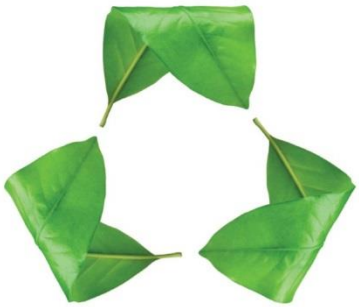
Construction and Demolition Waste Management in

SWEDEN

V2 – September 2015



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Screening factsheet

1. Summary

Construction and Demolition Waste (CDW) management national performance according to WStatR (here waste streams to be included in the calculation of the recovery target)

Year	2010	2012
Generated CDW (Mtonnes)	1. 22	1.31
Recycled CDW (Mtonnes)	0.12	0.18
Backfilled CDW (Mtonnes)	0.61	0.48
Landfilled CDW (Mtonnes)	0.021	0.015
Energy recovery if any (Mtonnes)	0.24	0.41
Unknown treatment (tonnes)	0.23	0.23
Recycling rate (%)	59.9	49.9

A breakdown of CDW into hazardous and non-hazardous waste for 2010 and 2012.

Waste category	2010, Mtonnes	2012, Mtonnes
Non-hazardous CDW		
CDW from buildings	1.24	1.20
Soils	4.00	3.50
Dredging spoils	3.50	2.07
Hazardous waste		
CDW from buildings	0,19	0.17
Soils	0,45	0.72
Dredging spoils	0	0
Total (non-haz. and haz. CDW)	**9.38**	**7.67**

In 2012, 7.7 million tonnes of construction and demolition waste (CDW) were officially reported as generated in Sweden. The amount of CDW in 2012 represents an 18% decrease compared to 2010 (9.4 million tonnes), to a large extent caused by reduced amounts of soils and dredging spoils which tend to normally go up and down between single years. The calculated recycling rates[1] in relation to the 70 % target were 60% (2010) and 50% (2012). In 2016, a new method for data collection on generated CDW amounts will result in partly improved CDW statistics. Waste management facilities (A- and B-classified[2]) will be obligated to report the received CDW and corresponding treatment method. The Swedish Environmental Protection Agency (SEPA) is also considering implementing an increased reporting requirement for C-classified facilities[3] but no decision has been made yet.

The Waste Management Plan (WMP) for 2012-2017 published by SEPA emphasizes especially improved waste statistics and improved management of CDW. The Swedish Waste Prevention plan 2014-2017 includes the following targets: in 2020 waste generation per m^2 built is decreased compared to 2014 and also the content of hazardous substances in materials and products shall be reduced. The WMP contains several concrete initiatives for key stakeholders which aim at sustainable CDW management such as waste

[1] according to the calculation method given in the Commission Decision 2011/753/EU of 18 November 2011 establishing rules and calculation methods for verifying compliance with the targets set in Article 11(2) of Directive 2008/98/EC of the European Parliament and of the Council

[2] Facilities needing a permit for CDW handling according to the Industrial Emission Directive

[3] Facilities needing a notification for CDW handling according to the Industrial Emission Directive

prevention and the minimization of hazardous substances in recyclable CDW, as well as an improvement of waste statistics and guidance for supervision of waste handling.

Some key points raised by several stakeholders:

- New thinking in the organization of demolition works and subsequent recycling planning with key stakeholders already at the early stage. Especially improved logistics in CDW management leads to cost savings. In addition, the Swedish Construction Federation has since 2007 published practical guidance on how to make CDW management more efficient in the whole value chain, starting from planning and waste sorting on site and the identification of hazardous wastes
- EU targets: Transform the general weight-based target into waste-specific targets. This would favour recycling of CDW in general and not only for high weight materials.
- Ranking of recovery operations in the calculation method for reporting progress. Backfilling should not be regarded as equal to other operations for recovery.
- Current statistics coverage and accuracy:
    - Data are lacking for CDW prepared for reuse. This is, however, considered to have a negligible influence on the fulfilment of the recycling target.
    - Construction wastes from private households are not included in current statistics.
- CDW quality is crucial for recycling. Not all CDW is recyclable due to unfavourable technical and environmental properties. Recycling of CDW causes also environmental impacts which need to be taken into account. Due to the long life span of construction products, old constructions may contain construction products with restricted substances that should not be recycled.

CDW management practices

The recycling rate of CDW in Sweden is considered to pass the EU 70% recycling target when the data collection to prove it becomes more successful. Most of the CDW is mineral waste, which is currently used as aggregate in roads, parking areas or in embankments. The second largest waste flow is wood waste, which is used as fuel in energy production. Sweden is providing recycling rates for metal, plastics, glass and mineral waste. Landfill taxes and a ban on landfilling of combustible waste fractions promote the sorting of CDW.

In Sweden, high priority is given to phasing out hazardous substances from society. Several guidance documents have been published on the identification of hazardous substances in CDW and also on selecting safe materials.

There is a strong commitment in Sweden to sustainable CDW management by SEPA, Swedish construction federation and construction companies: planning of activities, on-site sorting, CDW tracking and quality of the recyclable CDW.

Many R&D programmes on recycled materials from CDW have been supported by SEPA, Nordic Council of Ministers, EU Framework Programmes, national research funds like FORMAS, and the industry:

- Nordic initiatives by the Nordic Council of Ministers concerning the use of economic instruments to promote recycling and sustainable management of CDW to reach the EU recycling target and development of tools for sustainability;
- EU-project on new concepts for on-site recycling of construction products and technologies for recycling of asphalt;
- Identification of hazardous substances in construction products and selection of products free from hazardous substances will reduce the hazardous waste amounts generated in the future and also increase recycling potential.

Main obstacles to sustainable CDW management

The following obstacles were identified in the Nordic study*:*

- The EU recovery target favours recycling of high-density waste types. The result is that mineral wastes will have the largest impact while the largest environmental benefits might come from other waste types.
- It does not favour the most sustainable recovery operations. Above all, it does not distinguish between backfilling and other more resource efficient recovery operations. Since backfilling is a recovery option that generally results in both low benefits and future environmental risks, this increases the risk for “down-cycling”, which means that the waste is not recovered in the most optimal way.
- It is very sensitive to interpretations of what is considered as waste and waste recovery. This fact is significant, since the WFD definitions of waste recovery actions such as re-use or recycling are

mainly aimed at the building construction field and do not fit well with materials recovered within other construction fields. For instance, asphalt and ballast, which represent heavy material flows with a high recycling rate, are partly or even totally missing in the waste statistics, and there are strong indications that this inadequacy hinders Sweden from attaining the target though the country already does so in practice.

- Sweden has an abundant resource of high-quality rock, which sets concern on the quality of CDW in order to avoid the spreading of pollutants into the environment. Transport distances of CDW to end-users also set an upper limit for CDW recyclability in practice.

Main drivers to sustainable CDW management

- Cost savings through improved logistics in CDW management.
- Improved and better controlled quality of CDW opens new possibilities for recycling.
- Landfill taxes and ban on landfilling of combustible waste fractions promotes sorting of waste.

2. Definitions concerning Construction and Demolition Waste (CDW) and Management

In this section the definitions of waste used in Sweden are presented.

2.1. Definition of waste

The definition of waste in Sweden is given in the Environmental Code "Miljöbalken" (SFS 1998:808) Chapter 15 and is identical to the definition of the Waste Framework Directive 2008/98/EC (WFD).

2.2. Definition of Construction and Demolition Waste (CDW)

There is not a clear distinction between construction and demolition wastes.

The Commission Decision on the European List of Waste (LoW) (2000/532/EC)[4] is implemented in the Ordinance on Waste SFS 2011:927. Note: Decision 2000/532/EC is amended by Commission Decision 2014/955/EC[5] and a revision of the ordinance is under way.

CDW is defined according LoW 17xxxx entries in the Ordinance of Waste SFS 2011:927, Annex 4.

In the follow up of the EC recycling target, only the following waste fractions are included: "06.1 *Metal waste, ferrous*, 06.*2 Metal waste, non-ferrous*, 06.3 *Metal waste, mixed,* 07.1 *Glass waste*, 07.4 *Plastic waste*, 07.4 *Wood waste*, 12. Mineral waste (excl. 12.4 and 12.6) (from construction section), 12.1 *CDW other section* and 10.2 *mixed waste, not specified*."

Generally, naturally occurring materials excavated in the course of construction activities are not included in the total amount of CDW in the waste statistics.

Plastic waste is included in the follow-up of the target, which included plastic packaging (wrappings etc.). WEEE in constructions are not included in the follow-up of the target.

2.3. End-of-Waste (EoW) status

There are no national EoW criteria set for any types of waste so far, and at the moment there is no preparatory work ongoing.

2.4. Definitions of waste treatment operations

The Swedish Waste legislation complies with the WFD definitions for waste treatment operations. The definitions of preparing for re-use, recycling and recovery in the Ordinance on Waste (SFS 2011:927) are identical to the definitions in the Waste Framework Directive (WFD).

In the Swedish waste legislation, there is no official definition for backfilling. On behalf of the Swedish Environmental Protection Agency (SEPA), IVL Swedish Environmental Research Institute Ltd has developed a guide on how the reporting should be performed in practice. In the guide the following definition is given for backfilling: 1) re-filling of material e.g. in quarries, and 2) the use of waste as filling material e.g. for landscaping. Furthermore, the recovery of waste in construction is mentioned in the Ordinance of Waste (SFS 2011:927) in the context of the notification process.

