VTT Technical Research Centre of Finland

Best practices

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Best practices

PARADE. Best practices for Pre-demolition Audits ensuring high quality RAw materials.

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Content

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1. Introduction

1.1. Focus of document

This report presents selected examples of the best practices in demolition and waste management work covering the whole value chain from inventories to the new products from the recovered materials. The examples of solutions for reuse or recycling of construction and demolition waste can provide overview of the possible options for management of materials and components arising from the demolition or renovation works. This is especially important in the pre-demolition auditing process when the recommendations are formulated by the auditor and preliminary decisions are made by the owner of the material. The document also includes examples of policy instruments.

Additional examples of best practice in demolition have been compiled earlier in EU Construction & Demolition Waste Management Protocol[1].

1.2. Selection criteria for best practice examples and reporting

The examples presented in this document have been chosen based on the following criteria:

- good practices, processes and technologies covering the whole value chain
- proven technologies
- novelty value
- activities from different regions
- possibilities for multiplication
- further information is available in English, German or French

The examples are reported in the form of factsheets with brief information about the solution and links to the relevant documents and sources of additional information.

[1] European Commission "EU Construction and Demolition Waste Protocol", available online from https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en (2016)

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Table 1. Overview of selected examples.

Part of the value chain	Example (project or leading company)	Specification, comment
Inventory	NFDC protocol (UK) basic info	Information on recyclability and management of several C&DW streams
	Tracimat procedures (BE)	Quality management of demolition waste streams
Selective demolition	Democles project (FR)	Platform connecting stakeholders: project owners, contractors and waste managers
	Austrian standard ÖNORM B 3151 (AU)	Checklists, lists materials to be removed prior to demolition.
Reuse	Gamle Mursten (DK)	Upcycling old bricks
	Rotor Deconstruction (BE)	Facilitating the reuse of construction materials
	Arnošt Balcar (CZ)	Reuse of structural steelwork and envelopes of industrial and storage halls
	ArcelorMittal (Luxembourg)	Lease of building components
	FM-Haus (FI)	Modular demountable building parts
Recycling	High-grade concrete aggregates by OBCC and De Brabandere (BE)	Flemish standard specification for road construction, includes standards for high-grade concrete aggregates.
	EURIMA - European Insulation Manufacturers Association	Information Sheet on Waste Handling of Mineral Wool Insulation Recycling concept: Recycling of Mineral Wool Composite Panels Into New Raw Materials
	Eurobond, Rockwool and Tata Steel (UK)	Recycling mineral wool composite panels
	LB PLAST (SK)	Recycling of hardened PVC
	Energy giant Total SA, recycling charity Citeo, Saint-Gobain and the French union of fresh dairy product manufacturers (Syndifrais) (F)	"Polystyrene recycling channel" in France
	Sand2Sand	Recycling fine recycled aggregates as replacement for sand
	EKP Recycling and Chap-Yt (BE)	Recycling of post-consumer autoclaved aerated concrete (AAC)
	H&H Valorisation (BE)	H & H Valorisation specializes in the use of mobile extraction cleaning facilities

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Part of the value chain	Example (project or leading company)	Specification, comment
	Unilin (BE)	Recycling wooden waste in chipboards
	Advanced dry recovery (ADR) technology (NL)	Separation of mortar from concrete for high grade concrete recycling
	Desso's Take Back™ Programme	A collection and recycling scheme for carpets
	Roof2Road (NL)	Recycling of bituminous roofing
	GypsumtoGypsum project	Manufacturing of new gypsum plasterboard from gypsum waste
Other	Sloopcode (NL)	Good practice in demolition
	Materiaalitori (FI)	Market place for materials
	Green Public Procurement on demolition	Guide includes criteria related to the scope and content of the pre-demolition audits.

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2. Demolition inventory

2.1. Material data sheets

Selected example: NFDC Resource Protocol & DRIDS (UK)

The NFDC Resource Protocol has been produced by UK's National Federation of Demolition Contractors (NFDC) to help the maximal valorisation of materials recovered during the demolition and refurbishment process.

Figure 1 NFDC Resource Protocol

Background

The UK demolition industry already recycles more than 90% of materials produced during demolition. However, in order to maximise the recovery of material streams that are produced during refurbishment or demolition, a detailed pre-demolition inventory should be carried out and the waste that arises on the demolition sites has to be managed correctly.

Description of the solution

The Resource Protocol provides detailed information on how to carry out a pre-demolition audit to ensure all opportunities for the reuse and recycling of materials are realised.

In order to provide the industry with relevant and practicable information on specific materials, Demolition and Refurbishment Information Data Sheets (DRIDS) were developed. Here, you can find material-specific information on e.g. removal processes, waste management and safety requirements.

Excellence (how is the situation improved)

The Resource Protocol describes how to plan, perform and report a pre-demolition audit, taking into account the UK planning requirements and BREEAM schemes. The DRIDS provide information about reuse, recycling and recovery options for the different materials, specifically for the UK market.

