and mentioned by Skanska (initiative 18 in Appendix A), seems to focus on recycling and only to a very limit extent includes waste prevention.

The main part of the initiatives is based on information tools such as guidelines, handbooks, calculation tools and checklists. The target group is primarily the building and construction sector. The initiatives targeted at citizens are mainly different market places for buying and selling used building products.

The initiatives are mainly established by the authorities. Only a few initiatives have been established by the sector. No regulatory requirements have been identified concerning waste prevention in relation to reduction in quantities. However, a number of voluntary agreements exist between the industry and the authorities. One example of this (initiative number

15, Appendix A) in Sweden is from the stakeholders in the building and construction sector (Kretsloppsrådet) and the Swedish Environmental Management Council (Miljöstyrningsrådet), that together have developed a tool that integrates environmental planning and guidelines on public tenders when writing an environmental program for the project.³

3.3 Mapping of initiatives to reduce environmental and health impacts

The second part of the definition of waste prevention provided by the revised Waste Framework Directive refers to reducing

- *the adverse impacts of the generated waste on the environment and human health*

Very few initiatives focus on this part of the definition of waste prevention. However, impacts on the environment and on human health are often related to the two other parts of the definition, and thus is a secondary effect of reducing waste and reducing hazardous substances.

There are a variety of actions to be taken before materials become waste, in order to reduce various environmental impacts. This complexity, combined with no specific target set for the second part – *reducing the environmental and health impacts* – is one of the reasons that countries have not been focusing on this part of the definition. Most of the prevention initiatives or national/regional waste prevention plans analyse and benchmark their evolution based on the first (reducing waste quantities) and third (reducing the amount of hazardous waste) part of the waste prevention definition.

This absence of targets and plans on the second part of the definition refers to all waste streams, including construction and demolition waste. Therefore, there are no C&D waste prevention initiatives that target specifically the reduction of environmental and health impacts. These initiatives are mostly listed under waste management plans related to the implementation of the revised Waste Framework Directive and its target of 70% recycling for C&D waste. Therefore, most initiatives combine actions before the material becomes waste (waste prevention actions) with improvements in the waste management itself, so it is difficult to separate the purely waste prevention initiatives.

All interventions that lead to the increased utilisation of more environmentally friendly materials could be considered as prevention initiatives. For example, the replacement of aluminium window frames with wood frames would be prevention since wood is a more environmental-

³ Kretsloppsrådet, March 2011 in <http://www.kretsloppsradet.com/web/page.aspx?pageid=262902>

ly friendly material than aluminium⁴. On the other hand, while the replacement of concrete with steel reduces the weight of waste; it does not necessarily reduce the environmental impacts. Another good practice example is the reduced (or banned) use of asbestos as construction material due to its adverse health impacts, meaning that this development would be considered as waste prevention.

3.4 Mapping of initiatives to reduce the content of harmful substances in products and waste material

The third part of the definition of waste prevention in the EU waste framework directive includes measures to reduce

- *“the content of harmful substances in materials and products”*

This is an important aspect in waste prevention as we aim to reduce the exposure to these substances in our daily environment. Also, preventing hazardous substances in materials will entail a cleaner waste fraction which in some cases is more readily adaptable for recycling or makes up a smaller environmental issue if landfilled.

Harmful substances include carcinogenic and toxic substances which may have a negative influence on human health or on the environment.

The harmful substances that are addressed are, among others:

- Heavy metals (chromium, lead and cadmium)
- PCB
- Asbestos
- Polycyclic aromatic hydrocarbons (PAH's)
- Carcinogenic substances
- Persistent organic compounds
- Insulation materials containing ozone depleting substances

There have not been many studies focusing on this aspect of waste prevention. However, some harmful substances have been phased out but this is mainly due to the hazardous effects encountered during use rather than preventing hazardous waste. One example is the phasing out of PCB in joints, or in seals and thermo insulated windows, as PCB is volatile and will transfer to the air inside buildings. Of importance is the phasing out of problematic substances of the future, however, forecasting which substances that in the future will be identified as problematic

⁴ (<http://www.fao.org/docrep/004/y3609e/y3609e08.htm>).

or hazardous in respect to human health or to the environment can be difficult.

The Swedish BASTA⁵ system includes a register of construction products. In order to have products in the register, they must not contain harmful substances according to a list of criteria with a total of 12 different properties. The overall aim of the BASTA system is to phase out the use of harmful substances. Other similar systems exist in Sweden including Sunda Hus⁶ and Byggvarubedomningen⁷.

In all the Nordic countries regulation requires that hazardous substances and materials are identified and removed separately prior to demolition. This has been highly successful due to taxation and differentiated disposal costs resulting in very high disposal fees for waste that is not separated. This leads to cleaner waste generation for reuse, recycling or disposal.

There are several initiatives that aim towards selective demolition (for example the Danish NMK96 and regulation in Vienna) also focusing on separating hazardous substances from remaining waste. However, these initiatives are actions centred towards existing materials in buildings and do not enhance the use of non-hazardous substances in new buildings.

Skanska Norway has implemented a programme to reduce waste volumes as well as to also reduce the use of hazardous substances. Skanska has in this context developed a list of substances and materials that are not allowed in their construction work.

Environmental building certification and assessment schemes (for example LEED in USA and BREEAM in UK) have been developed to ensure sustainable construction and buildings⁸. The schemes aim to reduce the environmental impacts both from construction and production of construction material as well as impacts due to operation of the buildings. That means the standards focus on reducing energy demand, reducing water consumption and waste production and ensuring that materials can be reused or recycled. A very important aspect is that the materials should be sustainable and the use of harmful substances within the materials should be avoided.

⁵ BASTA webpage: www.bastaonline.se

⁶ Sunda hus webpage: www.sundahus.se

⁷ Byggvarubedomningen webpage: www.byggvarubedomningen.se

⁸ <http://www.bsria.co.uk/news/breeam-or-leed/>

4. Evaluation and prioritisation of initiatives for waste prevention

4.1 Criteria for prioritisation of initiatives

These criteria mainly refer to the selected examples within each group of initiatives. The selection of these examples is based on the following set of criteria:

Implemented initiatives

The first criterion is the implementation of the initiative in a country or region under a specific context. This implies that ideas or aspirations for implementation of prevention initiatives are not included in chapter 4. These types are investigated in chapter 5.

Covering the different parts of the definition of Waste Prevention

The definition of waste prevention can be divided into three parts as described in chapter 1.3. Most of the initiatives aim at the first part, namely reducing C&D waste quantities. However, if an initiative covers more parts (i.e. it aims at combining reductions in amounts, environmental impacts or hazardous waste quantities), it offers a more comprehensive solution to waste prevention objectives and is, therefore, prioritised. Unfortunately, no initiative targets environmental impacts but some initiatives exist that reduce simultaneously the amounts of both total C&D waste and its hazardous content.

Evaluated initiatives

Initiatives that have been proven effective through an evaluation process are more likely to succeed if implemented elsewhere. The evaluation would identify the advantages which can be exploited even further, opportunities for gaining more benefits out of the same initiative and drawbacks that should be avoided. In this way, the future implementation of similar initiatives would be equipped with a tool for a more successful application.

Relevant to the Nordic context

Since one objective of this project is to locate C&D waste prevention initiatives that could be the basis for similar activities in the Nordic countries, their relevance to the Nordic context and the special charac-

teristics of the countries should be taken into account, so that the transferability of knowledge and experience is feasible.

4.2 Assessment of prioritised initiatives

In the following paragraphs seven prioritised initiatives are assessed including a description and the potential of each initiative. Each description of the initiative is supplemented by a case study. The described and assessed categories of initiatives are the following:

- Reuse of building materials
- Information campaigns
- Waste prevention guidelines
- Voluntary agreements
- Identification of hazardous substances
- Tool for registration of non-hazardous building materials
- Certification schemes

4.3 Reuse of building materials

Description

Reuse of materials without them entering the waste management system is a way to increase their life span and, hence, avoid waste generation. This type of reuse, therefore, can be considered a good way to achieve waste prevention (initiative 3, 11, 17, 19 and 25 in Appendix A).

Initiatives focusing on extending the life span might refer to a building as a whole (renovation activities), building parts (e.g. Kretsloppsparken Alelyckan, initiative 17 in Appendix A) or excess material during the construction or renovation phase (e.g. ReLY, initiative 19 in Appendix A). No initiative has been identified that has a clear mandate to increase C&D waste prevention by extending the whole building's life span. However, the five identified initiatives above aim to reuse building components or reuse of excess material occurring during construction/renovation operations.

The initiatives refer to market creation for selling building materials or components. These markets can be physical or virtual/internet-based. All the initiatives target not only construction companies but also citizens that buy materials for private use. The selling of excess raw materials from construction sites has multiple benefits: from an environmental point of view this minimizes the waste produced during construction or renovation, while simultaneously reducing the cost of construction and creates new jobs for the commercial exploitation of the materials. In order for this initiative to be viable, it normally has to be implemented at a national level.

It is also important that the materials are free of hazardous substances, that reuse is economically viable, that national taxes do not oppose reuse, and that the reusable products are homogenous and free of composite materials. Finally it is important that the consumer of reusable products have documentation for the products in respect of not including undesirable materials in the product and those e.g. suitable standards are developed to ensure the quality of these products for commercial use. On the other hand, the reselling of used materials or building components such as window frames aim at reducing demolition waste. Waste producers have an economic incentive to participate since they avoid waste management costs (in case they just donate items) or they are also reimbursed.

Potential for waste prevention impact

Reuse of building materials is sometimes an “easy to implement” prevention measure, since the environmental profit is combined with an economic one. Moreover, it is easily quantifiable since the established resell bodies can measure the amounts sold, although no such data exist so far in the located initiatives. The exact life span extension is uncertain, but all in all the potential for its spreading and contribution to waste prevention is substantial.

Prevalence and future potential

Five initiatives of this type have been found in Europe. In spite of the advantages they offer, they have not been mainstreamed yet probably because of organisational problems or complications due to waste management regulations. If further incentives are given (regulation, quality standards, public sector participation etc.), reuse of building materials has an even higher future potential. The transferability of these initiatives to other countries would be considered easy except for some potential cultural differences in terms of the consumption of second-hand materials for reuse of demolished building components.

Table 2. Pros and cons for the reuse of building materials for its original purpose

Domain	Contribution	Legend
Waste amounts	++	++ very positive
Waste impacts	0	+ positive
Hazardous waste amounts	0	0 neutral
Costs for implementation	++	- negative
Costs for construction sector	+	-- very negative
Bureaucracy	+	
Employment	++	
Transferability to other geographical areas	+	

4.3.1 Case study – Kretsloppsparken Alelyckan in Gothenburg

Who: Local Municipality

Country: Sweden

Stakeholders involved: Public authorities, citizens and local businesses

Objective (target): Increase reuse of materials for its original purpose

Description of initiative

In the city of Göteborg, there is a site that provides different types of waste services to citizens. The Recycling Park was established to promote solid waste management and environmentally friendly services to the citizens of the local municipality. They can visit the park in order to sort their waste (mainly electronic, hazardous and bulky), to recycle it or to purchase second hand items, including many building products. The building products offered there can be divided into furniture and decorative items or infrastructural elements of buildings.

A special part of the park is dedicated to these building products and materials. The latter category includes different types of products varying from doors and windows to tiles and bricks. The additional advertised advantage of the items is that they offer different stylistic ideas to customers and can cover different architectural types of existing houses.

Citizens or businesses can donate items to the park, which are checked by specialised personnel so that their resell quality is guaranteed. There is no limit to the amount donated except for bulky waste that requires further processing. All citizens and companies can contribute to the reuse not only by bringing items to the park but also to two other recycling stations.

This prevention initiative promotes the reuse of materials by extending their life spans through a “second life”. The advantages cover all stakeholders: the municipality is promoting prevention while their expenses are covered by sales and the civil society can discard waste materials that they would otherwise normally have to pay to dispose of. Moreover, job creation occurs as the Park is employing primarily unemployed people that are trained to operate the park.

Effect of initiative

According to a recent study, the initiative prevents about 360 tonnes of waste annually (IVL 2011, Förebygga avfall med kretsloppsparkar). The combination of the reuse with a recycling centre helps attract more people since they can reuse and recycle at the same time. The costs are covered by the income from selling the items.