Backfilling is reported separately from traditional recycling but is included in the follow-up of the target, i.e. included in the numerator.

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[4] Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/C of the European Parliament and of the Council. http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1429545485347&uri=CELEX:32000D0532

[5] Commission Decision 2014/955/EU of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council

3. Legal Framework – Waste Management Plans and Strategies

In this section the legal framework governing CDW management in Sweden is presented.

3.1. Legislation concerning CDW in Sweden

The text about Swedish regulation is to large extent an extract from Arm et al. (2014)[6].

Waste Framework Directive transposition and waste regulation

General rules for waste and handling of waste are laid down in the Swedish Environmental Code "Miljöbalken" (SFS 1998:808) Chapter 15 and in ordinances made by the Government, e.g. Ordinance on Waste (SFS 2011:927). The management of CDW is mainly subject to the general waste legislation or the general rules of consideration in the Environmental Code, Chapter 2. However, there are some guidelines and regulations for certain waste fractions that influence CDW management as well.

Since 2002, it has been prohibited by the Ordinance on Landfilling of Waste (2001:512) to dispose of unsorted combustible waste at a landfill site. In 2005, the ban was extended to cover all organic waste with certain exceptions. The exception for landfilling of organic and combustible waste[7] is given in SEPA regulations and guidelines[8] on the handling of combustible and organic waste. Combustible CDW need not be sorted at source if circumstances are such that sorting on-site is not possible.

Landfilling of gypsum-based waste is restricted in the SEPA regulations on landfilling, criteria and procedures for the acceptance of waste at landfills (NFS 2004:10)[9] according to the Commission Decision 2003/33/EC[10]. Gypsum-based waste generated in construction, renovation and demolition can only be placed in non-hazardous waste landfills in cells where no biodegradable waste is accepted. There is no definition of gypsum-based waste, no criteria on the content of, for example, sulphate that triggers classification of waste as gypsum-based waste and no specific requirements on separate sorting of gypsum-based CDW in Swedish regulations. The guidelines of the Swedish Construction Federation recommend separate collection of plasterboards in building production[11], but not in demolition [12](SCF, 2013).

Provisions on keeping hazardous waste separate and a ban on the mixing of hazardous waste are laid down in the Waste Ordinance (SFS 2011: 927, § 16).

National legislation on CDW management

Waste management in the demolition of buildings is regulated in the Building Code (SFS 2010:900) and guidance is given by the Swedish National Board of Housing, Building and Planning. An inventory of the generation of hazardous waste is required prior to the demolition of buildings. The management of both hazardous waste and non-hazardous waste should, in relevant parts, be stated in the inspection plan submitted to the local authorities. The inspection plan should include information on: sorting into waste fractions, precautionary actions to prevent environmental and health risks and the final disposal of the waste. An inspection plan should also be submitted in case of renovation. There is no specific regulation on the

[6] Arm, M., Wik, O., Engelsen, C.J., Erlandsson, M., Sundqvist, J-O., Oberender, A., Hjelmar, O. and Wahlström, M. (2014). ENCORT-CDW – Evaluation of the European recovery target for construction and demolition waste.

[7] Concerning CDW to be accepted at landfills: the waste must – if it has a homogeneous composition - have a TOC < 10% (w/w) or – if it has a heterogeneous composition - a content of combustible material that does not exceed 10% (vol/vol) (NFS 2004:4, in force 1.1.2005)

[8] SEPA. (2004a). NFS 2004:4. Naturvårdsverkets föreskrifter och allmänna råd om hantering av brännbart avfall och organiskt avfall (Regulations and guidelines on the handling of combustible and organic waste),

[9] SEPA (2004b) NFS 2004:10 (in force July 20, 2004), Naturvårdsverkets föreskrifter om deponering, kriterier och förfaranden för mottagning av avfall vid anläggningar för deponering av avfall (Regulations on landfilling, criteria and procedures for the acceptance of waste at landfills),)

[10] Council Decision 2003/33/EC of 19 December 2002establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC

[11] SCF (2013b) Resurs- och avfallsriktlinjer vid byggande och rivning (Resource and waste handling during construction and demolition) Bilaga 3, Avfallsfraktioner vid byggproduktion – basnivå (Annex 3, Waste fractions at construction works – base level)

[12] SCF (2013c). Resurs- och avfallsriktlinjer vid byggande och rivning (Resource and waste handling during construction and demolition) Bilaga 2, Avfallsfraktioner vid rivning – basnivå (Annex 2, Waste fractions at demolition works – base level)

management of waste during the construction of new buildings or for the demolition, renovation or construction of civil engineering constructions.

The Swedish Transport Administration (STA) applies general environmental requirements on the content of hazardous substances in articles and chemicals. These requirements are not based on risk assessment but on hazard classification schemes related to the CLP regulation on chemicals. The fundament of these requirements is that materials must not contain hazardous substances that trigger labelling with hazard pictograms according to concentration limit values in the CLP, but that other limit values are applied as well.

The management of PCB contaminated construction products is regulated in the Swedish Ordinance on PCB (SFS 2007:19) which requires identification of products in buildings and facilities. Decontamination is required prior to 2016 if the PCB content exceeds 500 mg/kg. In connection with renovation or demolition, products with PCB content exceeding 50 mg/kg have to be removed.

Waste-handling activities that include management, processing and recycling of CDW require a permit from the competent authority – either licensing by court or county authority or a less extensive notification to local authorities. In the case of recovery of waste in constructions, the notification process is used more frequently compared to other recycling alternatives (Ordinance on Environmental assessment SFS 2013:251). The recovery of waste in civil engineering requires notification in the case of a minor risk of pollution of land or water area or groundwater, and licensing in the case of more than a minor risk. The assessment of minor risk is based on the procedure presented in the handbook on recovery of waste in civil engineering[13].

The Swedish Radiation Safety Authority has published a regulation on naturally occurring radioactive material[14] indicating that contaminated CDW such as lightweight concrete based on alum shale, can be re-used in civil engineering without restrictions due to low radioactivity (activity concentration less than 10 kBq/kg per nuclide in the uranium and thorium chains).

Legislation or regulatory work in progress:

- Swedish Parliament is reviewing a proposal to further clarify the waste hierarchy in the Environmental Code.
- SEPA is considering implementing an increased reporting requirement for C-classified[15] facilities but no decision has been made yet. This will require changes in legislation concerning environmental reports (NFS 2006:9)[16].

3.2. Waste Management Plans (WMP) and strategies

The Swedish Environmental Protection Agency is responsible for drawing up and establishing national waste plans and programmes for waste prevention.[17]. Sweden's Waste Plan 2012–2017[18] was published in 2012. It supersedes the previous waste plan dating from 2005: A Strategy for Sustainable Waste Management – Sweden's Waste Plan[19]. The first waste management plan did not specifically address CDW.

According to the Waste Plan 2012-2017, the government's interim objective for CDW is for reuse, recycling and other material utilization of non-hazardous construction and demolition waste to increase to 70% by weight by 2020. One of the priority areas in the second Swedish waste management plan for 2012-2017 is CDW. SEPA lists the following actions:

- Continue the work to compile reliable statistics for construction and demolition waste.

[13] SEPA. (2010). Återvinning av avfall i anläggningsarbeten (Guidelines for recyclingof waste in civil engineering),
[14] SRSA. (2011). Strålsäkerhetsmyndighetens föreskrifter och allmänna råd om naturligt förekommande radioaktivt material (Regulation on naturally occurring radioactive material) SSMFS 2011:4. Swedish Radiation Safety Authority (in Swedish)
[15] There are 3 classes of treatment facilities named 'A' , 'B' or "C" facilities. A and B facilities need to have a permit issued by an environmental court (A) or those with a permit issued by a county administrative board (B). There are also many other smaller facilities that are notifiable to the municipality, known as 'C facilities'.
[16] SEPA (2006). NFS 2006:9. Naturvårdsverkets föreskrifter om miljörapport
[17] in accordance with the Ordinance on Waste (SFS 2011:927, § 83).
[18] SEPA (2012a in English)). From waste management to resource efficiency Sweden's Waste Plan 2012–2017.
[19] SEPA (2005). Strategi för hållbar avfallshantering – Sveriges avfallsplan. https://www.naturvardsverket.se/Documents/publikationer/620-1248-7.pdf

- Prepare guidance concerning the way in which the general rules of consideration in the Environmental Code and the waste hierarchy should be applied in connection with inspections of the management of construction and demolition waste, and how the cooperation between municipal construction boards and environmental boards can be developed.
- Monitor developments and, when necessary, propose additional measures and instruments to achieve the EU's recycling target.

According to the Environmental Code, Chapter 15, a local WMP is to be drawn by the municipalities. A first guidance for the development of the waste plan was published 2006 by SEPA. In 2012, the Swedish Waste Association published an update to the guidance[20].

The Swedish first Waste Prevention Programme (WPP) for 2014-2017[21] was published in 2013. The Swedish Environmental Protection Agency will monitor the programme and draw up a new programme by 2018. The programme objectives will contribute to the fulfilment of the Swedish environmental objectives and supplement the interim objectives.