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Further information

- https://demolition-nfdc.com/download/demolition-and-refurbishment-resource-protocol/
- http://nfdc-drids.com/

2.2. Material traceability system

Selected example: Tracimat (Belgium)

The Tracimat traceability system has been developed in Flanders, Belgium. The purpose of Tracimat is to act as a traceability system providing quality assurance for the selective demolition process and the waste streams produced.

Figure 2 Logo of Tracimat

Background

Proper management of construction and demolition waste (C&DW) – most importantly correct handling of hazardous waste – is of great importance and is required to guarantee a good quality of the recycled product. It is equally important that users of the recycled material have confidence in its quality.

Description of the solution

Tracimat covers the following elements:

- pre-demolition inventory;
- monitoring and supervision of flows;
- certification system for the construction and demolition material from selective demolition to be accepted as "low environmental risk material".

Excellence (how is the situation improved)

Tracimat certification means that the demolition waste has been selectively collected and gone through a tracing system, thereby assuring the processing company of the quality of the recycled demolition waste – guarantee its origin/source and quality as free of contaminants. This means that the aggregate can be classified as a material with low risk environmental profile with significant cost reduction in management.

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Online tools and a database support the quality system. The materials identified in the building are put into the online platform of Tracimat by the expert. This database holds information about available quantities of various recyclable materials and is of great value for investors in their decision on what technologies to invest in and/or will help in dimensioning new recycling plants.

Further information

Van Cauwenberg, L., Vanden Eynde, A. 2017. The Traceability: a tool for the valorization of secondary materials in the Flemish region. International HISER Conference on Advances in Recycling and Management of C&DW Demolition Waste, 21-23 June 2017, Delft.http://hiserproject.eu/images/mat_na_strone/Proceedings-_HISER_Conference.pdf

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3. Selective demolition

3.1. Collaboration across the whole value chain

Selected example: DEMOCLES (France)

DEMOCLES is a French collaborative platform on the initiative of the eco-organization Récylum. DEMOCLES aims to improve waste prevention and waste management practices (increased recovery) from heavy rehabilitation and demolition projects. Today, the platform brings together more than a hundred representatives including project owners, contractors and waste managers.

Background

The DEMOCLES project showed that up to 80% of the non-stony fraction of C&DW can be recycled at no extra cost if all actors are involved through responsibility sharing, planning and especially sorting at the source (selective demolition).

Description of the solution

The DEMOCLES website show the valorisation chain of the recyclable non-stony material fractions of C&DW (e.g. flat glass, plasterworks, mineral wool) in France, with all actors and their location. An overview is given of the acceptance criteria of these material fractions. Furthermore, a guide on the integration of waste requirements in tenders and framework contract for demolition works is available.

Figure 3: Example of the content of the DEMOCLES website (figures for the glass valorisation chain).

Excellence (how is the situation improved)

A clear overview of the valorisation chain of the non-stony material fractions in France allows contractors and project owners to easily find possible valorisation routes for the material fractions that are currently mostly landfilled or incinerated.

Further information

- https://www.democles.org

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- Guide d'accompagnement de la Maîtrise d'ouvrage et de la Maîtrise d'œuvre: Intégration des prescriptions «Déchets» dans les CCTP et les contrats cadres de chantiers de réhabilitation loured et de démolition.
- Ētude sur la responsabilitē de la maîtrise d'ouvrage en matiēre de dēchets.

3.2. Technical standardization of the selective demolition

Selected example: ÖNORM B 3151 (Austria)

This Austrian standard describes the required actions for the design and execution of a demolition of structures. The aim of the selective demolition is to obtain pure waste fractions, free of contaminations and impurities.

Background

An efficient and optimized use of recycled and reused materials and components is only possible when waste fractions are pure. The separation of waste starts with a selective demolition of structures/building. Standards are necessary to describe a systematic and optimized demolition process to ensure the purity of different waste streams.

Description of the solution

The ÖNORM B 3151 (AU) describes an extensive investigation of harmful substances and contaminants. This investigation must be carried out by a trained expert when a demolition of more than 3500 m³ converted space is planned. The materials with dangerous substances and materials with impurities must be removed before the actual demolition of the structure will take place.

Table 2 – Lists with materials that should be removed before demolition

Materials containing dangerous substances:	Materials containing impurities:
Loose artificial mineral fiber (if hazardous) Components or parts containing mineral oil (e.g. oil tank) Smoke detectors with radioactive components Industrial smoke stacks (e.g. fireclay boxes, bricks or lining)	Stationary machinery (e.g. building services, electrical devices) Floor constructions and double floor constructions Suspended ceilings Non-mineral flooring and wallcovering (except wallpaper)

Excellence (how is the situation improved)

The different materials containing dangerous substances and impurities, like mentioned in Table 1 are removed before the actual demolition of the structure. The dangerous substances and impurities can be handle accordingly. The rest of the waste streams, originated from the demolition of the structures become pure, which results in a more efficient handling of the recycling process.