Time period:

2006 – Ongoing

Evaluation:

No

Future work:

-

Pictures/links:

- Swedish example in:
http://www.kretsloppsparken.nu/klp/klp.asp?nav2=om_klp
- Danish example in:
<http://www.genbyg.dk/>
- Austrian example in:
<https://www.wien.gv.at/umweltschutz/webflohmarkt/index.html>
- Hungarian example in:
<http://nemsitt.hu/>
- UK example in:
<http://www.reiy.net/>

4.4 Information campaigns

Description

One of the most widespread forms of C&D waste prevention initiatives are the information/awareness campaigns. The main advantage of this type of campaign is that there is a low cost associated with this whereas it is very difficult to assess the impact by a formal evaluation.

Information campaigns usually consist of the dissemination of information materials in the form of leaflets or websites, training courses, lists of tips and ideas for C&D waste prevention and fact sheets for the different phases of construction (e.g. initiatives 7, 10, 14, 23, 24 and 26).

The campaigns may target different stakeholders, namely local authorities (e.g. Local Authority Prevention Network in Ireland, initiative 12 and 13) and businesses (e.g. Informic in USA, initiative 23 and 24). Some campaigns are specialised for different stakeholders providing relevant information to them. This information aims at different ways to achieve prevention such as extending materials/buildings life spans or using raw materials more efficiently.

Most campaigns combine the waste prevention initiative with other environmentally friendly objectives such as resource efficiency, recycling, energy minimisation or with arguments supporting the synergies between different objectives such as cost savings through efficient raw materials management. On the other hand, most campaigns do not specifically target C&D waste, but provide information on different streams with the main focus on municipal solid waste.

The owners of initiatives vary greatly, ranging from public authorities to NGOs. Public authorities attempt to reinforce prevention, in some cases under the frame of National or Local Prevention Plans. Businesses issue leaflets for reducing their waste and increasing resource efficiency or complying with possible prevention targets. NGOs or construction

associations might also be involved in order to support other stakeholders in their objectives.

Potential for waste prevention impact

The potential impact of information campaigns on waste prevention is rather limited. The effect depends on the aggressive and extrovert character of the campaign, the number of stakeholders targeted and the detail of information provided for different branches/phases of the construction sector, – and perhaps not least, the active support and leadership shown by managers and decision makers who can make a difference in this regard.

In any case, the absence of any binding targets and the voluntary adoptions of the information by stakeholders make these initiatives hard to assess.

Prevalence and future potential

A large part of the initiatives located in the C&D waste domain focus on providing information, since this is an easy to implement measure. Therefore, different information tools exist that might refer to the national or international context thus covering large areas and different needs. This generalisation and integration, however, fails to address specific problems by different stakeholders in different geographies. There is a need for more targeted information campaigns which could provide very useful information to the recipients.

Table 3. Pros and cons for information campaigns

Domain	Contribution	Legend
Waste amounts	+	++ very positive
Waste impacts	0	+ positive
Hazardous waste amounts	0	0 neutral
Costs for authorities	0	- negative
Costs for construction sector	++	-- very negative
Bureaucracy	++	
Employment	0	
Transferability to other geographical areas	+	

4.4.1 Case study: Waste Prevention Kit for enterprises, education and households/JESSE project

Who: Helsinki Metropolitan Area Council

Country: Finland

Stakeholders involved: Municipality, public institutions.

Objective (target): No specific target for C&D waste

Description of initiative:

The Helsinki Metropolitan Area Council initiated a waste prevention initiative in 2005 aimed at providing information to reduce waste at source, targeting public institutions, households and enterprises. The enterprises were included (as well as the construction sector) and specific information per branch was provided as well as a means to benchmark waste prevention.

The main tools used for achieving the prevention objectives of the initiative were teaching materials for all age groups. On the other hand, a specific area in Helsinki was chosen as a case study to promote prevention through information campaigns for households. The funding came through the LIFE project funding of the EU. In fact this project was selected as a best practise example by the EU in 2009.

The Council decided to continue the initiative under the JESSE project for 2008-2010, funded by the Helsinki Council. This second project builds upon existing information and produces new material such as reports, booklets and action models.

The overall initiative has generally an educational approach to information campaigns targeting different stakeholder groups. The construction sector is included by providing experience and ideas for waste reduction to professionals for every stage of a buildings' life cycle: planning and design, construction, repair and maintenance. Some background documents exist where except for detailed advice, incentives for professionals are presented.

On the other hand, the educational material is provided under the "learning a profession" structure⁹. It contains tips and best practise for aspiring constructors as well as a questionnaire test supported by a correct answers document. Many topics or clusters of waste prevention initiatives are included in the information kit for teachers. These are divided according to the construction phase, namely construction site management (e.g. reuse of wastes and sorting), building materials (e.g. promotion of life cycle thinking), planning (e.g. inclusion of prevention already in design phase), foundations construction (e.g. selection of long lasting materials).

⁹<http://www.hsy.fi/en/fiksu/learningaprofession/buildingtrade/Pages/default.aspx>

The teaching material initiative of the original LIFE project was evaluated in terms of the frequency of using the prevention theme in schools and the target was exceeded.

Effect of initiative

The evaluation documented that 50% of the participants in the building sector know about the information material and 14% had actually read it.

Time period:

2005-2007, 2008-2010

Evaluation:

-

Future work:

-

Pictures/links:

LOGO

- http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.createPage&s_ref=LIFE05%20ENV/FIN/000539&area=2&yr=2005&n_proj_id=2883&cfid=29961&cftoken=85a2d807f56210a4-00DBC7AC-BB24-6BD8-882160155D9C1C19&mode=print&menu=false
- http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=laymanReport&fil=LIFE05_ENV_FIN_000539_LAYMAN.pdf

4.5 Waste prevention guidelines

Description

A measure towards waste prevention often employed by the authorities is to provide guidance to construction professionals and companies on how to achieve waste prevention. There is a thin line between information campaigns (see chapter 5.2.2) and guidelines. Many information campaigns include guidance documents. However, these documents differ from purely informational documents since they provide realistic and practical, usually stepwise steps to minimise waste.

The guidelines might refer to the entire life cycle of a building, but most of them normally provide targeted information by addressing one phase of construction only. The phases of construction are design, construction, maintenance and dismantling/disposal. On the other hand, fewer guidelines exist on other civil engineering applications, while some refer to general good practices on a construction site.

Most case studies focus mainly on the design and construction phase of buildings rather than maintenance and disposal (e.g. initiatives 1, 5, 12, 13, 20, 22 and 29). This focus is reasonable since the first two phases determine significantly waste generation from the building's entire life cycle. Proper design and corresponding construction offer possibilities for proper dismantling so that, for example, parts of the building can be reused.

Many of the guidelines are integrated into a general sound waste management framework. For example, the waste hierarchy is often mentioned as a general rule of thumb guideline. Moreover, a life cycle approach is promoted, namely the consideration of all life cycle phases when planning or constructing a building. The main suggested actions target the excess use of materials and the promotion of reuse.

Potential for waste prevention impact

There are some case studies cited, mainly in the WRAP documents, but little information is available on the guideline's effect on a national level. The case studies are accompanied with numbers on avoided waste but the magnitude of the reduction by the sum of all initiatives is not known. However, if construction companies are attracted enough by the guidelines (and the incentives provided such as cost reduction), the effect of the guidelines could be substantial. Therefore, this initiative's potential depends on the marketability and communication of the guideline documents.

Prevalence and future potential

Some countries have already issued national guidelines, while there are cases from municipalities (e.g. Vienna guidelines). There is normally no way of knowing how many construction actors adopt the guidelines at their worksites. Therefore, the prevalence of the measure is hard to assess. A monitoring/registration tool would be helpful in this case.

The future potential of the initiative depends on the success it has among construction professionals. Since there are no binding regulations in a guideline document, good communication of the guidelines and a highlighting of their benefits would enhance popularity.

Table 4. Pros and cons for waste prevention guidelines

Domain	Contribution	Legend
Waste amounts	+	++ very positive
Waste impacts	0	+ positive
Hazardous waste amounts	+	0 neutral
Costs for implementation	0	- negative
Costs for construction sector	++	-- very negative
Bureaucracy	0	
Employment	0	
Transferability to other geographical areas	++	

4.5.1 Case study: Designing Out Waste.

Who: Waste and Resources Action Programme (WRAP)

Country: UK

Stakeholders involved: Businesses and public authorities

Objective (target): Reduce C&D waste generation through better buildings' design

Description of initiative:

The UK's Waste and Resources Action Programme includes a web platform providing guidance to stakeholders regarding waste minimisation in the construction sector. The platform includes three main guidance documents, a general one on efficient waste minimisation in construction and two documents with guidelines for the design phase of buildings and for civil engineering applications. Both these last two domains of construction are also assigned a tool where the effects of designers' decisions can be simulated.

This chapter will describe the designers' document for buildings only. Besides the extensive document, WRAP also provides a short paper with a summary of the guidelines. The background document provides guidelines for building constructions according to five "designing out waste" principles:

- Design for Reuse and Recovery. In this section, considerations are presented for the designer to take into account so that reuse is promoted. Recovery is addressed both as a secondary option to reuse and in terms of the utilisation of materials with a high recycling content.
- Design for Off-Site Constructions. This section refers mainly to prefabricated construction elements and includes information on how to influence their management in the design phase.
- Design for Material Optimisation. This part focuses explicitly on materials management, aiming at increasing efficiency and decreasing amounts used.
- Design for Waste Efficient Procurement. This section provides an understanding of how work sequences affect waste generation.
- Design for Deconstruction and Flexibility. This part builds upon the reuse guidelines during maintenance, refurbishment and demolition of the building.

WRAP is trying to align the guidelines for waste prevention with other scientific domains such as sustainable aggregates management. Moreover, the guidelines structure is also in line with the Royal Institute for British Architects' division of construction design into phases. These two considerations help professionals locate added values and better com-

prehend the messages for waste prevention, while they do not have to deviate from their normal design procedures.

In general, WRAP's C&D waste prevention guidelines do not offer very specific information on particularly effective and commonly accepted actions. The guidelines aim at integrating waste prevention thinking into the designer's code of practice. This means that the criteria used by designers to support their decisions should be enriched with waste generation considerations.

On the other hand, some specific advice and guidance is given towards the end of the guideline. These specific actions and provisions cover the design of all phases of construction, based on consultation workshops where experts were asked to give practical advice for waste prevention measures. Moreover, the suggested actions refer to key materials used extensively in construction such as concrete, timber and bricks.

Time period:

2009 – ongoing

Evaluation:

No

Future work:

-

Pictures/graphs/links:

LOGO

- <http://www.wrap.org.uk/>

4.6 Voluntary agreements

Description

Another C&D waste prevention initiative occurs when a mutual agreement is made between different stakeholders. Usually, the public authorities establish voluntary agreements with private businesses with specific targets for waste management (e.g. initiatives 8, 15, and 21).

These targets might include a quantitative or qualitative benchmark for waste prevention. The agreements are operated under the legislative framework, in cooperation with public authorities and respect market conditions. They generally attempt to contribute to the fulfilment of the local or national environmental strategy/plan's objectives.

Most voluntary agreements combine waste prevention with other C&D waste management activities such as recycling e.g. the Danish agreement from 1996 on selective demolition (NMK 1996). The agree-

ments attempt to provide a general framework for the promotion of sound waste management within which prevention has a primary role. For example, the Swedish Recycling Council's environmental programme for 2010 describes in general the targets for the sector's energy consumption, materials management, reduction of hazardous substances¹⁰ etc. The prevention initiatives are included in the materials management through recommendations for the use of long lasting and quality building components.

The agreements have binding targets only for the companies that sign the agreement. The popularity of the measure lies in the incentives given to the private sector to participate. Therefore, the design of the agreement should describe the mutual benefits for all stakeholders involved such as waste reductions and cost savings or alignment with various environmental performance benchmarks.

Potential for waste prevention impact

The success of this type of prevention measure depends on the number of stakeholders participating. If the mutual benefits are sufficiently attractive and the collaboration of authorities with businesses is promoted, the level of participation and, therefore, waste prevention results is accelerated. There is no quantitative evidence, though, from the initiatives located and analysed.

Prevalence and future potential

Not many of the identified prevention initiatives belong to the voluntary agreement group. The process of bringing together different construction sector stakeholders in a broad geographical context is difficult, while the involvement of a sufficient number of companies is uncertain. If the benefits are recognised by all parties involved, the future potential of the initiative might be significant. It is important that the clients (those who contract builders) request and have a preference for those contractors, who have entered voluntary agreements, i.e. that leading (public) and institutional project developers motivate the contractors to become voluntary partners.