There are four focus areas in the programme of which one relates to CDW. The Swedish WPP focuses on waste prevention (or reduction of waste generation) and reduction of hazardous substances in construction materials and products. In the Swedish WPP the following initiatives/strategies are listed:

- Hazardous substances in construction products are to be replaced with less hazardous ones;
- Construction materials used must be documented;
- Increase in competence of constructor (more responsibility in demolition projects);
- Increased supervision in the construction sector;
- Increased reuse of construction products where dismantling is possible;
- Increased knowledge of waste prevention and waste flows, and strategic planning for waste prevention.

In 2014, SEPA was commissioned by the Swedish Government to explore the need for instruments or measures for achieving the 70% recycling target of non-hazardous CDW[22]. A report on the impacts of different options[23] was used as background information in the work. According to the SEPA report, [24] the 70% recycling target is achieved if reuse of asphalt on-site were included in calculating the recycling rate. The report especially highlights the need for improvement of waste statistics (several options have been evaluated) The SEPA is currently considering implementation of reporting obligations for smaller waste-handling facilities. In addition, collaboration between different authorities and stakeholders is proposed through several concrete actions. Several actions concern waste prevention and reduction of hazardous substances in construction products. Examples of these actions are preparation of guidelines on waste prevention and control plans used for permitting demolition work as well as improved systems for reporting hazardous substances.

3.3. Legal framework for sustainable management of CDW

This section aims at identifying specific legislation that would create good conditions for sustainable management of CDW as a preliminary overview for Task 3.

[20] Avfall Sverige (2012a). Handbok i kommunal avfallsplanering. Vägledning för ett framgångsrikt arbete

[21] SEPA. (2013a). Tillsammans vinner vi på ett giftfritt och resurseffektivt samhälle – Sveriges program för att förebygga avfall 2014-2017.(“Together we win having a non-toxic and resource efficient society”)

[22] SEPA (2015). Regeringsuppdrag Icke farligt byggnads-och rivningsavfall.

[23] Palm, D. Sundqvist, J-O, Jensen, C., Tekie, H., Fråne A. & Lunggren Söderman. (2015). Analys av lämpliga åtgärder för att öka återanvändning och återvinning av bygg- och rivningsavfall

[24] SEPA (2015). Regeringsuppdrag Icke farligt byggnads-och rivningsavfall.

Table 1 Legal framework

Description	Level of occurrence (Yes/No) Key Scope/Exemptions	Year established and policy reference	Further detail, information source, related web-site
National/regional obligation for selective demolition?	Yes Building code (SFS 2010:900) § 6, Paragraph 10: The monitoring plan prepared before demolition must declare how hazardous waste has been surveyed and how it will be managed.	2010	http://www.boverket.se/sv/PBL-kunskapsbanken/teman/rivningsavfall1/allmant-om-rivningsavfall-och-avfallshantering/kontrollplan/
National/regional sorting obligation (on-site or in sorting facility)?	Yes Waste Ordinance SFS 2011:927 (general) Building Code (SFS 2010:900)	2011	http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledningar/Avfall/Bygg--och-rivningsavfall/ The Swedish Waste Management Plan [25] mentions the following action for construction contractors: “Develop the sorting of waste at source and identify solutions as regards the possible reuse of surplus construction materials, e.g. through delivering it to a common recipient and retailer, instead of for waste recycling.”
National/regional separate collection obligation for different materials (iron and steel, plastic, glass, etc.)?	Yes The Regulation NFS 2004 :4 imposes sorting of combustible waste.	2004	n/a

[25] SEPA (2012a). From waste management to resource efficiency Sweden’s Waste Plan 2012–2017

Description	Level of occurrence (Yes/No) Key Scope/Exemptions	Year established and policy reference	Further detail, information source, related web-site
Obligation for separate collection and management of hazardous waste from construction and demolition operations?	Yes Building Code (SFS 2010:900) § 6, Paragraph 10: The monitoring plan prepared before demolition must declare how hazardous waste has been surveyed and how it will be managed. In the Swedish Ordinance on PCB (SFS 2007:19): The management of PCB contaminated construction products.	2010 2007	http://www.boverket.se/sv/PBL-kunskapsbanken/teman/rivningsavfall1/allmant-om-rivningsavfall-och-avfallshantering/kontrollplan/
Related Green public procurement requirements	Only in cases where the municipality acts as constructor.	n/a	n/a

3.4. Targets

In the Swedish Waste Prevention Programme the following targets related to CDW are presented:

- In 2020 waste generation per m^2 built is decreased compared to 2014;
- The content of hazardous substances in materials and products shall be reduced.

In a Nordic ENCORT report[26] financed by the Nordic Council of Ministers the following recommendations are given regarding the EU recovery target:

- Transform the general weight-based target into waste-specific targets. This would favour recycling of CDW in general and not only for high-weight materials.
- Rank the recovery operations in the calculation method for reporting progress. Backfilling should not be regarded as equal to other operations for recovery.

4. Non-legislative Instruments

In this section, any other instruments that may specify how the country is addressing the question of CDW management are highlighted, especially as a preliminary overview for Task 3, as these instruments may create conditions for sustainable management of CDW.

[26] Arm, M., Wik, O., Engelsen, C.J., Erlandsson, M., Sundqvist, J-O., Oberender, A., Hjelmar, O. and Wahlström, M. (2014). ENCORT-CDW – Evaluation of the European recovery target for construction and demolition waste.

Table 2 Non-legislative instruments

Description	Level of occurrence (Yes/No) Key Scope/Exemptions	Year established and policy reference	Further details, information source, related web-site
Economic instrument **Landfill tax** Law on landfill tax SFS 1999:673	Yes Some facilities are excluded. Also some waste categories are exempted, such as excavated soil that is deposited on landfill sites for inert waste. Reclaimed asphalt as well as construction and demolition waste is subject to the tax. A refund is granted for waste that is not disposed and subsequently removed, e.g. for recycling.	2000	http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Lag-1999673-om-skatt-pa-avf_sfs-1999-673/
Sustainability standards that cover CDW (e.g. BREEAM)	The most used sustainability assessment schemes include BREAAM (Note: a Swedish version developed), LEED and Miljöbyggnad. “Miljöbyggnad” (a system for environmental certification of buildings) is managed by Sweden Green Building Council for Swedish conditions. Currently discussions to include CDW in the scheme.	BREAAM: 1990, the Swedish version adopted in 2013 LEED: 2000	n/a
Extended producer responsibility scheme in operation?	No	n/a	n/a

Table 3 Key CDW management requirements and standards.

Description	Occurrence (Yes/No) Mandatory (Yes/No) Scope & exemptions	Year established	National or regional (specify if regional)	Details of Public sector and Industry enforcement/ involvement/ collaboration	Levels of performance e.g. tonnes recycled,% coverage	Further information/ web-site
Requirement for pre-demolition audits	Yes, focus mainly limited to health aspects (identification of asbestos) and hazardous wastes.	n/a	National	Public	Unknown	http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledningar/Avfall/Bygg--och-rivningsavfall/
Standards for recycled CDW	Yes Guidance values for recycling of waste in civil engineering without prior notification to environmental authorities (SEPA, 2010).	2010	National	Public	n/a	http://www.naturvardsverket.se/Om-Naturvardsverket/Publikationer/ISBN/0100/978-91-620-0164-3/
Selective demolition/ plan for large demolition sites/demolition standard	Many demolition measures are statutory or notifiable. Pursuant to Chapter 6, Section 8(3) of the Planning and Building Ordinance (2011:338), notifications must include information of the time at which the demolition works are scheduled to commence.	2010, 2011	National	Public	n/a	http://www.boverket.se/sv/PBL-kunskapsbanken/teman/rivningsavfall1/allmant-om-rivningsavfall-och-avfallshantering/kontrollplan/
Other CDW planning requirements	n/a	n/a	n/a	n/a	n/a	n/a

Table 4 Key CDW management guidance and tools

Description of guidance/ tool	Scope	Year established/ produced	National or regional (specify if regional)	Public sector and/or Industry lead organization	Levels of use (high/ medium/low) or specify	Further information/ web-site
Guidelines on sorting of CDW have been published by the Swedish Construction Federation (SCF, 2013a)	List of waste fractions to sorted on-site.	2013	National	Industrial	n/a	see SCF, 2013
The Swedish Construction Federation: Guidance for CDW management to support sustainable development construction and demolition. (incl. several appendices with practical guidance on wastes to be sorted, check lists and templates for waste management plan)	Focus on 1) waste minimization/ prevention 2) management of CDW enabling recycling 3) reducing content of hazardous substances in CDW.	2007, 2015 (latest update)	National	Industrial	unknown	https://www.sverigesbyggindustrier.se/nyheter/uppdaterade-riktlinjer-for-resurs--och-a__5101 Documents (in Swedish) • Resource and waste handling during construction and demolition • Resource and waste handling during construction and demolition • Waste fractions at construction works – base level • Resource and waste handling during construction and demolition • Waste fractions at demolition works – base level
BASTA (for choice of safe construction materials)	Database on construction materials with low content of hazardous substances.	n/a	National	Public, industrial	n/a	http://www.bastaonline.se/english/bastaonline/aboutbasta.4.386979f513a1a34373978f.html
SundaHus Miljödata (for choice of safe construction materials)	A system for health and environmental assessments of products within the buildings and real estate trade (database of chemicals,	n/a	National	Industrial	n/a	http://www.sundahus.se/home.aspx?lang=en