Further information

ÖNORM B 3151 - Dismantling of buildings as a standard method for demolition - 2014

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4. Reuse of construction and demolition waste

4.1. CE marking for reused materials

Selected example: Gamle Mursten (Denmark)
Gamle Mursten upcycles old bricks for new buildings.

Figure 4 Upcycled bricks

Background:
The old bricks often come from buildings dating back to 1900-1960. These bricks were fired in an old-fashioned ring oven, where the coal helped to give the clay a unique spectrum of colours. The old-fashioned production process and deference to the craft has given the bricks a long lifespan.

Description of the solution:
The company reclaims old bricks from demolition sites. The bricks are machine-cleaned, hand-sorted, stacked by robots and sold for new building and renovation projects. Through a patented technology, Gamle Mursten ensures that demolition waste can be cleaned and the bricks reused. Gamle Mursten brick is CE-marked through an ETA procedure.

Excellence (how is the situation improved):
Reused bricks significantly reduce the amount of building waste that is generated, and brick reuse in buildings saves the environment significant amounts of the CO_2 arising from producing new bricks. Everytime the new brick is replaced with a reused one, the environment is saved by 0.5 kg CO_2. An Environmental Product Declaration (EPD) of reclaimed bricks has been published (see link below).

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Further information
http://en.gamlemursten.dk/
http://www.epddanmark.dk/media/1029/md-gamle-mursten-16007-en.pdf

4.2. Deconstruction and reuse of non-structural components

Selected example: ROTORDC - Rotor Deconstruction (Belgium)
Rotor Deconstruction is a young actor in the field of salvaged building components. Besides running a store in the Brussels Region, they provide assistance to building owners, contractors and architects.

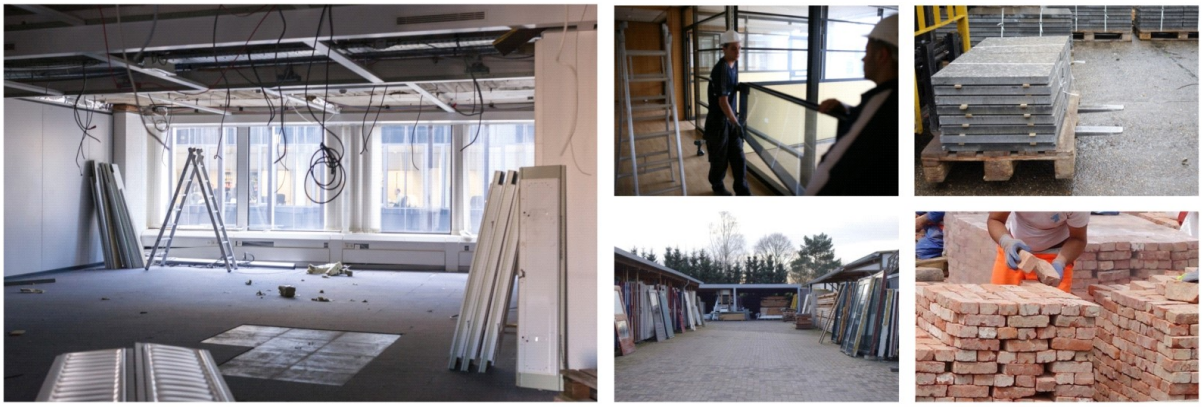

Figure 5 Building deconstruction and salvaged building components

Background
In Flanders today, more than 80 companies are specialized in dismantling buildings and reuse of building components. They try to anchor reuse in current building practice and get in touch with a new generation of professionals.

Description of the solution
Making use of reclaimed materials in large-scale projects is often quite challenging; timing needs to be kept, technical standards need to be followed, and risks need to be minimized. A team of consultants assist building owners and designers with the planning and execution of successful, ambitious operations.

Excellence (how is the situation improved)
Facilitation of the reuse of building components as a strategy on the path towards more resource-efficient materials economy. An overview of all dealers in second-hand building materials in Belgium is available on www.opalis.be .

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Further information
https://rotordc.com/
https://opalis.be/nl

4.3. Reuse of the whole building frame

Selected example: Arnošt Balcar, Haly-Sklady (Czech Republic)
Arnošt Balcar is an example of small entrepreneur providing consulting services in reuse of structural steelwork and envelopes of industrial and storage halls. He advertises the structures before deconstruction, looks for the investor and guides him through the whole reuse process.

Figure 6 reuse of structural steelwork. Photo credits: Arnošt Balcar

Background
Steel halls are modular, easily dismountable and have typically short service life. They provide a perfect opportunity for complete or partial reuse. Reuse of steel structures is one of the means of investment savings in the construction industry. Therefore, the existence of this market in the business environment can be considered as useful and economically justified.

Description of the solution
Consults and reuse coordinators such as Arnošt Balcar connect trades, dealers and specialized assembly/disassembly companies with the customers providing a cost competitive investment solution by offering a second-hand structure, often before it is deconstructed.