Table 5. Pros and cons for voluntary agreements

Domain	Contribution	Legend
Waste amounts	+	++ very positive
Waste impacts	++	+ positive
Hazardous waste amounts	+	0 neutral
Costs for implementation	-	- negative
Costs for construction sector	-/+	-- very negative
Bureaucracy	-	
Employment	0	
Transferability to other geographical areas	+	

¹⁰ <http://www.kretsloppsradet.com/web/page.aspx?pageid=170022>

4.6.1 Case study: Halving waste to landfill

Who: Waste and Resources Action Programme (WRAP)

Country: UK

Stakeholders involved: Public body and private sector. More than 500 signatories have signed up to the agreement

Objective (target): Halve the amount of C&D waste going to landfill in 2012 compared to 2008.

Description of initiative

The UK's Waste and Resources Action Programme, incentivised by the great amount of waste generated annually by the construction sector, initiated a programme to encourage the private sector to reduce their C&D waste going to landfills. The programme is based on improving the sector's environmental performance and the compliance with existing legislation (such as the recycling targets set by the EU's Waste Framework Directive).

WRAP provides a web platform where private businesses can be registered to the programme. The platform also provides numerous pieces of information in a comprehensive manner that might interest all stakeholders. This information can be divided into three clusters.

First, a description of the programme is provided together with the aims and the basis of the programme.

The second contains guidance documents for all parts constituting the construction sector such as designers, managers and leaders. Guidance exists for proper waste management and cost savings but also for practical issues such as sign up and reporting guides. A separate document exists on how to compile proper waste management procurement.

A third type of information provided contains all the incentives and benefits that would encourage private businesses to participate. Both environmental improvements and cost savings are highlighted as benefits. Moreover, technical support is also included such as information on the recycling content requirement process.

At the end of the platform, some examples of successful participation to the programme are mentioned. Finally, a simple calculation tool exists that helps actors calculate the waste arising from their projects and indirectly estimate the effect of prevention initiatives.

Prevention is stated as the priority action within the programme that would lead to a reduction of landfilled waste. Information, guidance and the benefits of implementing various prevention measures are included in many documents provided by the programme. The main prevention actions include the use of long lasting, quality materials and sound raw material management that reduces construction and renovation wastes.

Effect of initiative:

The initiative is supported via high participation. The objective is to reduce landfilled quantities which are supposed to be documented, but clear evidence of the effect on prevention does not exist.

Time period: 2010-2012

Time period:

2008 – 2012

Evaluation:

No

Future work:

-

Pictures/links:

LOGO

- http://www.wrap.org.uk/construction/halving_waste_to_landfill/

4.7 Identification of hazardous substances

Description

The main aim of an identification of hazardous substances in buildings that are to be demolished is to separate these substances and hereby ensure correct disposal of the generated hazardous waste and simultaneously ensuring that a large amount of waste is not contaminated with hazardous material (e.g. initiatives 4, and 15 in Appendix A).

The identification of hazardous substances is followed up by a waste management plan that defines the disposal of any identified hazardous substances in the building. There are a number of regulatory approaches also in this regard, as well as requirements in terms of acceptance criteria and price setting for C&D waste at the disposal facilities that also indirectly require the builders to sort and prepare for recycling as well as to recycle building and construction materials on site.

This initiative can either function as a voluntary agreement or be implemented as a mandatory action defined in local or national environmental policies. The Municipality of Oslo implemented the mandatory identification of hazardous substances and a waste plan for demolition projects in the middle of the 1990's and the national environment agency in Norway implemented similar demands in 2008 for any building of 100 m² or more (Norconsult, 2010).

Kretsloppsrådet has developed guidelines for information sheets for building material and products¹¹. If these are used in production or purchasing, it provides valuable documentation that can be used to identify hazardous substances when the buildings are renovated or demolished.

Potential for waste prevention impact

There is a huge potential for the reduction of hazardous waste, as hazardous substances are identified and dismantled separately. The identified hazardous substances can then be managed as hazardous waste while a large mass of waste can avoid becoming polluted with hazardous substances, and therefore prevent this mass of waste being categorised as hazardous waste.

Prevalence and future potential

Hazardous substances exist in all buildings in smaller or larger amounts including PVC flooring, PCB's, paints etc and very often these substances are mixed in larger volumes of C&D waste.

The future potential of the initiative depends on the regulation to be implemented and on self assurance and the extent of external controls on procedures.

Table 6. Pros and cons for identification of hazardous substances

Domain	Contribution	Legend
Waste amounts	0	++ very positive
Waste impacts	+	+ positive
Hazardous waste amounts	+	0 neutral
Costs for authorities	-	- negative
Costs for construction sector	-	-- very negativ
Bureaucracy/Administration	-	
Employment	+	
Transferability to other geographical areas	++	

4.7.1 Case study: Vienna building regulative

Who: The Vienna City Administration

Country: Austria

Stakeholders involved: Local administration

Objective (target): Separating hazardous waste at demolition

Description of initiative

Since 2006 there have been local regulations that determine that there must be an identification of hazardous substances in buildings prior to demolition. The guidelines contain procedural and contractual procedures governing the demolition of buildings. The identification includes an examination of the structure to be dismantled and an identification of

¹¹ Kretsloppsrådet, in <http://www.kretsloppsradet.com/web/page.aspx?pageid=170104>

asbestos-containing building parts. Waste assessment is carried out by the client.

Also, buildings frequently contain harmful substances, such as asbestos, polychlorinated biphenyls (PCB), polyaromatic hydrocarbons (PAH), synthetic mineral fibres, etc., which can pose health, safety and environmental risks in case of improper demolition. This is the reason for the identification of the expected harmful substances prior to building demolition.

It is important to separate these harmful substances from the remaining debris in order to achieve quality standards in order to use the building debris in recycling construction materials.

For this reason, the Municipal Department for Environmental Protection – MA 22 initiated and promoted the creation of ON rule ONR 192130, “Identification of Harmful Substances in Buildings Before Demolition Work”. This ON rule has been available since May 1st, 2006

Effect of initiative:

The direct effect of the initiative is that hazardous substances are identified and dismantled prior to demolition thus avoiding the contamination of a large mass of waste with hazardous substances and preventing a large mass of waste being categorised as hazardous waste.

Time period:

2006-ongoing

Evaluation:

No

Future work:

-

Pictures/links:

- <http://www.wien.gv.at/umweltschutz/abfall/>

4.8 Tools for registration of non-hazardous building materials

Description

The aim of tools for the registration of materials without hazardous substances is to promote sustainable products in the building and construction sector and in this way promote the phasing out of any undesirable substances in buildings and in future C&D waste (e.g. initiatives 16 and 31 in Appendix A).

Due to this approach, waste quantities may not be reduced, but the amount of hazardous waste will be reduced, both during construction and demolition.

There are different registration and eco-labelling systems with the most commonly known being the European Ecoflower and the Nordic Eco-label the Swan. These eco-labels are used on a wide range of products including building materials. However, only a limited number of building materials have yet been registered. The overall aim with eco-labelling is to ensure a safe environmental and indoor climate.

Currently eco-labelled building products are available within the following categories: Natural stones, paint, glue, thermowood and floors such as tiles, laminates, linoleum and timber. Other tools are focusing on building materials and registering these if they do not contain any hazardous substances.

Potential for waste prevention impact

There is a potential for reducing the use of hazardous substances in construction material as still today many materials contain undesired substances.

Prevalence and future potential

Hazardous substances exist in all buildings in smaller or larger amounts including PVC flooring, PCBs, paints etc and very often these substances are mixed in larger volumes of C&D waste.

The future potential of the initiative depends very much on the amount of materials that are registered and that the products cover a wide range of materials and characteristics.

Table 7. Pros and cons for tools for registration of non-hazardous building materials

Domain	Contribution	Legend
Waste amounts	0	++ very positive
Waste impacts	+	+ positive
Hazardous waste amounts	++	0 neutral
Costs for authorities	0	- negative
Costs for construction sector	0	-- very negative
Bureaucracy/Administration	-	
Employment	0	
Transferability to other geographical areas	++	

4.8.1 Case study: Title of case: BASTA

Who: Swedish Construction Federation, JM, NCC, Peab, Skanska and IVL

Country: Sweden

Stakeholders involved: Organisation, business and research institutes

Objective (target): Phasing out of hazardous substances in building materials

Description of initiative

The aim of the BASTA system is to speed up the phasing out of hazardous substances in buildings. Products are assessed according their chemical ingredients and may not contain or only in very limited concentrations chemical substances with the following properties:

- Carcinogenic substances
- Mutagenic substances (cause heritable genetic damage)
- Substances toxic to reproduction (impair fertility)
- Persistent or very persistent organic substances (low degradability)
- Bio-accumulative or very bio-accumulative organic substances (accumulate in tissue)
- Substances harmful to the ozone layer
- The content of lead, mercury and cadmium is regulated
- Furthermore, the content of sensitising substances, solvents, toxic and environmentally hazardous substances is limited in chemical products

It is the suppliers themselves who are responsible for the assessment. The supplier must also meet a number of requirements as to be allowed to register products in the system:

- the supplier confirms that any of their products registered in the BASTA database meet the properties criteria at all times.
- the supplier can present documentation verifying the properties of their products registered in the BASTA-database.
- the supplier has an organisation with a clear distribution of responsibility for all information upon which their registration in the BASTA-database is based.
- the supplier has the appropriate expertise available for dealing with the terms of qualification for registration of products in the BASTA-database.

The products that meet the BASTA requirements are held in a database with two parts: the BASTA register and the BETA register. Products that meet the more comprehensive requirements are held in the BASTA register. Those products that only meet the more basic requirements are instead held in the BETA register and an environmental and health risk

assessment is required for these products. The BETA register came into operation in April 2009 and will gradually be filled with more products.

There are two ways that BASTA can be used when selecting building products: by searching the database directly for a product, or by specifying in a building contract that all products used in the project must meet the BASTA properties criteria or be registered in the database. In this way, the decision maker does not need to be a chemicals expert.

In BASTA, it is the suppliers who have responsibility for the database. The database is freely available for everyone to use; it can be accessed without a password or membership.

Today more than 40,000 items can be found in the register. The BASTA system gives a clear indication to manufacturers about the construction industry's expectations for the development of new products.

The BASTA register is compliant with the EU regulation REACH and substances identified as Substances of Very High Concern (SVHC) by the European Chemical Agency.

Time period:

2009-ongoing

Future work:

ongoing registration of products

Pictures/links:

LOGO

- <http://www.bastaonline.se/english/bastaonline/aboutbasta>

4.9 Certification schemes

Description

Certification schemes aim at standardising the high quality of a building's construction. Through an analysis of the buildings performance, the schemes attempt to verify if the building achieves designated quality standards during its construction, use and disposal after its life span is exhausted (e.g. initiatives 2, 9, 27, 28, 30, and 32 in Appendix A).

The most internationally acknowledged schemes include LEED¹², BREEAM¹³, DGNB¹⁴ and HQE¹⁵. All of these schemes are based on a list of criteria to certify buildings, varying from indoor air quality to energy use. Most schemes include material (resource) efficiency and the envi-

¹² Leadership in Energy and Environmental Design, UK

¹³ BRE Environmental Assessment Method, USA

¹⁴ Deutsche Gesellschaft für Nachhaltiges Bauen, Germany

¹⁵ Haute Qualité Environnementale, France

ronmentally friendly disposal of building components, topics that touch upon waste prevention elements.

However, little reference is made to waste prevention itself. The materials used section usually refers to recycled and hazardous materials content and origin and the certification of components. On the other hand, waste management considerations mostly address the recyclability of construction materials and their easy separation during demolition. Moreover, focus is given on the handling of waste during the use phase, namely both household waste and renovation waste.

According to a recent Danish study in 2010, two of the aforementioned four schemes refer to waste reduction mainly during the construction phase, but prevention is not one of the major topics regarding waste management in certification schemes (Byggeriets Evalueringsscenter, 2010).

Besides the internationally acknowledged schemes, some countries have compiled national initiatives to match their own particular characteristics such as Sunda Hus and Byggvarubedömningen in Sweden, and the Ökopass in Austria.

In Denmark Lind & Risør promotes Swan eco-labelled houses. Lind & Risør has amongst other things phased out all PVC and pressure impregnated timber and changed paint and joint sealant due to eco-labelling which has reduced the amount of harmful substances. They have on the other hand deselected points for the measurement of waste fractions.