Description of guidance/ tool	Scope	Year established/ produced	National or regional (specify if regional)	Public sector and/or Industry lead organization	Levels of use (high/ medium/low) or specify	Further information/ web-site
	products). The system offers various services and functions for the following building phases: • Environment Program • Planning • Building • Maintenance • Demolition					
Byggvarubedömningen (for choice of safe construction materials)	A system for building material assessment.	n/a	National	Industrial	n/a	www.byggvarubedomningen.se
Smartphone application Guidance on hazardous waste (also available as a publication)	This app was launched by Sveriges Byggindustries. This app helps to identify hazardous waste and give guidance in waste management.	2013	National	Industry lead initiative	Unknown	https://itunes.apple.com/se/app/farligt-avfall/id648030074?mt=8 https://publikationer.sverigesbyggindustrier.se/sv/handbocker-fou/farligt-avfall__382 (publication)
Guidance : County Administrative Board Jönköping (example, similar documents found also for other counties/cities)	Guidance on waste sorting (focus on hazardous waste, recyclable waste).	n/a	Regional	Public	Unknown	http://www.lansstyrelsen.se/jonkoping/SiteCollectionDocuments/Sv/publikationer/informationsmaterial/Sorteringsguide.pdf

Table 5 Technical guidelines/standards/ Codes of Practice for use of CDW in construction application

Description of guidance/ tool	Scope	Year established/ produced	National or regional (specify if regional)	Public sector and/or Industry lead organization	Levels of use (high/ medium/low) or specify	Further information/ web-site
Example: CDW material bank for reuse (managed by municipalities or private companies)	Platform for material exchange (mainly focus on household).	n/a	National	Industrial	Unknown	Examples : - A pallet return system developed by and for the Swedish construction industry (Retursystem byggpall system för pallhantering) - Malmö Återbyggdepå – A rebuilding centre for re-use aimed at the construction and demolition sector and the public - Kompanjonen - A rebuilding centre for re-use aimed at the construction and demolition sector and the public - Rivners AB – A demolition company that sells used products from demolished buildings on their site
Swedish EPA: guidance for recovery of waste materials in construction	Criteria when recovery can be performed without prior contact with authorities are given..	2010	National	Public	n/a	http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledningar/Avfall/Handbok---atervinning-av-avfall-anlaggning/
Swedish Transport Administration : guidance for use of asphalt (including also crushed concrete and blast furnace slag)	Guidance for use of asphalt and alternative materials in pavements, bound road layers. Specifications for material, construction and quality control.	2004-	National	Public	n/a	Several handbooks and reports : STA. (2004a). Handbook on reuse of asphalt STA. (2004b). Handling of tar containing pavements STA. (2010). Specifications for chemicals STA. (2011a). Specifications for bitumen bound layers STA. (2011b). Road run-off water – Recommendations for choosing environmental measures STA. (2012). Specifications for articles and materials regarding content of hazardous substances). STA. (2013a). Alternative materials. Technical specifications for road construction with blast furnace slag, crushed concrete or asphalt granulate in unbound road layers). STA. (2013b). Specifications for material, construction and quality control for blast furnace slag, crushed

Description of guidance/ tool	Scope	Year established/ produced	National or regional (specify if regional)	Public sector and/or Industry lead organization	Levels of use (high/ medium/low) or specify	Further information/ web-site
						concrete or asphalt granulate in unbound road layers). STA. (2013c). Guidelines for use of blast furnace slag, crushed concrete or asphalt granulate in unbound road layers). STA. (2013d). Asphalt Rubber – asphalt pavement with rubber modified bitumen)
Guidance: Waste Minimization and Management, Guidance for construction clients, design teams and contractors	Waste prevention through planning.	2012	Regional	Industrial, public	n/a	Report entitled « Att minska byggavfallet En metod för att förebygga avfall vid byggande » : http://www.tyrens.se/Global/Nyheter/Nyheter%202012/Rapport%20Minska%20byggavfall%20120410.pdf
Guidance : hazardous materials in building	Guidance on content of hazardous compounds in construction products, aspects in planning of demolition.	2007	National	Public, supported by industry	n/a	Farliga material i hus (« Dangerous materials in building)– Formas: ISBN 13: 978-91-540-5979-9

Table 6 Other CDW initiatives

Description of initiative	Scope	Year established	National, regional, local (specify which local area/region)	Public sector and/or Industry lead organization	Levels of performance e.g. tonnes recycled	Further information/ web-site
Guidance The Swedish EPA has published guidance on the hazard classification of asphalt (SEPA, 2013b).	Criteria for classification of asphalt as non-hazardous.	2013	National	Public	Unknown	http://www.naturvardsverket.se/upload/stod-i-miljoarbetet/vagledning/avfall/klassificering/farligt-avfall-klassificering-20130213.pdf
TemaNord 2013:533. Proposals for targets and indicators for waste prevention in four waste streams	Providing first proposals for targets and indicators that can be used in the Nordic countries' waste prevention programmes.	2013	Nordic	Nordic Council of Ministers	n/a	http://dx.doi.org/10.6027/TN2013-533
Guidance on waste prevention	The southern province Scania (Skåne) has prepared 2 reports on reduction of CDW.	n/a	National	Public	n/a	http://www.skane.se/Upload/Webbplatser/Koncerninkop/Ext/Extern%20remiss/RS_drift/06.661%20Avfallsplan%2004%2008%2031.pdf Also mentioned in WMP by SEPA
A Council established by Swedish Association of Local Authorities and Regions	Actions for reduction of CDW. Guidance on aspects to be included in Public procurements.	2013	National	Public	Unknown	http://webbutik.skl.se/bilder/artiklar/pdf/7164-898-3.pdf
The Swedish National Board of Housing, Building and Planning : A campaign for control in construction and	Guidance on legal requirements in CDW management. Several useful links for actors involved on the web-page.	2013	National	Public	n/a	Useful links to the web-page of Swedish National Board Housing, Building and Planning :

Description of initiative	Scope	Year established	National, regional, local (specify which local area/region)	Public sector and/or Industry lead organization	Levels of performance e.g. tonnes recycled	Further information/ web-site
demolition activities (mentioned in WMP)						http://www.boverket.se/sv/PBL-kunskapsbanken/ http://www.boverket.se/sv/PBL-kunskapsbanken/teman/rivningsavfall1/ http://www.boverket.se/sv/PBL-kunskapsbanken/teman/rivningsavfall1/allmant-om-rivningsavfall-och-avfallshantering/

5. CDW Management Performance – CDW Data

In this section the performance of CDW management in Sweden is explored. This section particularly seeks to gather all available data and information about CDW generation and treatment, exports/imports, and treatment facilities in Sweden. The Swedish Environmental Protection Agency has published a report of waste statistics in 2010[27] and in 2012[28].

Table 7 Summary - CDW generation and recovery official statistics for waste streams to be included in the calculation of the recovery target

Year	2008	2009	2010	2011	2012	2013
Generated CDW (tonnes)	n/a	n/a	1 218 833	n/a	1 311 970	n/a
Recycled CDW (tonnes)	n/a	n/a	121 432	n/a	178 358	n/a
Backfilled CDW (tonnes)	n/a	n/a	608 659	n/a	475 943	n/a
Landfilled CDW (tonnes)	n/a	n/a	21 476	n/a	14 755	n/a
Energy recovery if any (tonnes)	n/a	n/a	240 746	n/a	413 924	n/a
Unknown treatment (tonnes)	n/a	n/a	226 520	n/a	228 990	n/a
Recycling rate (%)	n/a	n/a	59.9	n/a	49.9	n/a

The above table was compiled using:

- Figures from the 2012 survey on waste production and treatment in Sweden performed by IVL - PM, dated
- 2014-06-29, rev 1: 2014-07-03, author Jan-Olov Sundqvist);
- Sweden calculates CDW generation on the basis of the WStatR data;
- Recovery data are based on the input to pre-treatment facilities. Sweden provides recycling efficiencies for metal, plastic, glass and mineral waste.

These figures correspond to the ones sent to Eurostat.

These figures exclude hazardous CDW and naturally occurring materials. The CDW-generated quantities correspond to the CDW produced within the country; they include exported CDW and exclude imported CDW.

5.1. CDW generation data

Data are collected every even year (2010, 2012 etc.). SEPA is responsible for the data collection but purchases the service from a consortium called SMED in which IVL Swedish Environmental Research Institute and Statistics Sweden are involved in producing waste statistics. The data are collected based on three methods:

1. Waste factors expressed in kg of a specific waste type per m^2 for construction waste, demolition waste and refurbishment. The waste factors have been developed based on several projects. Based

[27] SEPA. (2012b). Avfall i Sverige 2010 (Waste in Sweden 2010).
[28] SEPA. (2014). Avfall i Sverige 2012 (Waste in Sweden 2010).

on national data on the total area of construction, demolition and renovation during a year the total waste amounts can be estimated.
2. Based on information from construction and demolition companies. Based on turnover number, the total waste amounts can be estimated.
3. Collected information from waste and recycling companies through environmental reports (no upscaling is required).