Excellence (how is the situation improved)
Information management of the possible offers and demands and suitable reuse contractors is crucial in the business, and therefore online marketing is important. Small entrepreneurs may

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benefit of joining larger networks such as Salvo in UK. This network, however, does not yet exist in the Czech Republic.

Further information
http://haly-sklady.cz/

4.4. Lease of reusable building components

Selected example: ArcelorMittal (Luxembourg)
ArcelorMittal is a large steel producer that entered recently the area of material reuse. The example of reusable sheet piles shows how the material manufacturer can go beyond the traditional recycling by leasing the products.

Figure 7. Reusable sheet piles. Photo credits: ArcelorMittal

Background
Sheet piles are used in construction, to provide earth or water retention in the foundations of buildings, roads, tunnels, or seawalls. Generally made from recycled scrap, they can also, like all steel products, be fully recycled, saving 1.29 tonnes of CO_2 for every tonne of steel made. Because of this, high-strength steel sheet piles already offer a more sustainable alternative to concrete.

Description of the solution
ArcelorMittal takes this one step further, since the sheet piles can be reused rather than recycled once the customer has finished their construction project. The current Environmental Product Declaration assumes that 25% of the piles are reused at the end of their service life.

Excellence (how is the situation improved)
The lease model used by ArcelorMittal means that, rather than selling the sheet piles, the company can offer the customers their availability for a period of time. It's a win-win for everyone: a reduced

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short-term cost for the customer, a stream of recurrent revenue for the producer, and a significant benefit for the environment in the long term.

Further information
https://corporate.arcelormittal.com/news-and-media/our-stories/steel-goes-circular

4.5. Modular demountable constructions

Selected example: FM-Haus (Finland)
FM-Haus Oy designs standard-sized, modular and simple parts that are easily demountable.

Figure 8. Modular demountable constructions

Background
Changes in business, lifestyle and population are increasing demand for flexibility in construction. Also requirements for resource efficiency in constrution call for new approaches.

Description of the solution
Design for deconstruction or disseambly enables reuse of building parts without damaging others and without a loss of quality or value.

Excellence (how is the situation improved)
For temporary constructions or for constructions where there are needs for changes with time, modular or demountable solutions support the circular economy goals for resource efficiency (reductions in environmental impacts, e.g. carbon footprint by resource savings) and also reduce the amount of C&DW generated.

Further information
https://fm-haus.fi/

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5. Recycling of construction and demolition waste

5.1. Recycling of concrete

Selected example: Oosterzeelse Breek- en betoncentrale Wegenbouw De Brabandere (Belgium)
O.B.B.C. recycles concrete into high quality recycled concrete aggregates that can be used in BENOR-certified concrete. They also produce cast-in-place concrete. Wegenbouw De Brabandere is a road construction company that uses high quality recycled concrete aggregates in new roads.

Figure 9 Concrete recycling and road construction

Background
According to scientific research, recycled concrete debris from demolished roads doesn't lead to a loss of quality providing that this debris is recycled in the proper way to the highest standards.

Description of the solution
Demolished concrete pavements are stockpiled separately to avoid contamination with other waste. Then the concrete debris is processed according the best available practice into high quality recycled concrete aggregates.

Excellence (how is the situation improved)
The best available practice in recycling concrete is a two-step crushing, sorting and sieving process. The high quality recycled concrete aggregates meet the requirements defined in the European Standard for aggregates in concrete EN 12620. These recycled concrete aggregates can be used in new concrete applications.

Further information
http://www.obbc.be
http://www.de-brabandere.be/recyclage

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5.2. Mineral wool insulation – general guide

Selected example: European Insulation Manufacturers Association (Belgium)

Eurima provides the information sheet in order to guide experts with the waste handling of mineral wool insulation.

Figure 10 Different types of mineral wool insulation

Background

Concerns about the possible health effects of inhalation of mineral wool fibers are still discussed. Mineral wool fibres are not classified as skin irritant; however, it may cause temporary skin itching due to the well-known mechanical effect of fibres. That is why the handling of mineral wool should meet some criteria.

Description of the solution

Providing current knowledge in concise and understandable form, the sheet can help the wider public to understand basic aspects of waste mineral wool handling. The information sheet includes information on:

- How to recognize mineral wool
- Where can the mineral wool be found in buildings
- How to differentiate between stone and glass mineral wool
- What should be done with mineral wool waste
- Safe deconstruction and demolition of mineral wool

Excellence (how is the situation improved)

Better understanding of waste mineral wool handling can help to achieve an improvement in the amounts of waste recycled.

Further information

https://www.eurima.org/uploads/ModuleXtender/Publications/151/Eurima_waste_handling_Info_Sheet_06_06_2016_final.pdf

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5.3. Mineral wool insulation – practical example

Selected example: Eurobond, Rockwool and Tata Steel (UK)

Recycling concept: Recycling of Mineral Wool Composite Panels Into New Raw Materials

Eurobond has developed a method for recycling mineral wool composite panels. By segregating the panel into constituent materials (mineral wool and steel), these can be fully and independently recycled so that new complete panels can be made and waste diverted from landfill.