Potential for waste prevention impact

Only those certification schemes that include waste prevention considerations can be classified as relevant. These schemes address the issue in a very general way, avoiding specific targets as they rely on qualitative assessments. On the other hand, given the popularity of the schemes among new constructions, a potential extra emphasis on prevention would help include prevention in a wider range of building activities.

Prevalence and future potential

The buildings' certification schemes are gaining momentum. The reason for that is the standardisation, the marketing potential and the recent research results showing that constructions according to certification schemes are more cost effective. On the other hand, in most countries they function on a voluntary basis so their proliferation is not mandatory.

In terms of waste prevention, more related issues could be integrated into the schemes however that would mean they would need to be revised. One barrier for including prevention is that it is very difficult to measure. However, a combination of resource efficiency and cost saving argumentation would have an effect in waste prevention especially during construction stage.

Table 8. Pros and cons for certification schemes

Domain	Contribution	Legend
Waste amounts	+	++ very positive
Waste impacts	+	+ positive
Hazardous waste amounts	+	0 neutral
Costs for authorities	--	- negative
Costs for construction sector	+	-- very negative
Bureaucracy	0	
Employment	+	
Transferability to other geographical areas	++	

4.9.1 Case study: Austrian Ökopass schemes

Who: Österreichisches Institut für Baubiologie und Bauökologie

Country: Austria

Stakeholders involved: Government and business

Objective (target): Increase quality standards in new buildings

Description of initiative

In Austria, two types of certification schemes exist that include waste implications. The IBO Ökopass refers mostly to residential buildings and the TQB building certification that addresses larger constructions mainly such as schools, commercial buildings and hotels. The Ökopass has somewhat less strict standards while the TQB certification implies premium quality buildings with subsequent demanding environmental considerations.

The Ökopass scheme is based on an evaluation of a building in two phases: a preliminary assessment before construction and a final evaluation after the construction is complete and before the tenants move in. This evaluation is based on a set of eight criteria and the four grades certified vary from satisfactory to very good. The evaluation of criterion 6 “Ecological properties of the building construction and materials” includes waste management but little focus is given on waste prevention. Waste prevention is mentioned in some documents on Ökopass but only as a qualitative target, since the attention is shifted to waste management. In Ökopass, the overall environmental performance is only one of the eight assessment categories, so only broad terms are used.

The Total Quality Building (TQB) scheme is more demanding. It is based on international research conducted until 2001 when the scheme was first applied. TQB was harmonised in 2010 with the other Austrian certification schemes, Ökopass and klima: aktiv. TQB is described as an optimisation tool that leads to a high standard of construction while it is classified as the most extensive building certificate in Austria. A proof of that claim is the inclusion of two environmental categories, the environmental protection in general and resource efficiency. TQB is a rating

system with numerical grades and in the waste category, prevention gets the highest ranking.

With respect to resource efficiency, TQB describes the waste problems and suggests prevention either through choosing less waste intensive construction materials or through agreements with suppliers to return excess material and packaging. Examples are given: An idea is to ask for refillable containers for construction materials such as paint. Waste-free building methods should be preferred as well, for example poured floors instead of tiles. Focus is also given to the separation of hazardous waste from non-hazardous in a proactive way, i.e. at the design phase.

Many provisions are included in the TQB scheme for increasing recyclability and the quality of recycling during demolition. The main proposed measures according to which a building is evaluated are the facilitation of material separation, the purity achieved and the eco-design for easy dismantling of the building components. Reference is also made to specific fractions of particular importance.

The TQB is accompanied with an online test tool which roughly assesses a construction in the lines of five criteria, including resource efficiency. The resource efficiency criterion includes sub-criteria such as the prevention of hazardous materials, recycled and certified materials content, efficiency of structure and disposal, which all constitute a rating system where prevention receives the highest ranking.

Both schemes provide no binding targets for C&D waste prevention. If prevention is foreseen, then a higher grade is given to the building's certificate. In that way, this initiative tries to exploit the marketing arena where the certificate is presented, but does not provide additional incentives for increasing waste prevention. Regarding the effect of the initiative on the overall C&D waste prevention in Austria, no measurement has been made so there cannot be an evaluation of the initiatives effectiveness.

Time period:

2001-ongoing

Evaluation:

-

Future work:

-

Pictures/links:

LOGO

- <http://www.ibo.at/de/oekopass/objekte.htm>

5. Other ideas for waste prevention

5.1 Introduction

One of the findings of the survey is that there are not many ongoing initiatives focusing on waste prevention from the building and construction sector. However, a number of new ideas and inspirations relating to the implementation of waste prevention measures have been identified during the mapping of activities.

Many of these have not been publicly presented and there are a range of other approaches to prevent waste of which some have been applied in a smaller scale in private companies. This chapter briefly describes a number of ideas of which some have as a direct target waste prevention, while other ideas have a broader scope and aim to influence building and construction in a more sustainable way.

5.2 Education of designers and structural engineers

In order for waste prevention to be considered as a priority objective, the people involved in designing and managing construction sites should be appropriately educated. The advantages of C&D waste prevention, the legislative background and the means and methods to achieve it, should be taught to designers and engineers so that they can apply prevention principles in their field of work.

Designers should have the background for including prevention elements in a construction's design while the engineers should be aware of the methods for applying waste prevention during construction of engineering applications. Therefore, in national universities, the study programme could include waste prevention elements in construction and provide information on how to integrate prevention in the designers' and engineers' common practices (e.g. flexible design, the design of components which are easily deconstructed and reused).

This initiative would contribute to the dominance of prevention and results would be even more effective than a targeted information campaign with similar characteristics as the relevant education would be provided to all designers and engineers.

5.3 Training in waste prevention guidelines

There are existing waste tools that facilitate the implementation and monitoring of waste prevention initiatives. This happens either by monitoring the flow of waste (evaluation of initiative) or by applying methods to decrease waste generation through e.g. raw materials management. These tools are relatively simple, but sometimes training is necessary for people involved in a worksite. In order for prevention to be effective, training especially in technical aspects (e.g. for carpenters, bricklayers) is essential.

Prevention initiatives should in principle engage all stakeholders involved in the construction process. Therefore, stakeholder training in prevention tools would help to implement prevention initiatives and also align all actors to the prevention objectives.

5.4 Construction materials database

Material standardisation and market competition has been the driver for the creation of many construction materials databases which contain information on the materials' performance. These databases, however, do not contain any information on the environmental performance and rarely on the life span.

If these databases were enriched with these types of information, C&D waste prevention would be facilitated. First, construction managers and designers would also be able to make decisions on materials based on their life span, hence promoting long lasting elements that would potentially increase the building's life expectancy and, therefore, contribute to waste prevention. On the other hand, designers and engineers would be able to choose more environmentally friendly materials, thus improving the buildings' environmental performance, which also constitutes waste prevention according to the second part of the definition (see Chapter 1.3).

A recent practical example of this database application is the Belgian Ecoliser tool¹⁶. This is a long list of construction materials accompanied with LCA information about them. Although the methodology for obtaining the LCA data is uncertain and the robustness of comparisons between different materials could be challenged, the Ecoliser tool provides a rough estimate of better material choices so that the environmental performance of the construction is improved.

This type of initiative is different than the already implemented registration of hazardous substances. The latter refer to the third part of the waste prevention definition and are usually accompanied with limit values for specific materials or substances (e.g. BASTA database).

¹⁶ <http://ovam.be/jahia/jahia/cache/offonce/pid/176?actionReq=actionPubDetail&fileItem=2270>

5.5 Enforcement of waste regulation

Municipalities or other authorities can pay higher attention to waste prevention in their enforcement of waste legislation, local by laws or permits. Authorities can guide or regulate the constructor in terms of waste prevention, when the authorities are conducting inspections of building sites in relation to waste legislation. Ringsted municipality in Denmark is planning to incorporate waste prevention guidance in their inspections of enterprises¹⁷.

5.6 GPP including prevention requirements

The green public procurement (GPP) provisions can have a significant effect on all national economic activities. This effect can be exploited by waste prevention so that C&D waste generation is reduced. The role of the public sector often as a frontrunner enables possible prevention requirements included in the GPP to become widespread in all construction activities.

These requirements may vary from simple standards for new constructions (e.g. promotion of certain materials or limitation of others) to specific waste prevention targets from the public sector activities that act as a driver for more sustainable waste management. For example, the Swedish Environmental Management Council has developed procurement criteria for building contracts, when building new blocks of flats¹⁸.

5.7 Prevention and smart design elements in public tenders

The role of the state in promoting waste prevention is rather significant. Among the diverse activities that public authorities can engage themselves in is the provision of prevention elements in public tenders. If all public construction tenders forced contractors to take into account C&D waste prevention, significant results should be expected since public construction is an important part of the whole construction sector, especially with regards to infrastructure works.

Another way to promote prevention is to include waste prevention criteria in the selection of tenders. It could be an idea if a Nordic guideline was developed with examples of how such criteria should be worded.

¹⁷Ringsted Kommune 2009 in <http://polweb.ringsted.dk/upload/data/open/610033.pdf>

¹⁸ Miljöstylningsrådet, 2011 in <http://www.msr.se/en/Upphandling/Kriterier/Bygg-och-Fastigheter/Byggentreprenader/>

5.8 Construction materials standards' upgrade

One viable way to achieve waste prevention in the construction sector is to extend the buildings' life spans. If a new standardisation of building materials and components is introduced, one that takes into account waste prevention characteristics, a significant extension of materials' (and hence buildings') life expectancy can be achieved. The increased quality of materials in terms of long lasting performance should be prioritised so that the longer the building lives, the longer waste is prevented.

A building's life span is normally determined by its structural elements as these components are difficult or impossible to repair or replace, and how flexible and adaptable the building is in terms of possible other future uses than the one planned at the time of construction. The standards' upgrade should start from these elements, so that the structure of the building acquires a longer life. However, a burden shifting might occur: if waste prevention is achieved through extension of the life span, a heavier structure might need to be used. Therefore, the prevention effect might not be so great (since the heavier structure might produce more waste, although at a later point in time) and other environmental impacts might arise from the use of additional materials.

5.9 Promotion of renovation and restoration

One way to achieve C&D waste prevention is to target demolition activities, which in fact are producing the highest share of C&D waste. If the life span of buildings is extended by applying extensive repairs, enhancing the performance of structural elements or adapting buildings for new purposes, the corresponding waste generation is delayed, while construction of a replacement building is delayed as well.

This argument reinforces the necessity for social and administrative authorities to focus on renovating and restoring old buildings so that they maintain their function for as long as possible. Under this framework, information campaigns that inform stakeholders about the value of extending a building's life cycle would be useful.

Another pathway to utilise renovation and restoration is the extension of architectural preservation schemes. The decision making regarding preservation of buildings of particular architectural value is based on aesthetic and economic criteria. Waste prevention would always favour preservation schemes as waste is avoided by prolonging a building's life span and avoiding construction wastes from new buildings. Waste prevention arguments could penetrate the preservation schemes discussion, therefore adding a new perspective according to which environmental improvement is the objective.

This more integrated approach to architectural preservation schemes could also be, in principle, considered as a waste prevention initiative. Another important aspect to consider is the overall environmental load from the building including the construction, use and demolition phase where the user phase due to energy consumption in some cases may argue for a replacement rather than restoration, if e.g. energy efficiency measures cannot reasonably be implemented.

5.10 Market-based instruments

Measures of an economic nature are normally expected to have increased effectiveness. However, no such measures exist that target waste prevention specifically. On the other hand, policy makers might consider some types of market based incentives for the promotion of waste prevention.

So far in the EU, all taxes on virgin materials aim at increasing the use of recycled material, as it is usually described in the accompanying procurement. The tax on virgin material, together with good standards and certification measures for recycled products creates an economic advantage for recycled products and therefore a market demand for their absorption.

This type of measure might only indirectly create waste prevention, since the recycled products are not taxed. If the raw material tax was combined with a (lower) tax on recycled raw materials, the consumption of these materials would decrease leading to more efficient materials management and waste prevention.

5.11 Cradle to cradle

Cradle to Cradle (C2C) is a holistic sustainability philosophy. It is based on three principles: "Waste equals food", "Use current solar income" and "Celebrate diversity".

The first principle plays a key role in nutrient recovery and the process of minimising the amount of generated C&D waste in the future. It means everything must be designed to go into either a biological or an industrial resource stream once the service life has come to an end.

According to C2C we must design for disassembly, simplify the design and remove dangerous substances and avoid composites with mixed materials that cannot be separated. We should always have reversed logistics. If a material can only go into landfill or if it will dilute into a resource stream it was not intended for we should simply not use that material.