The waste amounts derived for every waste fraction with the three methods are compared and evaluated. Finally one method and the respective waste amounts are chosen. This approach is adopted because the different methods have their own advantages and drawbacks.

The statistics on CDW generation covers the whole sector in terms of NACE F. However, the wastes directed to reuse are excluded in the amounts. The reused amounts are considered as very small compared to the total amounts. Construction waste from households (e.g. from refurbishment) is not included in the amounts.

Waste data based on collected information from environmental reports (method 3 above) only include so-called A- and B-classified (facilities which need an environmental permit) facilities. Waste management facilities receiving construction and demolition waste which are not obligated to submit environmental reports (C-classified) are not included, and therefore the total amounts are underestimated. Note that the C-classified facilities receive a lot of waste (soils, mineral waste, etc.) which are not included in the recycling target.

Waste amounts generated in 2010 and 2012 according to the categorization in WStatR are collated below in Table 8a. Total amounts of CDW including soils, dredges are collated in Table 8b. No other studies or data besides the official figures are available. The waste data have been checked through contacts to industry, but no requests for corrections have been presented.

Table 8a Amounts of CDW generated in 2010 and 2012 included in the definition of CDW according to the WStatR

Year	2010			2012		
Waste type	Generated	Source separated for material recycling*,	Off-site sorted for material recycling*	Generated	Source separated for material recycling*	Off-site sorted for material recycling*
06.1 Metal waste, ferrous	50 000	50 000	37 176	33 000	33 000	29 762
06.2 Metal waste, non-ferrous			4 766	28 000	28 000	4 904
06.3 Metal waste, mixed	22 500	22 500	1 717	79 000	79 000	771
07.1 Glass waste	5 000	5 000	12	2 000	2 000	181
07.4 Plastic waste	150	150	111	200	200	540
07.4 Wood waste	125 000			300 000	0	
12. Mineral waste from construction (excluding 12.4 and 12.6)	900 000	608 659		700 000	428 381	
12.1 CDW, other sectors	14 283			144 770		
12.8 Mineral waste from waste treatment	101 900		(included in 608 659 tonnes)			47 562
(10.2 Mixed waste, not specified)				25 000	0	0
TOTAL	1 218 833	686 309	43 782	1 311 970	570 581	83 720

- excluding backfilling & energy recovery

Table 8b Total amounts of CDW generated in 2010 and 2012 A breakdown of CDW into hazardous and non-hazardous waste for 2010 and 2012.

Waste category	2010, Mtonnes	2012, Mtonnes
Non-hazardous CDW		
CDW from buildings	1.24	1.20
Soils	4.00	3.50
Dredging spoils	3.50	2.07
Hazardous waste		
CDW from buildings	0.19	0.17
Soils	0.45	0.72
Dredging spoils	0	0
Total (non-haz. and haz. CDW)	**9.38**	**7.67**

In Sweden the treated waste in most cases could not be tracked down to a specific industry (NACE code). For the waste statistics in total the generated amounts are always greater than the treated amounts. The reason for this is, as mentioned above, that all wastes are not treated in A- and B-classified waste management facilities. For the construction sector, as mentioned earlier, the generated amounts are based to an extent on the treated amounts (information from environmental reports).

5.2. CDW treatment data

Data are only collected every even year (2010, 2012, etc.). The amounts generated and treated are presented in the previous table. Based on the types of CDW generated and the data from environmental reports of waste treatment facilities (see methods described in 5.1), the treatment of that specific waste can be estimated. The data is identical to the Eurostat data. The data are produced by SMED, and SEPA reports them to Eurostat.

The collected waste data are classified according to the European List of Waste (LoW) (2000/532/EC) and later aggregated to EWC stat waste codes. The origin of the waste (NACE code) that is treated by the recycling industry cannot be verified as this information is not collected by the recycling industry.

In Sweden there is a lot of mechanical sorting of mixed CDW and therefore it has been seen as important to include these amounts (from so-called secondary waste streams classified according to LoW code 19) in the generated waste amount. The secondary waste streams are included in the calculation of the recycling target in Sweden.

The CDW, such as combustible waste and mineral waste, is stored to a certain extent. However, the stored amount is assumed constant and therefore not further estimated.

5.3. CDW exports/imports data

The county administrative boards are the responsible authorities for the operative control of transboundary waste shipments to and from Sweden. The supervision is carried out in collaboration with the customs, the police, the coastguard, municipalities and SEPA. If waste from Sweden is stopped abroad since it is found to be illegally transported, SEPA takes action to bring it back to Sweden or make arrangements with the waste exporting stakeholder to find other appropriate solutions. If the stakeholder cannot or does not want to assist, or even no longer exists, SEPA assumes responsibility for further action.

The competent authority in the exports and imports of waste is SEPA. An approval from SEPA is usually required for the export or import of waste.[29]

In 2013, 23 362 tonnes of CDW was imported to Sweden from Denmark, Switzerland, Estonia and Germany. The main waste types imported were glass, plastic and wood containing or contaminated with dangerous substances (17 02 04*), and wood (17 02 01). In the same year, 2 484 tonnes of CDW was exported to

[29] http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledningar/Avfall/Avfallstransporter-Gransoverskridande/Anmalan-eller-informationsplikt/)

Germany, Denmark and Norway, the main waste types being cables containing oil, coal tar and other dangerous substances (17 04 10*), and soil and stones (17 05 04). In 2014, in total 23 362 tonnes were imported and 2 485 tonnes were exported. The data on exported/imported amounts are mainly based on information from building and demolition companies and information from environmental reports from waste management facilities. Regarding wood (17 02 01), it is unsure whether the wood waste really emanates exclusively from the building and demolition sector.

5.4. CDW treatment facilities data

In Sweden there are 30 landfills for inert CDW. The remaining capacity is 636 000 tonnes (1 January 2014). All of them are compliant with the EU legislation.

The landfill capacity is expected to decrease since no new landfills are planned.

In Sweden about 405 000 tonnes CDW were used for covering and rehabilitation on the existing landfills, which is reported as recovered. 200 000 tonnes are reported as input to sorting plants for mixed CDW. The number of treatment facilities only dedicated to CDW is unknown as CDW is mixed with waste from other sectors in these treatment facilities (landfills, sorting facilities, material recycling facilities, incineration facilities, etc.), but the number of so-called A-, B- and C-classified facilities which to some extent receive and treat CDW in Sweden is estimated to be around 1 250.

According to the manual on waste statistics from Eurostat, internally recycled wastes shall not be accounted for, meaning that (re)use of for instance bitumen on-site at road works shall be excluded. However, mostly stationary recycling facilities are used for asphalt recycling, but no recycled asphalt is included in the statistics today. A rough estimation of what amounts of asphalt which are not directly processed on-site, and subject to internal recycling, is from 800 000 to 1 Mtonnes annually. There is, however, an on-going discussion between SEPA and the industry on the issue.

For the time being, there is insufficient capacity for the use of more advanced separation technologies that can handle CDW. Thus, to maintain and increase the recycling of CDW the Swedish system depends to a large extent on the sorting of wastes at source.

5.5. Future projections of CDW generation and treatment

No study on future projections of CDW generation based on waste characteristics and treatment has been conducted in Sweden. There are projections for waste in general, but the studies do not include information of waste origin or characteristics.

It is likely that Sweden already fulfils the target of 70% preparation for reuse and recycling of non-hazardous CDW when accounting for not yet considered streams of asphalt and other recyclable CDW passing through small recycling plants, or amounts of CDW even not registered at such plants. A higher level in the waste hierarchy in waste treatment can be further achieved primarily through improved sorting and the encouragement of used raw material exchanges.

5.6. Methodology for CDW statistics

In Sweden, the methodology used for gathering data on CDW generation and treatment follows the Eurostat guidelines[30]. The same methodology has been used for 2010, 2012 and now 2014. The contact persons for official statistics are Ms Christina Jonsson and Mr Staffan Ågren at SEPA.

Compared to other sectors, the uncertainties in the current method are rather high, and potential methodologies have been assessed[31]. In 2016, the method for data collection of treated CDW amounts will be changed. Waste management facilities (A- and B-classified) will be obligated to report the received CDW and corresponding treatment method. SEPA is also considering implementing increased reporting

[30] Eurostat, 2013, Manual on waste statistics: http://ec.europa.eu/eurostat/web/waste/methodology
[31] Sundqvist, J.-O. E. (2013). Miljörapporter som källa för förbättrad avfallsstatistik -– med fokus på bygg- och rivningsavfall

requirement for C-classified facilities. but no decision has been made yet.[32] No views from stakeholders have been received but SEPA is aware of the rather high uncertainties.

6. CDW Management in Practice

In this section the CDW management “on the ground” in Sweden is explored.