Figure 11 Recycling of mineral wool composite panels

Background

Eurobond's approach, in collaboration with its strategic partners, is to manage the recycling of the composite panels and ensure delivery of all recycled material to the relevant manufacturer for transformation into new product.

Description of the solution

Managing the recycling of the composite panels has several key 'system components':

- Segregation (with acceptable levels of contamination)
- Delivery to recycling site
- Recycling: Composite panels of all sizes can be fed into the shredding machine (see Figure). The shredder separates the steel from the mineral wool and deposits it into individual containers for compression prior to delivery to Rockwool or Tata Steel. Mineral wool and steel

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are separated via a magnetic belt. This process ensures that the minimum amount of transport is required, leading to an environmental and financial benefit.

- Reprocessing back into new steel/mineral wool products

Excellence (how is the situation improved)

A joint collaboration between Eurobond, Rockwool and Tata Steel has demonstrated that there is a successful, commercially viable recycling process for stone wool composite panels. After processing, 100% of the separated stone wool and steel is re-entered into the manufacturing process to make new product.

Further information

http://www.wrap.org.uk/sites/files/wrap/xx%20Eurobond_WRAP.pdf'

5.4. Recycling of hardened PVC

Selected example: LB Plast (Slovakia)

LB Plast provides complex technology of recycling the PVC waste to produce secondary raw material suitable for reintegration into the new production process.

Figure 12 Recycled PVC dust, chips and granulate

Background

In Europe, around two-thirds of PVC produced is used in building applications such as PVC window frames and other 'profile' applications, pipes and fittings, flooring, electric cables and conduits, a variety of plastic linings, membranes and waterproofing applications, and in coated fabrics. Using recycled PVC helps meet resource-efficiency objectives, allows for the preservation of raw materials and reduces emission and landfill requirements.

Description of the solution

Hardened PVC wastes (production waste, as well as consumer waste - e.g. dismantled plastic windows) are recycled to PVC dust, PVC chips and PVC granulate. PVC waste is included in the recycling process by origin, brand profile and color. Subsequently, during the grinding process, it is

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automatically cleaned from dust, gaskets, ferrous and non-ferrous metals, sand, wood, and foil. Thus, it is free of all impurities and ready for further processing.

Excellence (how is the situation improved)

The advantage of using the processed PVC is, in particular, a wide range of fractions in different color designs. Waste PVC is processed exactly according to the requirements of a particular client. In the production of PVC chips there is a minimum of waste, so they represent the most environmentally friendly and cheapest input material for the further manufacture of new PVC products.

Further information

https://www.lbplast.sk/sluzby/recyklacia-tvrdeneho-pvc

5.5. Recycling of polystyrene

Selected example: Total SA, Citeo, Saint-Gobain and Syndifrais (France)

A consortium of leading French companies (energy giant Total SA, recycling charity Citeo, as well as multinational corporation Saint-Gobain and the French union of fresh dairy product manufacturers (Syndifrais)) has joined forces to drive the French government's circular economy roadmap forward, with the aim to create a "polystyrene recycling channel" in the country by 2020.

Figure 13 Polystyrene packaging and sheets

Background

According to Total, an estimated 110,000 tonnes of polystyrene packaging is put on the market each year in France. Lot of polystyrene products are also used in construction sector. Systematic collecting and returning to the production technology can enhance the amounts of raw materials containing recycled content.

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Description of the solution

The project will involve collecting post-consumer polystyrene packaging and finding the right technical solutions for recycling it. Additionally, it will identify potential, affordable uses for the recycled polystyrene. The company will also use polystyrene waste from other sources, such as construction.

Excellence (how is the situation improved)

The end products are expected to meet the same specifications as virgin polystyrene. The company supplying construction materials and insulation products will collect discarded insulation made of EPS at construction sites. It will then reuse the material in the production of new polystyrene products.

Further information

https://www.plasticsnewseurope.com/article/20180629/PNE/180629895/consortium-to-create-polystyrene-recycling-channel-in-france

5.6. Recycling of sand

Selected example: Sand2Sand project

Recycling fine recycled concrete aggregates as replacement for sand. In the Sand2Sand research-project four companies (Jacobs, Wegenbouw De Brabandere, O.B.B.C. and SIKA) and two research institutes (BBRI and KU Leuven–RecyCon) investigated the potential use of fine recycled concrete aggregates, size 0 – 4 mm, as replacement for natural sand in concrete applications, such as road pavements, ready-mixed concrete and precast elements.

Background

Sand is one of the most used natural building materials in the construction industry worldwide. The availability of natural sand becomes limited due to restrictions on extraction of sand from the riverbed or from sea as a result of erosion and coastal defence.

Description of the solution

The Sand2Sand research-project aims for a high-quality application of recycled sand that is generated during the recycling process of demolished concrete, with the aim of creating added value and responding to the Flemish shortage of construction sand. The most important characteristics of the breaker sand, which may be important for the application in concrete, are mapped. The differences between high-quality and ordinary concrete breaker sand were also mapped.