Many of the C2C ideas are not in themselves new but they are put together in a very appealing way where each idea is part of a greater picture and this could bring life to ideas that are otherwise overlooked.

In the Netherlands C2C has gained a lot of success and a number of companies have used C2C principles to redesign their products. The Dutch authorities have set the ambitious goal that in 2012 half of all public procurement must be according to C2C principles. The State of California is underway with similar ambitious plans and this could be an example for the Nordic countries to follow.

The successful examples in the Netherlands cover a number of materials also used in the building industry, e.g. plastic, timber, steel and glass. There are presently however, no blueprints on mineral materials. They are still left to either the reuse of bricks or down cycling of crushed concrete used as an alternative to gravel.

C2C has local representation for example in Denmark and Sweden, "Vugge til Vugge" and "Vagga til Vagga". This could indicate that C2C is on the verge of gaining the same momentum in the Nordic countries as it has in the Netherlands and this momentum could if properly nourished be the driver to remove dangerous substances from C & D waste.

6. Targets for waste prevention

6.1 Review and evaluation of indicators to evaluate waste prevention from the building and construction sector

The past experiences in the EU countries have shown the difficulties in finding reliable indicators to measure waste prevention. This is often the result of the inherent difficulty in measuring something that is not there anymore. Further, assessment of the different environmental impacts associated with the prevented quantity of waste is another problem. Waste prevention indicators are in demand but widely accepted models do not exist on an international scale (BIO Intelligence Service 2009).

A widely recognised rule in environmental policy is that “If you can’t measure it, you can’t manage it”. Therefore, development of indicators is essential to evaluate objectives and targets of waste prevention.

The three most commonly used indicators on construction and demolition waste in the EU are:

- Construction and demolition waste landfilled,
- Recycling of construction and demolition waste and
- Total generation of construction and demolition waste.

However, these indicators are mainly a reflection of past building and construction practices and illustrate the difficulties with measuring the amount of waste prevented. The three indicators are evaluated on the fulfilment of the RACER criteria (Relevant, accepted, credible, easy and robust). It is an evaluation framework applied to assess scientific tools for policymaking. The evaluation concludes that none of these indicators are well suited to measuring waste prevention. The most relevant criteria for waste prevention is total generation of construction and demolition waste (BIO Intelligence Service 2009).

The study proposed, based on the data availability and consideration about the best available and best wanted indicators, to include three core elements.

- Domestic extraction and import/export of construction materials,
- Construction and demolition waste generated and
- Physical activity in the construction sector.

These indicators will provide information on the waste intensity of the construction industry. Links are provided to relevant data sources. The proposal has to be seen as a first step and further research and development are needed (BIO Intelligence Service, 2009)

The Arcadis report (Arcadis, draft 2010) identifies some indicators used. The OECD proposes the indicator to be the amount of construction and demolition waste in tonnes/year or in tonnes/GDP per year.

6.2 Possible indicators to evaluate waste prevention

A commonly used indicator in some countries is the C&D waste sent to landfill. However, less landfilled waste is not necessarily equivalent to less produced waste, as more waste could be recycled or utilised at incineration plants.

Also, the amount of recycled waste is used as an indicator, but recycling is not by definition equivalent to waste prevention.

The European Commission has identified the most commonly used indicators shown in Table 9.

Table 9. Evaluation of commonly used waste prevention indicators.

	C&D waste landfilled		Recycling of C&D waste		Total generation of C&D waste	
Relevant	Not prevention itself, but linked with resource saving potential	2	Not prevention, but contributes to avoid extractions of virgin materials and landfilling of C&D waste	3	Direct measurement of pressures arising from C&D waste	4
Accepted	Not accepted as prevention, but accepted indicator of unsustainable use of construction material	2	Accepted as important element and contribution to resource savings and waste prevention indirectly	3	Amount and hazard-ousness of demolition waste reflects earlier building activities and technology	4
Credible	Difficulties with estimations	2	Difficulties with estimations (on site recycling)	2	Data reporting is to improved in several EU member states	2
Easy	Data availability is currently poor in most EU countries	2	Data availability is currently poor in most EU countries	2	Data availability is currently poor in most EU countries	2
Robust	Accounting of soil excavated distorts numbers. Unreliable data quality in several EU states	2	Difficulties with measuring on-site-recycling	2	Accounting of soil excavated distorts numbers. Unreliable data quality in several EU states.	2
Average score	2.0		2.4		2.8	

Source: Bio Intelligence 2009

Waste prevention initiatives are often difficult to evaluate as many factors influence waste production in society. Waste from the C&D sector is in particular sensitive to economic fluctuations, while changes in economic

growth will have a substantial effect on waste production. Particular large scale infrastructure projects may also for a period distort the annual statistics on C&D waste. Thus there could be reasons for combining indicators for economic growth with indicators for waste production.

The European commission suggested indicators as shown in table 10. It is suggested that resource and waste streams are related to the gross domestic product (GDP) or related to the actual physical construction activity measured in net area. It is also suggested that both domestic extraction and import/export of materials for construction and waste generated in the C&D sector are related to either economic or physical activity.

Table 10. Potential waste prevention indicators.

	Domestic extraction ¹⁹ (DE)	C&D waste generated (CDWG)	C&D waste landfilled (CDWL)
Gross domestic product (GDP)	DE/GDP	CDWG/GDP	CDWL/GDP
Output of the construction sector (OUT)	DE/OUT	CDWG/OUT	CDWL/OUT
Area of new construction (PA)	DE/PA	CDWG/PA	CDWL/PA
Proposed combinations	(DE+CDWG)/GDP (DE+CDWG)/PA (DE+CDWL)/GDP (DE+CDWL)/PA		

Source: Bio Intelligence 2009

The indicators defined above in Table 10 focus on the first part of the waste prevention definition to reduce waste amounts. The second and third parts of the definition are not aimed at by these indicators.

To focus on the third part of the definition some indicators could be the amount of hazardous waste or the amount of hazardous waste per GDP. This indicator will, however, show the amount produced currently and is mostly dependent on historic construction activities. If the aim is to reduce the use of hazardous substances, an indicator could be the consumption of some selected substances in the building and construction sector.

6.3 Challenges in setting targets for waste prevention

There are a range of challenges in the aim of defining targets for waste prevention. The first challenge is the availability of suitable data on waste generation from the building and construction sector. Appendices B and C describe and quantify C&D waste amounts from the Nordic countries. Data from the countries varies from 68 kg to 4700 kg per citi-

¹⁹ A country's domestic extraction of a resource is the total extraction of the relevant resource that occurs only within the country.

zen per year and it is obvious that the differences among countries' data are large. These varying figures cover differences in treatment and registration of waste in the Nordic countries and setting common targets must at least require similar waste registration.

Another challenge is that the effects of the different initiatives are very uncertain and rarely quantified in respect to waste generation. This means that it is quite difficult to set any realistic reduction targets before effects of any waste prevention initiative are evaluated.

Finally the waste generation from the sector is produced many years after construction and consumption of materials. This means that any initiatives on more sustainable construction with reduced used of hazardous substances will affect the waste generation many years after the initiative. This time aspect must be considered in any targets that may be set.

7. Communication

In order to successfully achieve an effective waste reduction through preventive indicators within the construction and demolition sector, an important factor is to develop a communication strategy. Successful communication will enhance the sector's ability to connect best practices and new ideas to the efforts of other organizations.

We suggest that the communication strategy will be based mainly on the use of existing channels and build on existing communication platforms. That is the Nordic Environmental Protection Agencies, the Nordic Council of Ministers, waste societies and professional organizations and various companies that produce construction materials.

Communication research indicates that the probability for changing markets, and behaviour, is most advantageous when it is economically viable and if the stakeholders themselves are involved and committed. Hence, an obvious communication point is the benefits that companies and businesses get by preventing and minimizing waste. This could also focus on how companies can advertise their work and use it in their marketing, for example, as part of the CSR-strategy, or through its environmental profile.

Stakeholders must also feel obligated to participate in this work, and we propose that occurs in the project through the proposed workshop at the seminar, where governments and the construction industry meet to talk about opportunities in the work. Therefore, we suggest that a strategy for communication and outreach will be developed interactively with stakeholders on a seminar on waste prevention in the construction and demolition sector. The communication strategy should establish the following:

- Objectives
- Target audiences
- Key messages
- Tools and activities
- Resources
- Timescales
- Evaluation and amendment

The strategy can be used as a platform for developing an information toolkit on waste prevention, like the JESSE-case, see chapter 4.4.1.

8. Conclusion and discussion

Preventing waste is the action that has the highest priority under the EU's recently revised framework directive on waste. An effective implementation of waste prevention initiatives could be based on the already existing valuable experience from successful waste prevention activities that have been tested in various countries, regions and municipalities. The general perception within the industry is that the environmental benefits of waste prevention, including direct re-use and minimisation at source, are often enormous. Also, it is believed that waste prevention activities have a large potential of paying off economically. Further on, manufacturers of building elements also see eco-labelling their products as a marketing advantage in the global market.

However, only a limited number of actual waste prevention measures have been implemented within the construction and demolition waste domain. The measures and good ideas that were found came from all types and levels of stakeholders (such as industry, contractors, public purchasers, designers, distributors, researchers and local and central authorities). In total some 30 initiatives were identified and the case studies confirmed that the ongoing initiatives are at an early stage. Hence, most of the waste prevention measures found were difficult to evaluate other than in a descriptive way as a built-in evaluation of their performance was not considered.

During the mapping, the main part of the initiatives could be referred to as waste recycling activities according to the EU waste definition (figure 1). The measures focused on end-of-chain concepts, such as recycling, and recovery activities, rather than actual waste prevention at source.

The case studies demonstrate that voluntarily initiated measures so far play a leading role in waste prevention within the construction and building sector. Most of them are related to measures to reduce hazardous substances from C&D waste. Respondents in the study have emphasised the need for education and information among all actors, from the early planning stage to the carrying through of projects.

Political steering instruments are another measure for handling the waste prevention challenge, including legislative and economic measures such as taxation and regulations. Indirectly EU directives, such as the Ecodesign directive, the Construction products directive (CPD), and REACH establish consistent EU-wide rules that can be used for waste prevention measures on a product oriented level. This could indirectly promote waste prevention in the building and construction sector by influencing practical decisions taken at an early stage of the life cycle:

how products are designed, manufactured, made available to the industry and finally used, reused, recycled or disposed.

Different national waste prevention strategies are in fact already in place in the Nordic countries based on these EU directives. The measures are often of a technical, voluntary or educational character, e.g., eco-labels, substitution of hazardous substances, life-cycle assessments, design of products, building information modelling, information sheets, awareness campaigns, and guidelines.

All these clusters address one or more types of stakeholders in the construction sector. The initiatives may also refer to different stages of a construction's life cycle, varying from the design phase to the end-of-life treatment. The main focus is on the design phase so that an efficient use of resources is achieved, while many initiatives that target the end-of-life stage are more comprehensive by merging prevention initiatives with recycling.

Also, there seems to be a lack of practical initiatives regarding waste generation that might be of importance in the construction process. During the construction phase, building and construction material is often spoiled due to improper storage, e.g. in the Nordic climate region, we have lately experienced an increased precipitation during summers in combination with harsher weather conditions. If building materials haven't been covered under a waterproof shield, this will lead to an increased amount of materials getting discarded and an increase in waste generation.

A combination of resource efficiency and cost saving argumentation would have an effect in waste prevention especially during construction. Further work is needed on performance indicators for waste prevention from the building and construction sector so that the baseline for the calculation of the effects is well defined.

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Sammenfatning på dansk

Nærværende rapport har identificeret og evalueret initiativer til forebyggelse af affald fra bygge- og anlægssektoren. I alt er 32 initiativer blevet identificeret og grupperet i syv kategorier, som er følgende:

- Direkte genbrug af byggematerialer
- Informationskampagner
- Vejledninger til forebyggelse af affald
- Frivillige aftaler
- Identificering af farlige stoffer
- Værktøjer til registrering af byggematerialer uden farlige stoffer
- Mærknings og certificeringsordninger

Syv casestudier på initiativer, én fra hver af ovennævnte kategori, er beskrevet i detaljer og vurderet hver for sig. Dette studie viser, at initiativer til forebyggelse af affald kun i begrænset omfang i dag er en integreret del af aktiviteterne i bygge- og anlægssektoren. Mange af de aktiviteter, som sker i sektoren, har til formål at reducere mængden af affald til deponering, frem for at reducere de samlede affaldsmængder. En stor andel af aktiviteterne fokuserer desuden på øget genanvendelse, mens forebyggelse og herunder direkte genbrug udgør en mindre andel af de initiativer, som sker i branchen.