6.1. CDW management initiatives

[32] -SMED. (2015). PM Konsekvensanalys av en utökad rapportering av bygg och rivningsavfall för C-anläggningar

Table 9 Projects or specific initiatives showing how the legal and non-legal framework is applied

Description of initiative	Scope	Year established	National, regional, local (specify which local area/region)	Public sector and/or Industry lead organization	Levels of performance e.g. tonnes recycled	Further information/ web-site
SITA Environment Circle Building	Concept concerning CDW management covering the whole value chain. Improvements in waste quality, cost savings through logistic solutions ("discharge" of containers when filled).	2013	National	Industrial	n/a	http://www.cobuilder.com/coBuilderDocuments/getfile?&dokid=769111&code=MzA0NjgwJTJGMTMwNV9CeWdnX2ZvbGRlcl82c2lkX1dFQkIucGRm&ext=.pdf See also section 7.5
Swedish EPA: Contract by Swedish Government. Report on impacts of different measure in CDW recycling	Proposals for actions to reach the recycling target for CDW, impact analysis.	2015	National	Public	n/a	www.naturvardsverket.se/Miljoarbete-i-samhallet/Miljoarbete-i-Sverige/Regeringsuppdrag/Redovisade-2015/Icke-farligt-byggnads--och-rivningsavfall/
EU IRCOW project (Innovative Strategies for High Grade Material Recovery from Construction and Demolition Waste (CDW) Materials)	“Innovative technologies and eco-design recommendations for reuse and recycling of construction and demolition waste, with a special focus on technologies for onsite solutions".	2011-13	EU	EU	Unknown	http://www.ircow.eu/
EU Guidance on Asphalt recycling	Innovative technologies for enhanced end-of-life strategies for asphalt road infrastructures (dismantling, characterization, handling, processing, lifecycle assessment).	2012	EU	EU	Unknown	http://re-road.fehrl.org/index.php?m=1

Description of initiative	Scope	Year established	National, regional, local (specify which local area/region)	Public sector and/or Industry lead organization	Levels of performance e.g. tonnes recycled	Further information/ web-site
Gypsum Recycling International (GRI, 2013)	EU funded Life+ project on gypsum recycling Aim : *"to close the loop effectively and transform the plasterboard demolition waste market to achieve higher recycling rates of plasterboard waste".*	2013-15	EU	EU	The manufacturers involved in the project will strive to include 30 % recycled gypsum in the plasterboard, also including construction and production waste.	The major obstacle to close the loop is that buildings are currently demolished and not dismantled in the majority of the Member states of EU. This leads to unsegregated waste going to landfills without having the possibility to recover valuable recyclable materials, among others gypsum plasterboard waste.
The Swedish Construction Federation	Guidance for CDW management to support sustainable development construction and demolition. (incl. several appendices with practical guidance on wastes to be sorted, check lists and templates for waste management plan)	2007-	National	Industrial		https://www.sverigesbyggindustrier.se/nyheter/uppdaterade-riktlinjer-for-resurs--och-a__5101
Ecocycle (Kretsloppsrådet)	Guidelines for the construction and property sector's working methods regarding the management of waste from the construction and demolition of houses.	2007	National	Industrial		http://www.byggvarudeklarationer.se/wp-content/uploads/2013/04/071026_Guidelines_BPD_31.pdf

Within these initiatives, the following could be selected as interesting case studies for Task 2:

- **SITA Environment Circle Building** describes improvements in the whole CDW value chain through logistics and practical solutions in waste collection (see further Section 7.5).
- **The Swedish Construction Federation:** Guidance for CDW management to support sustainable development construction and demolition.

6.2. Stakeholders' engagement

This sub-section is addressed to all contacted parties during the stakeholder consultation of the screening phase in order to incorporate their views, insights and hands-on experience of CDW management initiatives already in place in Sweden. The table below aims to gather information on the existing initiatives – identified above – or other initiatives identified by the stakeholders themselves, together with a preliminary assessment of the enabling factors/obstacles, advantages/drawbacks, and other relevant comments.

Table 10 Stakeholders' engagement

Description of initiative	Scope, year established, actors involved	Advantages/ Enabling factors	Disadvantages/ Obstacles	Further information/ web-site
Swedish Confederation for Construction	2007	Efficient recycling due to guidance for procurements, sorting, identification of hazardous waste. Cost saving	Continuous need for updates	https://www.sverigesbyggindustrier.se/nyheter/uppdaterade-riktlinjer-for-resurs--och-a__5101

6.3. Waste legislation enforcement

Supervision responsibilities

Many demolition measures are statutory or notifiable. Pursuant to Chapter 6, Section 8(3) of the Planning and Building Ordinance (2011:338), notifications must include information on the time at which the demolition works are scheduled to commence. The work may not commence until the construction board has issued a written approval. In such a written approval, the construction board must establish a control plan. There should normally also be a designated person who is responsible for the monitoring with relevant knowledge and experience. This person's duties include assisting the developer in the preparation of a proposal for a control plan and, regarding demolition measures, assisting in the inventory of hazardous and other waste. The control plan must state what hazardous waste the demolition measures may give rise to and how hazardous and other waste should be dealt with.

The municipal environmental administrations are responsible for inspections concerning the management of construction and demolition waste. The scope of the inspections varies between municipalities. The inspections are hindered by the fact that the inspection authorities have no guidance on how issues concerning recycling and resource efficiency should be managed within the inspections.

Resources and monitoring realization

The Swedish Environmental Protection Agency is in charge of developing a waste management plan and a programme for waste prevention. SEPA also provides guidance to the municipalities and the regions in waste management in order to achieve equal implementation of legislation. SEPA monitors the objective based on the national waste statistics.

In Sweden there are 21 County Administrative Boards (CAB) and at the municipality level so-called public health committees. They are the Environmental Enforcement Authorities (EEAs) and are, as such, responsible for enforcing the waste regulation requirements in the Swedish Environmental Code (1998:808) and specific ordinances regarding waste, for example, in the Waste Ordinance (SFS 2011:927). An overview of the Swedish licensing, inspection and enforcement system is presented in a note[33] published by SEPA.

The enforcement authority at the municipal level is financed through municipal taxes and the fees collected from environmentally hazardous activities. Activities with permits pay an annual fee, and others pay an hourly fee for the time that the authority has spent on the activity. The CABs are exclusively financed by the Government.

[33] -SEPA (2009). Licensing, inspection and enforcement system in Sweden for environmentally hazardous activities. Information note.

Each authority has the mandate to decide on the adequate capacity to enforce compliance within their mandated area according to legislation. Every municipality covers a certain geographic area of Sweden. As there are 290 municipalities and public health committees in Sweden, the capacity of enforcement and the demand on the authority vary significantly. The Swedish Association of Local Authorities and Regions (SKL) represent the interests of all the municipalities in Sweden and gives guidance on organizational issues.

The Environmental Inspection Ordinance (2011:13) specifies the requirements for conducting the evaluation and enforcement. The system for the enforcement reporting is currently under assessment for improvements.

Illegal management of CDW

National legislation stipulates penalties such as environmental sanction charges, fines and imprisonment. The environmental sanction charges can be imposed on operators pursuant to a decision by an inspection authority. Charges are imposed where the operators fail to comply with regulations pursuant to the Environmental Code, for example, where an operation, for which a permit must be obtained, is started without a permit. The amounts vary between EUR 110 and 110 000. Anyone infringing specified regulations in the Environmental Code, regulations issued pursuant to the Code or violating conditions in a permit might be subject to pay a fine or might be sentenced to a maximum of two years imprisonment by a court decision.

Even if illegal landfill is acknowledged to occur in Sweden, no official data is available.

6.4. Drivers / barriers to increase CDW recycling

Table 11 Drivers and barriers of recycling

Factor / characteristic / element in CDW recycling chain	Drivers	Barriers
Legislation: EU recovery targets		• The EU recovery target favours recycling of high-density waste types. The result is that mineral wastes will have the largest impact while the largest environmental benefits might be on other waste types. • It does not favour the most sustainable recovery operations. Above all, it does not distinguish between backfilling and other more resource-efficient recovery operations. Since backfilling is a recovery option that generally results in both low benefits and future environmental risks, this increases the risk for “downcycling”, which means that the waste is not recovered in the most optimal way. • It is very sensitive to interpretations of what is considered as waste and waste recovery. This fact is significant, since the WFD definitions of waste recovery actions such as re-use or recycling, are mainly aimed at the building construction field and do not fit well with materials recovered within other construction fields. As an example, asphalt and track ballast, which represent large material flows with a high re-use or recycling rate, are generally not included in the waste statistics and this will highly influence the interpretation of attaining the target. (conclusions presented in ENCORT report (source: Arm et al 2014) Furthermore : • Selection of waste code is not always clear (e.g. use of Chapter 20 in LoW if waste is handled by municipality.
Economics	Avoidance of transport and landfill costs Landfill taxes and ban of landfilling of combustible waste fractions promote sorting of waste. Mixed fractions that are sent for centralized sorting cost considerably more than sorted waste.	Small waste amounts incur added costs when not all the materials can be sourced from a single location. Sorting results in higher treatment costs compared to combustion (ref. SEPA 2015, Regeringsuppdrag).