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Excellence (how is the situation improved)
The different concrete mixtures have been tested and the test program learned that 'recycled sand' can be used in the opted concrete applications. The first steps towards market application are also taken, with attention to economic feasibility, demonstration of the possibilities and the regulatory framework (standards, legislation, technical regulations).

Further information
https://iiw.kuleuven.be/nieuws/sand2sand-voor-cleantechfestival
https://www.wtcb.be/homepage/index.cfm?cat=projects&proj=545

5.7. Recycling of autoclaved aerated concrete

Selected example: EKP Recycling and Chap-Yt (Belgium)
EKP Recycling and Chap-Yt recycle autoclaved aerated concrete (AAC) waste as a sand replacement in floor screeds and cement stabilized sand. Around 20 kton/year of AAC waste is recycled this way in Belgium.

Background
Autoclaved aerated concrete (AAC) is a lightweight cellular concrete that has been used for more than 80 years. The amount of AAC waste that can be recycled in the production of new AAC is limited because of quality issues. Furthermore, recycling AAC into traditional concrete or as unbound aggregate causes both technical and environmental problems because of the low compressive strength of AAC and its high amount of leachable sulfate.

Description of the solution
AAC demolition waste can be used as a fine aggregate (0-8 mm) for the replacement of sand in floor screed and cement stabilized sand. In these products, the leachable sulphate is immobilized as ettringite in the fresh products. The presence of other stony materials has no negative effect on this recycling route. Recycled AAC aggregate can replace 40% of the sand fraction in floor screed.

Excellence (how is the situation improved)
A recycling process was developed for a material fraction that was previously landfilled or formed a contamination for other material fraction. The post-consumer waste of AAC is recycled in a high-grade product.

Further information
- https://www.chapyt.be/2019/04/chapyt-vermaalt-cellenbeton-in.html#more
- https://www.jacobsbeton.be/ekp-recycling-nv/

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- Bergmans, J., Nielsen, P., Broos, K., Snellings, R., Quaghebeur, M.. Recycling of autoclaved aerated concrete in screed and stabilized sand. CONMAT 2015, Whistler (CA).

5.8. Treatment of contaminated waste streams

Figure 14Treatment of contaminated soils

Selected example: H & H Valorisation (Belgium)

H & H Valorisation specializes in the use of mobile extraction cleaning facilities, both on sanitation projects and on authorized sites, for the treatment of contaminated soils, inert waste streams, waste materials and construction and demolition waste contaminated with asbestos or other contaminants, residual ash and sorting sand.

Background

During demolition of buildings and infrastructures, and removal of the debris, often the demolition waste becomes contaminated with various contaminants. Soil that is mixed with stony fractions or with other contaminants such as asbestos, become pure waste while in fact it contains large quantities of reusable raw materials such as sand and aggregates.

Description of the solution

Contaminated waste streams are treated by washing and other cleaning actions. The recovered materials are treated soil, sand and aggregates.

Excellence (how is the situation improved)

The installation operates autonomously. The water is used in a closed circuit during the process, no water is discharged. The complete installation is modular and can be adapted to the waste streams to be treated. In addition, it can also be transported and returned operational in a two-week period.

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5.9. Wood recycling

Selected example: Unilin (Belgium)

Unilin, one of the largest chipboard producers in Europe and the company behind Quick-Step, makes chipboard panels containing up to 85% recycled wood. A big part of this is post-consumer wood from the packaging industry and the construction sector.

Background

Unilin is located in the densely-populated region of Flanders, which is low in primary wood production. In order to find local resources, Unilin relies heavily on the 'urban forest', wood from demolition processes and other industries.

Description of the solution

Unilin has invested in an automated sorting process, using Near-Infra-Red sensoring technique and other sorting equipment to obtain the necessary purity of their material. Unilin can recycle all non-hazardous wood waste, with the exception of wood products from wood chips, strands or fibres. Those latter products can only form up to 30% of the resource mixture, to avoid high amounts of small wood chips.

Figure 15 Shredded wood waste for recycling

Excellence (how is the situation improved)

In a bit more than twenty years, Unilin has increased the recycled wood content in their chipboard from 0% to 85%. Unilin recycles ±800 ktonnes post-consumer wood per year. The rest of their wood resources come from thinned wood from sustainable forest management or from pre-consumer wood (timber industry).

Further information

https://vlaanderen-circulair.be/en/cases-in-flanders/detail/unilin
https://www.mo.be/reportage/unilin-maakt-spaanplaten-met-het-stadsbos

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https://www.unilinpanels.com/en/about-unilin-panels/sustainability/we-give-wood-a-second-lease-of-life

5.10. Separation of mortar

Selected example: advanced dry recovery technology (the Netherlands)

The advanced dry recovery (ADR) technology was developed and demonstrated by TU Delft for separation of mortar from concrete in the FP7 project C2CA and the H2020 project HISER.