Der er dog en lang række gode ideer til fremtidige initiativer, som diskuteres blandt sektorens interessenter inklusive bygherrer, entreprenører, offentlige indkøbere, arkitekter, forskningsinstitutioner og statslige institutioner. Derfor er der i rapporten et særskilt kapitel, hvor disse ideer fremlægges.

Hovedparten af de beskrevne initiativer er baseret på informationsværktøjer såsom retningslinjer, håndbøger, beregningsværktøjer og checklister. Målgruppen er primært bygge- og anlægssektoren.

Aktiviteter vedrørende forebyggelse af affald inklusive foranstaltninger til at reducere indholdet af skadelige stoffer i materialer og produkter er et væsentligt aspekt af affaldsforebyggelse, da vi sigter mod at reducere eksponeringen for skadelige stoffer i vores hverdag. Ligeledes er det vigtigt, at undgå skadelige stoffer i materialer, og som dermed vil medføre en renere affaldsfraktion, som i visse tilfælde er velegnede til direkte genbrug. Undgåelse af skadelige stoffer vil desuden medføre en mindre påvirkning på miljøet, hvis affaldet genanvendes, forbrændes eller deponeres. Disse aktiviteter er ofte integreret i andre initiativer, f.eks. i certificeringsordninger for bæredygtige bygninger.

Evaluering af data og statistik har vist sig at være en vanskelig og tidskrævende opgave. Selvom kvaliteten af de indberettede data er forbedret i løbet af de seneste år, kan de stadig ikke sammenlignes mellem de forskellige nordiske lande. Det skyldes forskelle i rapporteringssystemer og definitionen af affald f.eks. om jord er inkluderet eller ej. Forebyggelse af affald i form af jord er ikke medtaget i denne rapport, dog er data for jord inkluderet i de finske data, da jord ikke kan udskilles.

Dataproblemerne indebærer, at initiativer til affaldsforebyggelse er svære at dokumentere og dermed vurdere effekten af. En kombination af øget fokus på ressourceeffektivitet og sparede udgifter forventes at have en effekt på forebyggelse af affald i byggesektoren. Yderligere arbejde med at udvikle indikatorer er nødvendigt, således at udgangspunktet for beregning af initiativernes effekt er veldefinerede.

Casestudierne viser, at frivillige aftaler spiller en fremtrædende rolle i affaldsforebyggelse i bygge- og byggesektoren. De fleste af de frivillige aftaler er relateret til udfasning af farlige stoffer fra bygge- og anlægsaffald. Referencegruppen til dette projekt har understreget behovet for uddannelse og øget information til alle aktører i hele kæden fra den tidlige planlægning til udførelse og afslutning af byggeprojekter.

Appendice A: Identified initiatives

#	Stake-holder	Description	Type of instrument	Method	Country	Who and where	Time	Reference	Effect (e.g. saved tons or cost, prevalence)
1	local government	A guideline on waste reduction in the C & D sector, including checklists for waste minimisation	information	guideline	AU	Canberra		http://www.tams.act.gov.au/_data/assets/pdf_file/0006/37968/Waste_Minimisation_in_the_Construction_and_Demolition_Industry1.pdf	
2	B&C sector and state	IBO ÖKOPASS – building pass for residential complexes The IBO ÖKOPASS is a building pass specially developed for residential complexes. It aims at showing proof of the quality of residential complexes on the basis of building biology and building ecology principles and the use of it as a tool for marketing and quality assurance. All criteria are checked and assessed by means of measurements and calculations in the framework of a two-step assessment (preliminary assessment and final assessment)	certification	certification	A	Österreichisches Institute für Baubiologie und Bauökologie	2010	http://www.ibo.at/en/oekopass/kriterien.htm	
3	Municipality	Web-based market service for exchange of goods including building material, consumer products..	promotion of market	Internet portal	A	Wien municipality	ongoing	https://www.wien.gv.at/umweltschutz/webflohmarkt/index.html	1000 tons of waste yearly
4	Municipality	The expected harmful substances should be identified prior to building demolition. Therefore the municipal Department for Environmental Protection promoted the creation of the rule "Identification of harmful substances in buildings before demolition work.	regulation		A	Wien municipality	2006	http://wien.gv.at/english/eco/	
5	Municipality	The 17&4 project provides with guidelines to construction companies in order to minimise their waste mainly from construction activities. The project was part of Vienna's development competition	Information	Guideline	A	municipality	ongoing	http://www.17und4.at/e_pr_abfallver.html	
6	local government	The Public Waste Agency of Flanders is supporting prevention initiatives in the private sector by providing expertise and funding of (initially) three prevention projects. This cooperation will be continued in the future.	Financial	funding of projects	B	national	ongoing	http://www.ovam.be/jahia/Jahia/pid/1800?lang=null	
7	State	Sustainable project design. (Miljørigtig projektering)	Information	PC-programme in 2002	DK	Danish EPA, Danish Building Research Institute and others	2002 ongoing	http://www.sbi.dk/miljo-og-energi/miljovurdering/miljorigtig-projektering-af-byggeri/miljorigtig-projektering-af-byggeri	
8	B&C sector/state	Agreement on selective demolition (Aftale om selektiv nedrivning)	Voluntary agreement	Agreement	DK	Minister of Environment og association of building contractors	1996 ongoing	http://www.mst.dk/NR/rdonlyres/5138B808-B9B5-453A-9CE5-4A75EF9D4259/0/NMK96_01.pdf	
9	B&C sector	Use of different sustainability certifications schemes for buildings which may include waste prevention initiatives e.g. Bream (UK) LEED(USA) SBI in Denmark has published a report comparing	certification	certification	Global		2010	http://www.byggeevaluering.dk/db/files/baeredygtighed_hr_inkl_uk.pdf	

#	Stake-holder	Description	Type of instrument	Method	Country	Who and where	Time	Reference	Effect (e.g. saved tons or cost, prevalence)
10	municipality	different schemes COWI has also published information about Breeam and Leed. A booklet describes the means to prevent and reduce waste throughout the lifecycle of the construction of a building. Specific advices are given for the planning and design phase of the construction, on the building site, and for maintenance or reparation by the user. It is also proposed to deliver a service plan to the client by new constructions and renovation, with information on materials and requirements for maintenance. Thus the developer can ensure optimal maintenance of the building.	Information	a booklet	FI	Helsinki Metropolitan Area Council (YTV), Finland (local)	2007 – ongoing	http://www.ytv.fi/ENG/fiksu/ait_work/building_trade/frontpage.htm	Evaluation 14%in the B sector had read it http://www.ytv.fi/NR/rdonlyres/076FE5D-D-661D-4A64-A712-299BB51ECB16/0/BP_Building_eng_nettti.pdf
11	NGO	Web Platform for the Trade of C&D Waste "nemsitt.hu" On the web platform advertisements of demolition materials and construction leftovers are available (wide range of categories).	promotion of a market	Web platform	H	National	ongoing	http://nemsitt.hu/	
12	Local government	A project designed to provide information to municipalities on how to plan, execute and monitor a waste prevention programme in cooperation with businesses or other communities.	Information	Programme including various guidance documents, a web platform and training courses	IRL	national	2009 and ongoing	http://localprevention.ie/about/	
13	B&C Sector	The New Integrated Prevention Programme in Ireland is providing guidance and useful advice to construction businesses that want to be engaged in prevention initiatives. One case study is demonstrated as an example.	Information	Guideline and case studies	IRL	national	ongoing	http://www.managewaste.ie/e_guides/i_effective_construction_waste.asp	
14	B&C sector	The green initiative of Skanska integrates waste prevention in the companies overall environmental activities. Avoid redesigning of buildings and thereby avoid additional waste. Use of Lean construction. Prefabrication of buildings reduce waste, Another way to reduce waste is to deliver materials and installations, without packaging.	Information	Strategy and casestudies	Global	Skanska	2010	http://www.skanska.no/no/Om-Skanska/Samfunnsansvar/Miljoansvar/Materialer-og-kjemikalier/ http://www.skanska.com/upload/About%20Skanska/Our_Green_Initiative/Green_thinking_book.pdf	
15	B&C sector and state	The Environmental Program is based on an environmental review which has identified the significant environmental aspects of the building sector. From these significant environmental aspects – The use of energy, The use of materials, The use of hazardous substances and The impact on indoor air quality in buildings – the Ecocycle Council has formulated a number of environmental objectives and a plan of action.	voluntary agreement	Environmental program	SE	national	2003 and ongoing	http://www.kretsloppsradet.com/web/page.aspx?pageid=170022	
16	NGO	The aim of the BASTA system is to speed up the phasing out of hazardous substances in construction. Products are assessed	information tool	web-database	SE	National part of the environmental	2009	http://www.bastaonline.se/english/bastaonline/aboutbasta	

#	Stake-holder	Description	Type of instrument	Method	Country	Who and where	Time	Reference	Effect (e.g. saved tons or cost, prevalence)
		according their chemical ingredients. The assessment is addresses a number of properties criteria for the chemical ingredients in a product, and it is the suppliers themselves who are responsible for the assessment. Only products that meet these requirements can be registered in the BASTA system.				programme (Kredsløbsrådet)			
17	Municipality	The Goteborg city is running this recycling and reuse centre. The reuse centre sell used building materials e.g. old windows to private citizens and business	promotion of market	recycling and reuse centre	SE	Göteborg	2006-ongoing	http://www.kretsløppsparken.nu/klp/klp.asp?nav2=om_klp	
18	Waste sector	SITA and Veolia have developed a calculation tool to reduce the amount of waste landfilled. The method calculate the cost of mixed waste compared to sorted waste. The method is used in pilot projects in Sweden and Norway. In the future it might be used to reduce the amount of waste generated.		calculation method	SE NO		2010	Personal communication Carl Enqvist, Skanska Sweden	
19	NGO	<i>ReiY – short for Reuse It Yourself – is a UK-wide network of building material reuse centres. These are social enterprises which collect excess construction materials and sell them on</i>	<i>Promotion of a market</i>	<i>Internet portal</i>	UK	<i>Group of SMEs in UK</i>	2008 – ongoing	http://www.reiy.net/	
20	WRAP	Designing out Waste:a design team guide for buildings	guideline	guideline based on design competition in 2009	UK	WRAP, UK	2010	http://www.wrap.org.uk/wrap_corporate/news/wrap_and_ri_ba_launch.html	
21	B&C Sector/state	"halving waste to landfill" voluntary agreement. more than 460 contractors have signed up. WRAP provides a procurement guidance document for sustainable management of construction, supported by successful case studies across the UK	voluntary agreement	Guideline and case studies	UK	national	2008-2012	http://www.wrap.org.uk/construction/tools_and_guidance/procurement.html	
22	WRAP	WRAP provides a guidance document which contains practical technical information on effective waste minimisation	Information	Guideline	UK	national	ongoing	http://www.wrap.org.uk/downloads/Waste_min_technical1.9704a177.5119.pdf	
23	NGO	WasteCap Resource Solutions provide planning, technical and educational assistance during construction and demolition projects.	Information	training	USA	Wisconsin	1998	www.wastecapwi.org	
24	NGO	A NGO has developed a Community Waste Prevention Toolkit: Construction & Demolition Fact Sheet Built to Last: Preventing Waste from Construction, Renovation, and Demolition Materials	Information	Tool kit	USA		ongoing	http://www.informinc.org/pages/research/waste-prevention/fact-sheets/community-waste-prevention-toolkit-construction-a-demolition-fact-sheet.html	
25	Private initiative	A private Danish company operates a web platform where building components are resold. The company takes care of repairing and resells products online or at a store.	promotion of a market	Internet portal/store	DK	national	ongoing	http://www.genbyg.dk/	
26	State	GLITNE – Economical value of environmental impacts in construction	information	toolkit	NO	national	ongoing	http://www.sintef.no/glitne	
27	B&C sector	LEED – Environmental assessment and verification of sustainable	Environmental	evaluation and	USA	worldwide	ongoing	http://www.leed.net/	

#	Stake-holder	Description	Type of instrument	Method	Country	Who and where	Time	Reference	Effect (e.g. saved tons or cost, prevalence)
7		constructions and buildings.	assessment	certification					
2 8	B&C sector	BREEAM – Environmental Assessment Method. It sets the standard for best practice in sustainable design and has become the de facto measure used to describe a building's environmental performance. BREEAM addresses wide-ranging environmental and sustainability issues.	Environmental assessment	evaluation and certification	UK	worldwide	ongoing	http://www.breeam.org/	
2 9	B&C sector	Green building information modelling (BIM)	information (report)	Guidelines	USA	worldwide	ongoing	http://construction.com/market_research/FreeReport/GreenBIM/MHC_GreenBIM_SmartMarket_Report_2010.pdf	
3 0	B&C sector	Sunda Hus The SundaHus summarizer tool is a tool for finding out which environmental classification an existing or new building will have using the "Dialogue project" method. SundaHus has implemented the different environmental classification parameters into the summarizer tool in order to enable interactive work with this method.	Environmental assessment	web-database	SE	Sweden	Ongoing	http://www.sundahus.se/home.aspx?lang=en	
3 1	B&C sector	Byggsvarubedomningen Database with construction materials that are evaluated in respect to environment.	Environmental assessment	web-database	SE	Sweden	Ongoing	http://www.byggsvarubedomningen.se/sa/node.asp?node=303 .	
3 2	B&C sector	Miljöbyggnad Swedish environmental classification system that is created for Swedish conditions.	Environmental assessment	evaluation and certification	SE	Sweden	ongoing	http://www.sgbc.se/certifieringssystem/miljoklassad-byggnad/	

Appendice B:

Data for the Nordic countries on waste amounts and composition

B.1. Data on waste amounts and composition

Data on construction and demolition (C & D) waste for Nordic countries are quite limited. The reporting obligations for waste producers and treatment companies are different for each country so is the statistical system in place.