Factor / characteristic / element in CDW recycling chain	Drivers	Barriers
Sorting and recycling process and techniques	Cost savings through logistics in CDW management. Landfill taxes and ban of landfilling of combustible waste fractions promote sorting of waste and improves quality of CDW.	Off-site sorting is less efficient compared to on-site sorting. Availability of automatic equipment for off-site sorting is limited.
Resources allocated to CDW legislation enforcement		Lack of sufficient resources needed for supervision by the authorities. This would result in fair business conditions for all stakeholders through equal implementation of CDW legislation (e.g. avoidance of illegal waste treatment with consequently lower treatment costs). Supervision of demolition activities by small entrepreneurs is challenging for the authorities. Small entrepreneurs are often also involved in sorting and waste management (certain waste material fractions might be sent forward for processing even if not suitable).
Definitions and statistical data		Data on CDW amounts prepared for reuse is lacking. Collection of this data is challenging and new methods are needed. (see SEPA 2015)
Works contracts	Organization of works with several stakeholders already at the planning stage promotes efficient recycling (guidelines for good practice developed by Swedish Construction Federation).	Involvement of several stakeholders sets challenges for waste prevention. Variations in waste streams make recycling in practice difficult.
Quality		Lack of certificates, quality proof, CE-marking. CDW often does not fulfil the strict requirements for construction products. How to secure quality issues in construction works if the quality standards are not fulfilled? CDW is often not suitable for recycling due to risk for presence of hazardous substances. Due to the long life span of construction products, old constructions may contain products with restricted substances which should not be recycled. Material degradation is also an issue in long life-span products. Data on technical properties of waste is lacking.
Regional aspects		Waste amounts generated in regions with low population density are often not sufficient for advanced recycling technologies, which leads to use in low-

Factor / characteristic / element in CDW recycling chain	Drivers	Barriers
		grade applications or landfilling. Treatment in centralized facilities sets needs for storage facilities and leads to transport costs. Sorting on-site in urban areas is challenging due to limited space for containers etc.
Typology	Old houses (due to architecture, choice of materials) not demolished as frequently as block houses from the 60s or 70s.	

7. CDW Sector Characterization

In this section some specific characteristics of the CDW management sector in Sweden are presented.

7.1. Sector characteristics

The actors involved in the CDW recycling are:

- Building companies
- Demolition companies
- Waste transport companies
- Waste sorting or treatment companies
- End-users (incl. waste incinerators, landfill companies)
- Authorities (permitting, monitoring)

The National Board of Housing, Building and Planning has created a web-page [34] with links containing clear and practical information and guidance concerning the requirements of the Swedish Planning and Building Act. The web-page also gives information of the obligations of different actors in CDW management.

CDW treatment scheme:

CDW recycling and storage facilities can be operated by different types of actors: building firms, waste recycling professionals, quarries.

- These different actors are represented by several sectoral organizations, the main ones being:
  - The Swedish Recycling Association. (http://www.recycling.se/medlemmar/medlemsforetag) - members are private companies dealing with waste including CDW.
  - Avfall Sverige (http://www.avfallsverige.se/) - members are municipalities and municipal recycling companies dealing with waste including CDW.
  - The Swedish Construction Federation with members from construction companies and also representing “Demolition companies”.

The existing capacity for CDW in Sweden is sufficient and no actual export is needed. In Sweden the waste is, in many cases, considered as a commercial product where the market forces will adjust the capacity according to the generated amounts. Note that the CDW is often treated together with other industrial waste flows.

[34] www.boverket.se/sv/PBL-kunskapsbanken/teman/rivningsavfall1/allmant-om-rivningsavfall-och-avfallshantering/slutsamrad-och-slutbesked/

7.2. Exports / imports of CDW

The CDW generated is mainly treated within Sweden. Only small amounts of CDW is exported and imported (see Section 5.3). In Sweden there is an overcapacity for incineration, which explains the import of CDW.

7.3. CDW as landfill cover

The mineral CDW such as less contaminated soils is used as covering material on landfills. Furthermore, the inert fraction (sorting residue) (secondary waste) from central sorting facilities is used as coverage material on landfills.

The Swedish Environmental Protection Agency has published a guide[35] on the use of waste in civil engineering, which also covers the use of waste as landfill cover. The guidance values are both for total content and maximum leaching in granular waste **Error! Hyperlink reference not valid.**

7.4. Market conditions / costs and benefits

Waste tax is currently SEK 500 /t (EUR 54 /t). The landfill costs depend on the waste type. South Scania Waste Company (SYSAV) lists, for example, the following landfill costs for mineral non-hazardous waste: gypsum waste SEK 650 /t (EUR 65 /t) and mixed concrete wastes SEK 500 /t (EUR 54 /t).[36] Some waste types (e.g. metal wastes) going to recycling are free of charge.

One of the objectives in the Swedish waste management plan[37] is to increase the use of waste and materials that is safe from an environmental and health perspective. According to the plan, the landfill tax should be reviewed such that it encourages the safe use of waste from an environmental and health perspective. Exceptions should still be made for waste for which the best use is landfill disposal. At a regional level, greater coordination is required between activities that generate waste and surplus materials for construction purposes and the suppliers of conventional ballast.

The strongest driving force behind the use of waste is currently the avoidance of transport and landfill costs and other treatment (e.g. incineration) costs. However, this is less relevant to waste which is exempt from landfill tax and which can be accepted at landfills for inert waste, where the landfill costs are lower. As waste that is disposed of in landfills which exclusively accept certain types of inert waste is exempt from landfill tax, there is no incentive to reuse clean soil or rock material, for example. However, the landfill tax represents a very strong driving force for identifying alternatives to landfill for other waste types.[38]

Sweden has abundant resources of high-quality rock, which sets concern on the quality of CDW for avoidance of pollutants spreading into the environment. Transport distances of CDW to end-users also set an upper limit for CDW recyclability in practice.

7.5. Recycled materials from CDW

The major part of recycled CDW is used as construction materials (concrete, bricks, gypsum, insulation materials, excavated soils) at landfills or transported to landfills as inert waste. Some is also used for other construction works.[39]

SEPA has published a handbook on the recovery of waste in civil engineering[40]. The handbook provides guidance on when the recovery activity requires notification or licensing, and a procedure is set out for assessing environmental and health risks. Criteria when recovery can be performed without prior contact with authorities are given for the content and leaching of both hazardous and non-hazardous substances. These criteria only apply to granular waste and not to products used in monolithic constructions such as asphalt courses. It should be noted though that these guidance values do not have legislative force.

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[35] SEPA. (2010). Återvinning av avfall i anläggningsarbeten (Guidelines for recyclingof waste in civil engineering),
[36] Example of price list: http://www.sysav.se/foretag/Priser/Prislista-for-atervinningscentral-for-foretag/).
[37] SEPA (2012a in English)). From waste management to resource efficiency Sweden's Waste Plan 2012–2017.
[38] SEPA (2012a in English)). From waste management to resource efficiency Sweden's Waste Plan 2012–2017
[39] SEPA (2014). Svensk avfallshantering 2012 (Swedish handling of waste 2012).
[40] SEPA. (2010). Återvinning av avfall i anläggningsarbeten (Guidelines for recyclingof waste in civil engineering),

SEPA has published guidance on the hazard classification of asphalt [41]. The criteria for classification of asphalt as non-hazardous if the content of PAH-16 or PAH-7 (carcinogenic PAH) are below 300 and 100 mg/kg, respectively. A limit of 1 000 mg/kg PAH-16 is used by some local Swedish authorities[42] and has also been proposed by the Swedish Transport Administration (STA)[43] .

The STA has published several handbooks and guidelines[44, 45, 46,47, 48, 49, 50, 51] which promote the recycling of asphalt and concrete waste and the safe use alternative materials in roads. At present, these documents only cover three materials (asphalt, concrete and blast furnace slag), but may in the future be extended with sections for other alternative road materials. Specifications for material, construction and quality control have also been compiled. Permit – either licensing or notification – is also relevant in the production of new construction materials, e.g. asphalt plants, gravel pits or rock quarries. The recovery of waste in civil engineering requires notification in case there is a minor risk of pollution of land or water, and licensing in the case of more than a minor risk.

The STA has developed a materials database for the trading of and information concerning excavated materials. The development of this type of database to also encompass information concerning geotechnical and environmental properties can facilitate the assessment of possible applications for both operators and inspection and permit authorities. The assessment time can be minimized if the authorities receive complete notification and permit/licensing documents. This also applies to consultation and permit processes for projects and activities where the intention is to use the materials.

In Sweden, as well as in Finland, a significant part of the CDW is wood due the large share of wood in the housing construction. Wood waste is recycled or reused if the recycling infrastructure and re-manufacturing is present. However, an efficient energy recovery replacing the use of fossil fuels, biomass and wood chips, is often the best economically and environmentally option also with the climatic conditions taken into account. During the use phase, the quality of wood may under certain condition deteriorate and the wood waste is not always suitable for recycling or reuse. Also the pretreatment of wood materials containing nails and paint is labour intensive. To a minor extent, timber structures (e.g. beams) and interiors (doors, windows) are reused today. Research is going on to develop new products (e.g. panels, wood-plastic composites) by using fibres from wood CDW and there are already products on the market. However, the recyclability of these products needs also to be assessed, especially if the wood fibres are mixed with other materials. In Central Europe the recycled wood scrap is used in manufacturing of particle board, but especially the long transport distances of waste wood to the particle board manufacturer (in Sweden only three manufacturers), requirements and quality controls on the input materials (removal of impurities, waste sorting needs) and also logistics of the finished particle board to foreign customers due to the limited domestic use hamper the use in particle boards.[52]

The company SITA Sweden AB, now SUEZ has created an innovative concept - Environment Circle Building - the entire chain of CDW management. The concept is based on the choice of optimal equipment for the collection of waste in place, employee training for waste collection / sorting and even logistics solutions throughout the handling chain. The concept improves in the quality of the collected CDW and also gives savings in costs (e.g. emissions of containers when filled, optimization of waste transport through planning and information to the recipients of the collected waste receivers in advance through an interactive electronic documentation system for waste). The cost savings are illustrated in Figure 1.The whole concept also