Background

The separation of fine materials (<1 mm) is crucial for enabling high-grade recycling from concrete waste in new concrete. Fines contain more cement/mortar paste which increases the water need during mixing and makes the mixture sticky. Also the possible presence of sulphates and chlorides in the fines fraction makes production challenging.

Description of the solution

Concrete waste from selective demolition is crushed (<12 mm), autogenous milling is used to remove the loose mortar from the aggregate's surface. First, kinetic energy is used to break the water bond that is formed by the surface moisture associated with the fine particles, after which first fines <1 mm are removed and then the coarse aggregates, (4–16 mm) and a finer fraction (1-4 mm) containing impurities such as wood, plastics, and foams is separated.

Excellence

The ADR is a mechanical low-cost process and can be applied without prior drying or wet-screening. The coarse aggregates, typically nearly 50% by weight, recycled in concrete have shown comparable properties to natural aggregate in terms of workability and compression strength.

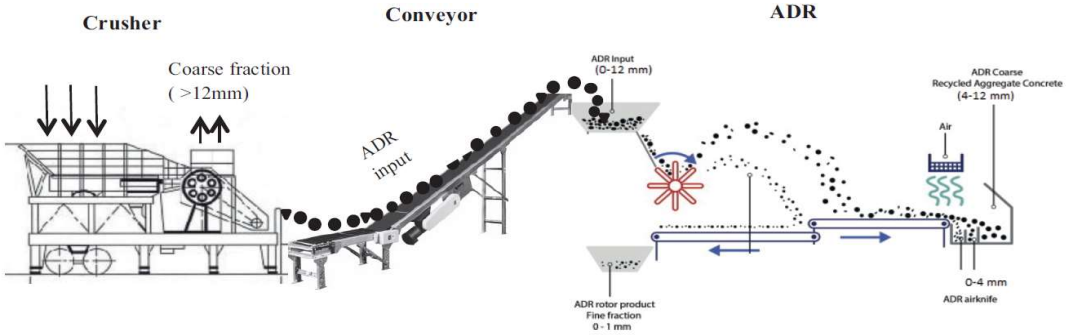

Figure 16 Concrete crushing and sorting concept. Source: Gebremariam et al., 2018

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Further information

Gebremariam A.T., Di Maio F., Lotfi S., 2018. , 'Advancements in recycling of end-of-life concrete'. *Concrete Plant International* – 3.

H2020 project HISER (2015-2019). www.hiserproject.eu

5.11. Recycling of fabrics

Selected example: Desso's Take Back™ Programme

Desso has put in place a collection and recycling scheme for carpets in six European countries.

Background

Nowadays, carpets are usually not recycled. Europe discards annually approximately 1.6 Mton of post-consumer carpet material (source: ClosedLoopCarpet, 2013).

Description of the solution

Desso has developed an innovative separation technique, Refinity®, which makes it possible to separate the yarn from the bituminous backing, producing two material streams that can each be recycled. Desso developed EcoBase®, a backing that is designed for disassembly and can be fully recycled in their own production process. Due to the innovative composition of this backing, DESSO EcoBase® can be fully recycled in Desso's own production process after separation. Desso introduced a Take Back™ Programme that collects used carpets from their clients.

Excellence

Newly developed Desso carpet tiles (AirMaster Gold) contain >60% of recycled material and are 100% recyclable if the Ecobase® backing is used.

Figure 17 Recovered textile fibres

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Further information

http://www.desso.ch/globalaccounts/wpp/take-back%E2%84%A2-programme/
LIFE project ClosedLoopCarpet (2013-2018).

5.12. Recycling of bituminous roofing

Selected example: R2R (the Netherlands)

R2R recycles bituminous roofing for the use in the production of asphalt or new bituminous roofings.

Background

Currently only limited amounts of bitumen roofing (mainly construction waste) are recycled.

Description of the solution

Old bituminous roofs that need to be renovated or demolished are assessed for suitability for R2R recycling. If the roof is suitable, it will be demolished by a certified R2R specialist. This is a professional roofing company or demolition contractor that works according to the R2R guidelines and ensures that the bitumen roof material is offered clean and separated to R2R for high-quality recycling. Roof2Roof processes the clean and separated bitumen roof material into raw materials for the production of new roofing rolls. Roof2Road uses recycled bituminous roofs for the production of new asphalt roads.

Excellence

By implementing an integrated chain approach from renovation or demolition works to the recycling routes, R2R provides a guaranteed collection of bitumen roofs free of tar and asbestos and processed into pure high-quality raw materials.

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Figure 18 Recovery of roofing bitumen and recycling as road pavement

Further information

www.roof2roof.nl

5.13. Recycling of gypsum

Selected example: GypsumtoGypsum project

The GypsumtoGypsum (GtoG) project aimed at transforming the European gypsum demolition waste market to achieve higher recycling rates of gypsum waste, thereby helping to achieve a resource efficient economy.

Background

Gypsum demolition waste is a most complex waste stream because other construction material can be adhered to the gypsum (e.g. paint, glue, stony material). Most of the gypsum demolition waste is landfilled.