This fact combined with the limited obligation to report for the EU creates a very diverse picture for the situation in the different Nordic states. Another factor that affects this diversity is the different interpretation of the definition of this waste stream.

The C&D waste generation in Nordic countries varies quite a lot (table B1), starting from around 70 kg (Iceland) up to more than 4.5 tonnes per capita (Finland), although the figure for Finland includes soil so the range should be significantly smaller. The differences can be explained not only by the different reporting or definition but also by waste quantities escaping the official waste management. Especially in Iceland, waste producers themselves dispose of the waste in unofficial sites or *in situ* on the construction sites.

Table B1. Generation of total C&D waste in all countries (in 1000 tonnes and kg/capita).

	Total generation		Per capita generation	
	2006	2008	2006	2008
Denmark		4048		739
Finland ²⁰		24979		4713
Iceland		21		68
Sweden	9083	3310	1004	357
Norway		1500		317

B.1.1 Denmark

A quite long time series is available for the generation of C&D waste in Denmark. The available data start from 1994 and end in 2008 (ISAG database from the Danish EPA). In Table B2 below, the total C&D waste generation and the per capita generation is presented, starting from 2001.

²⁰ Finland's data include soil

Table B2. Generation of total C&D waste (excluding soil) in Denmark.

	2001	2002	2003	2004	2005	2006	2007	2008
Generation (in 1000 tonnes)	3,391	4,044	3,785	4,496	5,270	6,113	5,767	6,009
Generation (in kg/capita)	634	753	703	833	974	1,126	1,059	1,097

Source: ISAG from the Danish EPA.

Table B2 shows a general trend towards increase in the per capita generation, with small setbacks such as 2003. The C&D waste generation is directly linked to the sectoral economy of the construction sector, so fluctuations in the building activities have an immediate effect on the waste quantities generated.

After 2006, the construction sector seems to have stopped expanding, hence the waste generation is stabilising or even decreasing. This fact might as well be linked to the economic crisis, but only for the year 2008 and after.

Regarding the waste composition, the Danish EPA provides with a rather detailed breakout of C&D waste into fractions, which are presented for the last five years in Table B3, according to the European Waste List classification (EWC).

Table B3. Generation (1000 tonnes) of C&D waste fractions in Denmark.²¹

EWC Code	Name	2004	2005	2006	2007	2008	2008 (%)
17 01 01	Concrete	1,047	1,179	1,393	1,569	1,452	24
17 01 02	Bricks, Tiles and	247	242	290	332	221	4
17 01 03	Ceramics						
17 02 01	Wood	43	67	68	70	68	1
17 02 02	Glass	14	30	5	9	4	0
17 02 03	Plastic	2	2	2	2	2	0
17 03	Asphalt and tar	716	737	965	781	884	15
17 04	Metals	21	19	17	15	14	0
17 05	Soil and dredging soil	1,367	1,932	2,245	1,726	1,961	33
17 06 01	Insulation material Containing asbestos	13	16	16	21	28	0
17 09	Other C&D waste	1,025	1,045	1,113			0
	TOTAL	4,496	5,270	6,113	5,767	6,009	100
	TOTAL (excl soil)	3129	3338	3868	4041	4048	

Source: ISAG from the Danish EPA.

Judging from table B3, the relative part of each fraction in the total C&D waste arising does not change a lot with time. Soil and stones, concrete and asphalt are the dominant materials included, apart from the "other C&D waste" fraction which comprises of diverse materials. Nevertheless, some small fractions may have a very important role in terms of envi-

²¹ Some data gaps can already be identified since in 2007 and 2008 the sum of the fractions' generation does not equal the reported total generation.

ronmental damage, despite their low amounts. For example, metals account for a very small part in C&D waste but, due to their environmental impacts, they are especially important for C&D waste prevention and management.

B.1.2 Finland

The data regarding C&D waste generation and treatment in Finland is fragmental and limited. The responsible body for collecting and managing data in Finland is the National Statistical Office, which provides with the most detailed data with respect to the composition of waste.

Table B4 shows the data availability according to different sources. The oldest data are drawn from a report by the European Topic Centre on Sustainable Consumption and Production (ETC/SCP) on recycling. For 2004, the data sources are two, since both Eurostat and Statistics Finland provide with data. The difference in the total amount is not significant, but the Eurostat data are preferred since they include information on the waste composition.

Table B4. Generation of total C&D waste in Finland.

	1995	1997	2004a	2004b	2008
Generation (1000 tonnes)	8,000	9,800	20,843	21,600	24,979
Generation (kg/capita)	1,569	1,909	3,993	4,138	4,713

Sources; ETC/SCP (1995, 1997), Eurostat (2004a), and Statistics Finland (2004b, 2008).

The data are quite problematic since there is a big divergence between the 1995, 1997 data with the following years which could only be explained by a sudden boost in the construction sector. The difference might lie with the inclusion/exclusion of soil from the registration.

Data for the composition of the generated C&D waste can be found for 2004 and 2008, but from different sources (Table B5). In these composition data, it appears that the inert fraction (17 01) represents the majority of C&D waste. However, the figure for 2004 also includes soil in this waste list code.

In general, it is difficult to separate the fractions on one hand and on the other, no information is given for many other fractions. Nonetheless, it is safe to claim that the major part of Finnish C&D waste is soil.

Table B5. Generation of C&D waste fractions in Finland.

EWC Code	Name	2004		2008	
		1000 tonnes	%	1000 tonnes	%
17 01	Concrete, bricks, tiles, ceramics and gypsum-based materials	15,545	74.58	23,726	94.98
17 02 01	Wood	676	3.24	729	2.92
17 02 02	Glass			37	0.15
17 02 03	Plastic			1	0.00
17 04	Metals	226	1.08	249	1.00
17 05	Soil and dredgin soil	385	1.85		
17 07	Mixed C&D waste			237	0.95
	Total	20,843	100	24,979	100

Sources: Eurostat (2004) and Statistics Finland (2008).

B.1.3 Iceland

C&D waste generation in Iceland is very diverse, according to the relevant data. The IBRI report from 2002 attempted a detailed analysis of the C&D waste generation and treatment by inquiring collection and treatment private and public companies (Sveinsdottir et al, 2002). The results of the survey showed that there are many problems with the collection coverage of the Icelandic territory.

The report divides the country into the Reykjavik metropolitan area and the different other regions. The C&D waste generation in Reykjavik is estimated to be around 600 kg/cap/year in 2000, higher than the European average of 480 kg (estimated in the report). On the other hand, the other regions present great diversity in their estimation varying from 21 to 490 kg/capita/year, with an average of 110 kg. The reason behind this inconsistent situation is that waste is brought to (official or un-official) sites without involving collection companies.

The IBRI report also includes an analysis on the composition of C&D waste based on the reporting of a large collection company and two landfill sites. The results show that (besides soil) concrete, gravel and asphalt are by far the dominating fractions (Table B7). Statistics Iceland present total generation figures for the years 2002-2006. The generated quantities increase from 12 to 25 thousand tonnes.

Through personal communication with Statistics Iceland, CRI managed to collect some further data for 2006-2008 regarding the C&D waste generation and some rough distribution into fractions. The sum of all data collection, as well as the sources is presented in Table B6 and Table B7.

The collected data, however, are rather unclear since variations in waste amounts are not easily explicable (e.g. wood and glass generation in Table B7). The reason is again that data are collected through waste

collection companies which might choose to collect separately some fraction one year and as part of mixed waste the next year.

Table B6. Generation of total C&D waste (excluding soil) in Iceland.

	2000	2002	2003	2004	2005	2006	2007	2008
Generation (1000 tonnes)	86	12	15	17	22	44	33	21
Generation (kg/capita)	308	42	52	59	75	145	107	68

Sources: IBRI Report (2000), Statistics Iceland (2002-2005), and personal communication with Statistic Iceland (2006-2008).

Table B7. Generation in tonnes of C&D waste fractions in Iceland.

EW Code	Name	2000	2000 (%)	2006	2007	2008
17 01 01	Concrete	52,429	61			
17 01 02	Bricks	1,363	2			
17 01 03	Tiles and ceramics	212	0			
17 01 04	Gypsum	519	1			
17 02 01	Wood	4,167	5	13,000	7,701	16,657
17 02 02	Glass	2,287	3	5,547	5,428	132
17 02 03	Plastic	84	0			
17 03 01	Asphalt containing tar	17,696	21			
17 03 03	Tar and tar products	140	0			
17 04 05	Iron and steel	91	0			
17 04 07	Mixed metals	9	0			
17 04 08	Cables	62	0			
17 04 09	Metal coatings	292	0			
17 05 01	Soil and stone	33,685	.			
17 05 05	Gravel	48,659	.			
17 05 06	Soil and earth	128,167	.			
17 05 07	Mixed soil	815,669	.			
17 06 01	Insulation w/asbestos	757	1			
17 06 02	Other insulation	157	0			
17 07 00	Mixed C&D waste	5,589	7	25,000	19,884	4,677
	Total	1,112,034	100			
	Total (excl soil)	85.854		43.547	33.013	21.466

Sources: IBRI report (2000) and Statistic Iceland, personal communication with Statistic Iceland (2006-2008).

It is interesting to notice in Table B6 that the effect of the economic crisis, which was particularly severe for Iceland, on the generation of C&D waste in the last three years, during which generation was halved. The gradual decrease in quantities is strongly connected to the activity in the construction economic sector.

The analysis performed during the IBRI report was, as shown in Table B7 quite detailed, while the reporting to Statistics Iceland for the later years is only fragmental. The IBRI report involved stakeholders in

the survey by providing questionnaires. In both cases, the results of the composition inquiry are based on collected amounts by private/public companies, which can partly explain the differences in the quantities of some fractions (e.g. glass). It is important to note that the IBRI report has made estimations where necessary in order to tackle data gaps.

B.1.4 Norway

In Norway, the national Statistics Office has created a databank in order to disseminate different types of data to interested parties. This databank contains also C&D waste statistics regarding their generation. In Table B8, the data from 2002 to 2008 are presented. Table B8 shows that Norway has rather low per capita generation when compared to other Nordic countries, except for Iceland. The generated amounts do not show vivid fluctuations, they appear to be stabilised around 300 kg/cap.

Table B8. Generation of total C&D waste (excluding soil) in Norway.

	2002	2003	2004	2005	2006	2007	2008
Generation (1000 tonnes)	1,233	1,165	1,174	1,394	1,253	1,543	1,500
Generation (kg/capita)	273	256	256	303	270	330	317

Source: Statistics Norway.

Table B9 includes information on the composition of the generated wastes. This division illustrates that concrete is the largest fraction, followed by wood, besides “other C&D waste”. The important element in this table is that Norway does not provide with data on soil or other inert fractions, probably because of the registration system. This fact is mainly responsible for the significantly lower generation observed in Norway compared to other neighbouring countries.