[41] SEPA. (2013b). Klassning av farligt avfall (Classification of hazardous waste).
[42] SALAR. (2004). På väg igen – Vägen tillbaka för återvunnen asfalt (On the road again – The road back for recovered asphalt).
[43] STA (2004b). Hantering av tjärhaltiga beläggningar
[44] STA. (2004a). Handbok för återvinning av asfalt. Publikation 2004:91. The Swedish Transport Administration
[45] STA. (2004b). Hantering av tjärhaltiga beläggningar.
[46] STA. (2010). Kemiska produkter – granskningskriterier och krav för Trafikverket (Specifications for chemicals).
[47] STA. (2011a). TRVKB 10 Bitumenbundna lager. Trafikverkets Krav. Beskrivningstexter för Bitumenbundna lager i vägkonstruktioner (Specifications for bitumen bound layers).
[48] STA. (2011b). Vägdagvatten – Råd och rekommendationer för val av miljöåtgärd (Road run-off water – Recommendations for choosing environmental measures).
[49] STA. (2013a). TRVK Alternativa material (Technical specifications for road construction with blast furnace slag, crushed concrete or asphalt granulate in unbound road layers).
[50] STA. (2013b). TRVKB Alternativa material (Specifications for material, construction and quality control for blast furnace slag, crushed concrete or asphalt granulate in unbound road layers).
[51] STA. (2013c). TRVR Alternativa material (Guidelines for use of blast furnace slag, crushed concrete or asphalt granulate in unbound road layers).
[52] Interview/email contacts with Gunilla Beyer, Swedish Forest Industries Federation & Topi Helle, Finnish Wood Research Oy

improves the safety of workers with clear instructions on collection and disposal. Even accounting for generated waste is recorded and can later be used for planning and reporting.

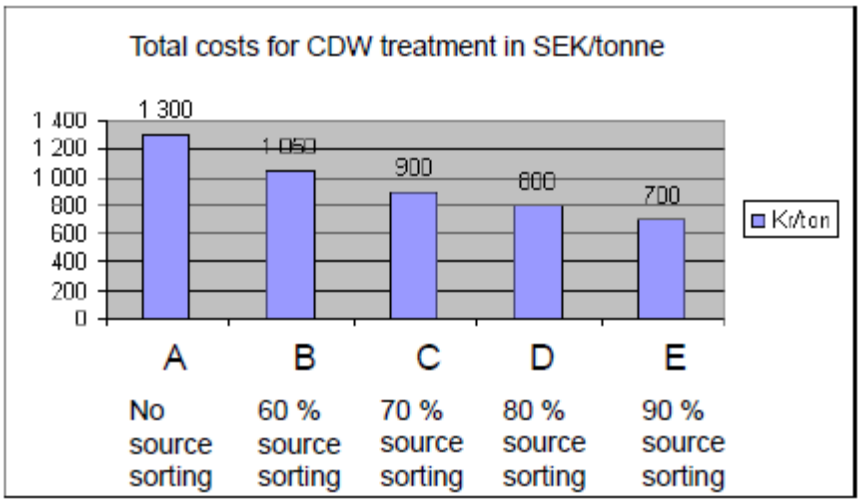

Figure 1. Cost saving in source separation at site according to SITA.

In Sweden, CDW gypsum is recycled into new plasterboard. According to information from the South Scania Waste Company[53] (SYSAV), the recycling of CDW gypsum is cheaper than landfilling. SYSAV collects yearly around 7 000 tonnes of gypsum waste, mainly CDW, at their own 16 recycling centres. The collected waste is brought to treatment in the Måsalycke treatment facility where it is crushed and sieved. The remaining paper fractions are removed at Knauf Danogips (Åhus situated 50 km north of Måsalycke), the manufacturer of plaster products for construction purposes, and the paper waste removed is sent back to SYSAV waste incineration plant in Malmö. There are no end-of-waste criteria in place for aggregates or other materials.

7.6. Construction sector make-up

The total turnover of the Swedish construction sector in 2013 was SEK 500 billion (EUR 53 billion). [54] The number of companies in the construction industry in 2014 was about 96 700 (The Swedish Construction Federation, 2015). Employment in the construction sector and in the whole social construction sector in Sweden is about 311 000 and 500 000, respectively (The Swedish Construction Federation, 2015).

In 2014, the total construction investments of buildings were SEK 380.9 billion (EUR 41 billion). The investments are forecasted to increase by 8% for 2015 and 2% for 2016. [55]

Construction sector

In 2014, there were 37 992 buildings started, which is an increase of 25% compared to 2013.[56] Fig. 1 illustrates the share of the construction sector of GDP in Sweden.

[53] Email contact with Lars Carrick, SYSAV, 2015.
[54] Swedish Construction Federation. (2013). Fakta om byggandet
[55] Swedish Construction Federation (2015). Email 7.6.2015
[56] Swedish Construction Federation (2015). Email 7.6.2015

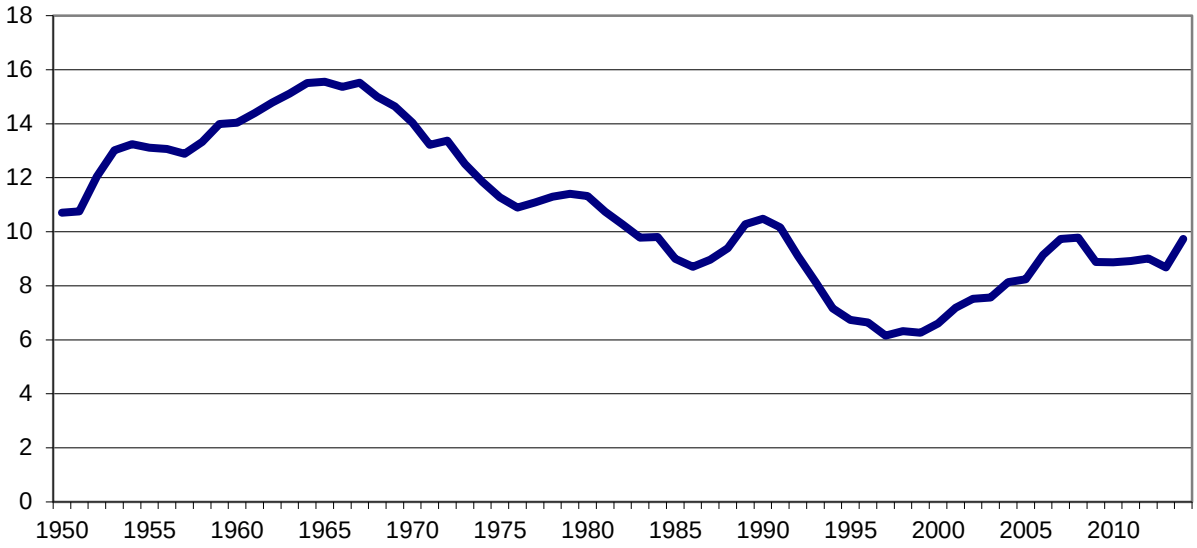

Figure 2 Building investments as percentage of GDP in Sweden during 1950-2014. (Swedish Construction Federation 2015)

Investments in housing construction

In 2012, the investments in housing amounted to SEK 121 billion (EUR 13 billion). Of the investments, SEK 55 billion (EUR 5.9 billion) was linked to new buildings and SEK 66 billion (EUR 7.0 billion) to refurbishment. (Fig. 2)

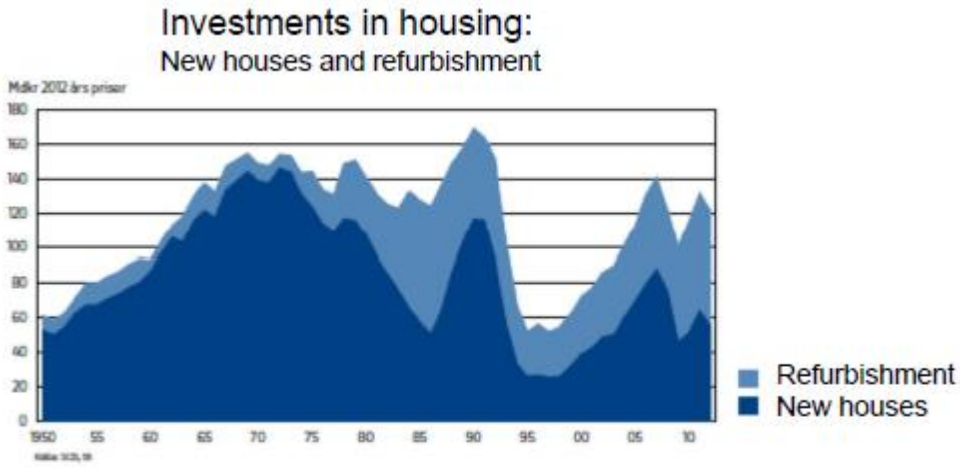

Figure 3 Investment in housing (SEK billion) according to price level at 2012) for building of new houses and refurbishment in housing in 2012. (Swedish Construction Federation 2013)

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