Description of the solution

The GtoG project successfully incorporated up to 30% of recycled gypsum in the manufacturing of new gypsum plasterboards. Recycled gypsum needs to meet stringent specifications in order to be incorporated in the manufacturing process, these specifications require a selective demolition process. Two gypsum recycling companies (New West Gypsum Recycling & Gypsum Recycling International) are active in several European countries.

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The GtoG project has released the European handbook on best practices on deconstruction techniques of gypsum-based systems and the European manual for best practices in audit prior to deconstruction of buildings.

Excellence

The GtoG project has put in place an integrated approach to gypsum recycling, starting from refurbishment and demolition sites to the reincorporation of the recycled gypsum in the manufacturing process via the processing of gypsum waste as a secondary raw material.

Further information

Life+ project Gypsum to Gypsum (2013-2015). www.gypsumtogypsum.org
New West Gypsum Recycling: www.nwgypsum.com
Gypsum Recycling International: www.gypsumrecycling.biz
Eurogypsum: www.eurogypsum.org

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6. Other aspects

6.1. Good practice in demolition work

Selected example: Vereniging voor Aannemers in de Sloop (the Netherlands)

VERAS (Vereniging voor Aannemers in de Sloop - the Dutch representative association for demolition contractors and asbestos removal companies), has published the Code for Responsible Commissioning and Contracting during the Tendering and Execution of Demolition Works.

Background

Many stakeholders are involved in the preparation and execution of demolition projects (including removal of asbestos). Trust in executing of demolition work through common understanding of high quality performance and terms is in the interests of the parties involved.

Description of the solution

The Code consists of the following themes:
1: Open & considered tendering process
2: Sufficient project-related information
3: Transparency and pricing Code
4: Adequate execution and mutual respect.

Each theme is described including explanation of the rationale and objective. This Code is not legally binding, but the parties can hold each other to account using this Code during the preparation and execution of a demolition project.

Excellence (how is the situation improved)

Common understanding, criteria and conditions create confidence among stakeholders for execution of the demolition projects.

Figure 19 Demolition works

Further information

https://www.sloopcode.nl/site/media/Dutch_Demolition_Code_EN.pdf

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6.2. Digital marketplace

Selected example: Materiaalitori (Finland)

Platform managed by the Finnish state owned company Motiva Ltd[2] for exchange, sale and purchase of waste materials, side streams and left overs.

Figure 20 Logo of Materiaalitori

Background

C&DW can be used as secondary raw materials. There is often a lack of information among stakeholders about generated materials and components that can be reused or recycled.

Description of the solution

"Materiaalitori" is an internet platform intended for the professional exchange of waste and production side streams from companies and organisations. "Materiaalitori" also allows searching for and offering related services, such as waste management and specialist services. Registered companies can use "Materiaalitori" transparently and free of charge by notifying in the platform a material stream supplemented with appropriate description (characteristics, amounts, pictures and also a note if the stream is classified as waste)

Excellence (how is the situation improved)

"Materiaalitori" service aims to promote the circular economy and the recovery of waste and side streams by providing operators in the field with a platform that enables those offering and needing recycled materials to find each other. Forming such industrial symbioses is a requirement for recycling materials.

Further information

https://www.motiva.fi/en/solutions/material_efficiency/materiaalitori

6.3. Green Public Procurement for demolition

Selected example: Guideline for Green Public Procurement for ordering demolition work (Finland)

The Finnish Ministry of the Environment has developed a guideline for Green Public Procurement (GPP) for the demolition of public buildings (to be published in English in 2020).

[2] the mission of Motiva is to promote material and energy efficiency on a national level.

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Figure 21 Finnish guide on circular economy in public demolition projects

Background

Green Public Procurement (GPP) is a voluntary instrument aimed to be used by the municipalities to improve the recycling of C&D waste arising from the demolition of public buildings.

Description of the solution

The target group for the guideline is the public authorities making decisions on contractors for public demolition work. Potential criteria to be taken into public procurement processes are proposed. One of the suggested criteria relates to the scope and content of the pre-demolition audits, e.g. including plans for reuse or recycling of C&D waste. In addition, criteria related to the competence of the waste auditor are proposed.

Excellence (how is the situation improved)

GPP is a tool to support achievement of Circular Economy in the demolition of public buildings. Construction and demolition wastes arising from public buildings are directed to reuse and high quality recycling. Also other than concrete and brick wastes and metals are sorted and recycled if possible.

Further information

- Kuittinen, M. 2019. Circular economy in public demolition projects. Procurement guide. Publ. of the Ministry of Environment 2019:31. http://urn.fi/URN:ISBN:978-952-361-038-5
- PARADE seminar presentation 19.11.2019: Green Public Procurement in Demolition - Finnish guideline by Riikka Kinnunen. Link: https://www.vtt.fi/sites/PARADE/events

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PARADE - Best practices for Pre-demolition Audits ensuring high quality Raw materials




www.vtt.fi/sites/parade

rawmaterialsacademy.eu