Table B9. Generation (1000 tonnes) of C&D waste fractions in Norway 2003-2007.

EWC Code	Name	2003	2004	2005	2006	2007	2007 (%)
17 01 01	Concrete	572	553	656	581	720	47
17 02 01	Wood	162	176	215	191	240	16
17 02 02	Glass	65	65	77	70	85	6
17 02 03	Plastic	10	12	14	13	15	1
17 04	Metals	47	49	58	53	64	4
	Other C&D waste	309	319	374	345	419	27
	TOTAL	1,165	1,174	1,394	1,253	1,543	100

Source Statistics Norway.

B.1.5 Sweden

Data on generation and treatment of C&D waste in Sweden are provided by the Swedish EPA. The available data are included in the report "Avfall I Sverige" (Naturvårdsverket, 2010). This report contains data on all types of waste and from all sources including the construction sector. The data refer to 2004 and 2006, as shown in Table B10 below.

Table B10. Generation of total C&D waste in Sweden.

	2004	2006	2008
Generation-including soil and minerals (1000 tonnes)	11,209	9,083	
Generation-excluding soil and minerals(1000 tonnes)	5,209	2,516	3,037
Generation-including soil and minerals (kg/capita)	1,249	1,004	
Generation-excluding soil and minerals (kg/capita)	580	278	357

Source: Naturvårdsverket

An observation of the data indicates that there is a decrease in the generated amounts between 2004 and 2006. The decrease is quite significant, around 250 kg/cap or 20 %. This cannot be explained by the general economic growth since the Swedish GDP was increasing, but by specific developments in the construction sector which could be arbitrary. In any case, the length of the time series is so small that no safe conclusions can be made.

Regarding the composition of waste, the Swedish statistics follow their own classification system which coincides with the European system for some fractions only. Table B11 shows that mineral waste is the dominant fraction and the following fractions comprise of diverse or unidentified materials. An interesting finding is that the amount of hazardous C&D waste increased massively from 2004 to 2006, which might have been caused by a change in regulations regarding to the classification of produced waste as hazardous.

Table B11. Generation of C&D waste fractions in Sweden.

EWC Code	Name	2004		2006	
		1000 tonnes	%	1000 tonnes	%
17 02 01	Wood	200	1.78%	8	0.08%
17 02 02	Glass	1	0.01%	1	0.01%
17 02 03	Plastic	10	0.09%	0	0.00%
17 04	Metals	250	2.23%	196	2.16%
-	Mineral wastes and soil	6,000	53.53%	6,567	72.30%
-	Hazardous waste	62	0.55%	894	9.84%
-	Other C&D waste	2,286	20.39%	307	3.38%
17 07	Mixed C&D waste	2,400	21.41%	1,110	12.22%
	TOTAL	11,209	100.00%	9,083	100.00%

Sweden. Source Naturvårdsverket.

Appendix C:

Data for the Nordic countries on waste treatment

C.1. Data on waste treatment

The Nordic countries in general recycle most of the C&D waste generated. In spite of the inert nature of the –by weight– major part of this waste stream, recycling is greatly stimulated. The inert waste has limited environmental impacts when landfilled, so the incentive for recycling is lower, besides fiscal measures.

For the fact that recycling in Nordic states is increasing, a part in this development should be attributed to the implementation of landfill and raw materials tax. However, no indication is given on the type or quality of recycling applied. For example, since a significant part of C&D waste is soil, landscaping, soil cover for landfills or use on site in building foundations are considered as recycling activities, thus increasing the recycling percentage for all C&D waste.

Regarding other treatment options, a lot less information is available. It seems, though, that landfilling is preferred mainly for not easily recyclable fractions such as asbestos and soil. On the other hand, although incineration is applied widely in most countries, there are not many combustible fractions in C&D waste, hence incineration is limited. This absence might have been provoked by the fact that some generated wood is directly combusted in private households and therefore not reported. Another issue is that a large part of the combustible wood is impregnated and cannot be incinerated due to regulation.

C.1.1 Denmark

Denmark has quite detailed data regarding treatment of C&D waste in the ISAG database. The information contained there refers not only to recycling but also to incineration, landfilling, special treatment and storage.

Denmark recycling an impressive amount of C&D waste, as recycling has stabilised above 95 % for the last years. Table C1 Table C2 show indicatively data from the last two available years, where landfilling and incineration play a minor role. This high recycling is close to the maximum possible recycling, since most of the fractions are totally recycled.

Table C1. Treatment of C&D waste in Denmark.

in 1000 tonnes		2007				2008			
EWC Code	Name	Recycling	Incineration	Landfilling	Other	Recycling	Incineration	Landfilling	Other
17 01 01	Concrete	1,569	0	0	0	1,452	0	0	0
17 01 03	Tiles and Ceramics	332	0	0	0	221	0	0	0
17 02 01	Wood	70	0	0	0	68	0	0	0
17 02 02	Glass	9	0	0	0	4	0	0	0
17 02 03	Plastic	2	0	0	0	2	0	0	0
17 03	Asphalt & tar	781	0	0	0	884	0	0	0
17 04	Metals	15	0	0	0	14	0	0	0
17 05	Soil and dredgin soil	1,706	0	0	0	1,925	0	36	0
17 06 01	Insulation material w. asbestos	0	0	0	0	0	0	28	0
TOTAL		5,506	71	172	18	5,732	74	177	25

Source: Danish EPA.

Table C2. Treatment of C&D waste in percentages in Denmark.

in 1000 tonnes		2007				2008			
EWC Code	Name	Recycling	Incineration	Landfilling	Other	Recycling	Incineration	Landfilling	Other
17 01 01	Concrete	100%	0%	0%	0%	100%	0%	0%	0%
17 01 03	Tiles and Ceramics	100%	0%	0%	0%	100%	0%	0%	0%
17 02 01	Wood	100%	0%	0%	0%	100%	0%	0%	0%
17 02 02	Glass	100%	0%	0%	0%	100%	0%	0%	0%
17 02 03	Plastic	100%	0%	0%	0%	100%	0%	0%	0%
17 03	Asphalt and tar	100%	0%	0%	0%	100%	0%	0%	0%
17 04	Metals	100%	0%	0%	0%	100%	0%	0%	0%
17 05	Soil and dredgin soil	99%	0%	0%	0%	98%	0%	2%	0%
17 06 01	Insulation material w. asbestos	0%	0%	1%	0%	0%	0%	100%	0%
TOTAL		95%	1%	3%	0%	95%	1%	3%	0%

Source: Danish EPA.

C.1.2 Finland

The Finish Statistical Office does not provide with data on treatment of C&D waste. The only available data come from (ETC/SCP, 2009) and they refer to 1995 and 1997. The recycling percentage then was 26 % and 41 % respectively. The indication of significant improvement between only two years, combined with the fact that the latest data are very old, leads to the conclusion that C&D waste recycling is currently covering most of treatment. This conclusion is reinforced by the imple-

mentation of the Waste Framework Directive which calls for increased recycling with specific targets.

C.1.3 Iceland

Iceland provides with adequate data only for 2000 through the results presented in the IBRI report. These results include treatment based on information on separately collected fractions of C&D waste. Through personal communication with the statistical office in Iceland, some data were reported for more recent years but are relatively poor.

Table C3 and Table C4 show the treatment options preferences per fraction both in tonnes and in percentage values. The overall recycling percentage is very low, because the large (in mass) fractions are almost entirely landfilled, e.g. concrete, asphalt and soil fractions. The environmentally relevant fractions, though, such as metals, plastic and wood are recovered.

Table C3. Treatment of C&D waste in Iceland.

EWC Code	Name	2000			2006	2007	2008
		Recycling	Incineration	Land-filling	Recycling	Recycling	Recycling
17 01 01	Concrete	269	0	52160			
17 01 02	Bricks	45	0	1318			
17 01 03	Tiles and ceramics	102	0	110			
17 01 04	Gypsum	358	0	161			
17 02 01	Wood	636	3531	0	2,574	2,538	12,757
17 02 02	Glass	59	0	2228	2,188	0	0
17 02 03	Plastic	84	0	0			
17 03 01	Asphalt containing tar	0	0	17696			
17 03 03	Tar and tar products	140	0	0			
17 04 05	Iron and steel	86	0	5			
17 04 07	Mixed metals	9	0	0			
17 04 08	Cables	62	0	0			
17 04 09	Metal coatings	292	0	0			
17 05 01	Soil and stone	10	0	33675			
17 05 05	Gravel	4	0	48655			
17 05 06	Soil and earth	0	0	128167			
17 05 07	Mixed soil	70	0	815599			
17 06 01	Insulation w/asbestos	0	0	757			
17 06 02	Other insulation	128	0	29			
17 07 00	Mixed C&D waste	1108	0	4481	0	0	0
	TOTAL	3463	3531	1105040			

Source IBRI report (2000) and personal communication Statistics Icelan (2006-2008).

Table C4. Treatment of C&D waste in percentages in Iceland.

EWC Code	Name	2000			2006	2007	2008
		Recycling	Incineration	Land-filling	Recycling	Recycling	Recycling
17 01 01	Concrete	1%	0%	99%			
17 01 02	Bricks	3%	0%	97%			
17 01 03	Tiles and ceramics	48%	0%	52%			
17 01 04	Gypsum	69%	0%	31%			
17 02 01	Wood	15%	85%	0%	20%	33%	77%
17 02 02	Glass	3%	0%	97%	39%	0%	0%
17 02 03	Plastic	100%	0%	0%			
17 03 01	Asphalt containing tar	0%	0%	100%			
17 03 03	Tar and tar products	100%	0%	0%			
17 04 05	Iron and steel	94%	0%	6%			
17 04 07	Mixed metals	100%	0%	0%			
17 04 08	Cables	100%	0%	0%			
17 04 09	Metal coatings	100%	0%	0%			
17 05 01	Soil and stone	0%	0%	100%			
17 05 05	Gravel	0%	0%	100%			
17 05 06	Soil and earth	0%	0%	100%			
17 05 07	Mixed soil	0%	0%	100%			
17 06 01	Insulation w/asbestos	0%	0%	100%			
17 06 02	Other insulation	82%	0%	18%			
17 07 00	Mixed C&D waste	20%	0%	80%	0%	0%	0%
	TOTAL	0%	0%	99%			

Source IBRI report (2000) and personal communication Statistics Iceland (2006-2008).

The presented detailed data are relatively old, so no safe conclusions can be made on the current state of C&D waste management in Iceland. The more recent figures show a relative increase in wood recycling but give no robust information about other fractions.

C.1.4 Norway

Although the Norwegian statistics reports quite detailed data on the generation of C&D waste, its treatment is not mentioned. Table C5 below contains data gathered for a working paper of ETC/SCP published recently (ETC/SCP, 5/2010). The presented data refer to 2004 and include only some of the fractions included in C&D waste. However, an indication is given on the level of recycling which overall is around 64 %.

Table C5. Treatment of C&D waste in Norway.

EWC Code	Name	2004	
		1000 tonnes	%
17 02 01	Wood	65	37%
17 02 02	Glass	1	2%
17 02 03	Plastic	2	19%
17 04	Metals	35	72%
	Other C&D waste	33	10%
	TOTAL	756	64%

Source: ETC/SCP (5/2020)

Unlike Denmark and Finland (the only other countries with detailed composition of recycling), Norway does not seem to recycle almost all of the metal quantities. However, metals claim the highest recycling percentage among all fractions.

C.1.5 Sweden

Sweden does not provide with much information on treatment of C&D waste. In the EPAs data, only an aggregated figure is mentioned for 2004 and 2006. According to these figures, Sweden recovered 53 % and 72 % of the generated C&D waste in 2004 and 2006 respectively.

Unfortunately, no information is given on the type of recovery, since it could be divided into material or energy recovery. In any case, it is safe to assume that the remaining quantities are landfilled.

The two figures show a significant increase in recovery between 2004 and 2006. The fact that the mixed C&D waste is reduced (see Appendix B, chapter B1.5) might have played a role since it indicates increased focus on separate collection, which facilitates recycling.

Appendice D:

Reference group

A reference group that was set up for this study. The reference group took part in all stages of the study, and especially during mapping of initiatives and presenting new ideas for future waste prevention initiatives.

The participants in the reference group were:

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Carl Eneqvist	Skanska Sverige AB
Marianne Fox	COWI
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Anne-Marie Johansson	Kemikalieinspektionen
Hanne Johnsen	Avfall Danmark
Per Lillehorn	Byggherrarna
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