ANALYSIS OF EUROPEAN CONTEXT IN DEMOLITION AUDITS

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CONDEREFF
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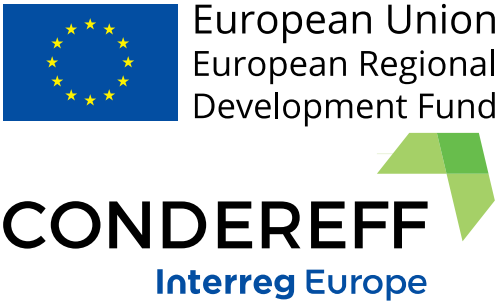

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Editors:

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SUMMARY

This document examines the state of the art of demolition audits and some practices of construction and demolition waste management in several European Union countries: Austria, France, Spain, Italy and Czech Republic. The context that allows this cooperation among these different countries comes from the project “Construction & Demolition Waste Management Policies for Improved Resource Efficiency”, from now on CONDEREFF. This project is supported by the program Interreg Europe.

This project started from the need of aligning the regional policy instruments of these countries with the new guidelines set out by European Union Protocol on Construction and Demolition Waste Management in order to adapt circular economy and environmentally friendly trends to the CDW sector.

The next pages present comprehensive information for the aims and the structure of the project and then provides information more focused on each region related to the demolition audits and CDW management practices which was shown in an international workshop of the project.

Regarding Styria region in Austria, it is presented its Legal Framework and Practical experience in is Pre-Demolition Audits. A university research of Pardubice region in Czech Republic about the reuse of secondary material in Transport Structures, roads and geotechnics is presented. With regard to Italy, on one hand it is explained the Pre-Demolition audits as a tool for an Eco effective management of CDW and on the other hand, are described methods used to demolish the damaged building after the earthquake basing on their management of rubble after the earthquake of Amatrice e Accumuli. Concerning Rhône-Alpes in France, the state of art of the pre-demolition audits is exposed and finally, about Valencia region in Spain, the environmental requirements for maintenance work and waste management service procurement are identified.

KEYWORDS

Construction and demolition waste management, CDW, Reuse, Recycling, Circular economy, Pre-demolition audits, Management service procurement.

CONTENTS

INTRODUCTION

The initiatives of the European Commission in the field of circular economy together with the European Union protocol on construction and demolition waste management, is leading some European regions want to improve their policies in this area with views to a more sustainable growth. CONDEREFF project is born from the initiative of these countries together with the support of the program Interreg Europe.

Construction and demolition waste (CDW) are one of the heaviest and most voluminous waste streams generated in the EU, being responsible for the 33% of the total waste generated in the EU. Although there is a high potential for recycling and re-use since its components have a high resource value, only 50% of this waste is recycled. The target according to the Waste Framework Directive is to reach 70% waste recycled by 2020.

The challenge to be faced by the regions over the 5 years project is to accelerate the improvement in the regional policies instruments, to increase confidence in the C&D recycled materials quality and strengthen public authorities' capacities in managing C&D waste, public procurement, landfill restrictions, recycling facilities, public perception, and acceptance. For this purpose, it will be required to increase capacity to implement resource efficiency policies related to C&D waste management and to enhance practices in managing C&D waste streams generation, tracing, and processing that improve the waste identification, source separation and collection Also, it should be emphasized to adopt of proven C&D monitoring processes and regulation enforcement method and to improve regional chain actors' perception and confidence in C&D waste re-use potential and value.

It is expected at the end of the project aspects like lack of investment (and skills) on infrastructure, weaknesses in policy considered procurement procedures and lack of administrative capacity of public authorities to manage relevant projects and programmes have been significantly improved.

In order to achieve these objectives, the project partners will work and cooperate in a a series of activities organized as exchange of experience activities, communication and dissemination activities and project management activities. From all these activities there is obtained the best practices, procedures and knowledges which exist in each region and could be shared and pooled.

Concerning the most important documents, the Green Public Procurement (GPP) drafted by the European Economic Community are a guide for the administrations in order to apply the sustainability criterion in the public tenders and their different areas.

In one of the papers below are analyzed the environmental requirements for works and services in the Valencian Community regarding the management of Demolition and Construction Waste (CDW).

The main results show the limited specification with regard to the environmental requirements existing for the waste recovery for the CDW generated in works of different administrations.

Also, it shows an example for the use of recycled aggregates as an application of the environmental improvement criteria in the operation of non-hazardous waste plant managed by S.A. Agricultores de la Vega de Valencia (SAV).

The article is part of the research field regarding the recycling and recovery of CDW as a collaboration between the S.A. Agricultores de la Vega de Valencia (SAV) company and the European Project CONDEREFF (Construction and demolition waste management policies for improved resource efficiency).

On the one hand, Austria is one of the regions which have a high percentage of wastes treated. In 2015, 10 million tons of construction and demolition waste were generated and 87% of C&D waste were treated in a treatment plant in spite of the fact that the Austrian Recycled Construction Materials Ordinance entered into force fully on 1st January 2016. The aim of this ordinance is to promote the recycling of construction and demolition waste by ensuring a high quality of waste generated during the construction and demolition activities.

Also, this ordinance claims that the builder and the building contractor are responsible for the separation of the construction and demolition waste. Furthermore, the builder is responsible for the supply of the required area and establishment.

Regarding the waste separation, hazardous and non-hazardous waste, C&D waste and other waste occurring have to be separately collected on-site. Excavated soil, mineral waste, excavated asphalt, wood waste, metal waste, plastic waste and residential waste must be separately collected. If the separation on-site is not possible, due to technical reasons or disproportionate costs, the separation must be executed at an authorized treatment plant.

In order to produce a secondary raw material from recycling-construction material, the quality-assurance process has 5 steps: receiving inspection, quality requirements, quality assurance, designation of the quality-assured recycling construction materials, end of waste of the quality-assured recycling construction materials.

Landfilling is connected to negative impacts if this is not performed according to the legal requirement. The main faced issues are the occurring danger during demolition activities due to hazardous substances, the mixing of the different materials and landfilling at the end of the demolition process. Hazardous substances are in first instance harmful to workers on the building site.

The recently published revision of the Waste Prevention Program containing a multitude of individual measures which need to be carried out in order to ensure a successful waste prevention policy. The area of CDW consists of two packages: “Low-waste construction and extending the useful life of buildings” and “Design and reuse of parts of buildings”. Both the Austrian Recycled Construction Material Ordinance (2016) and the Waste Prevention Program 2017 are suitable to foster the move towards circular economy in Austria. Especially the Recycled Construction Material Ordinance provides clear instructions and procedures for a quality-assured recycling of C&D waste. Both documents also aim to increase the volume of reused waste. The current challenge is, however, to better transfer these provisions into the daily practice of the building sector. To get this done, better dissemination of specialist information and targeted awareness raising activities are highly needed.

The construction and demolition waste management policy should be evaluated and, if necessary, developed further, in order to guarantee efficient resource management and waste prevention. The EU-project CONDEREFF is the ideal platform to initiate the necessary steps

On the other hand, France is another example of region which remarks the importance to understand the issue of pre-demolition audit and the need for effective audit practices and the main forces at play hindering the implementation of recycling and re-use practices.

The main barriers in France when talking about wastes audit are the low level of knowledge of the regulation among local authorities, the urgent need to train auditors and contracting authorities which are the cornerstone and must be trained to prescribe recovery solutions in tenders. Also, a tracking system should be developed and must stem from a common agreement between value chain actors and tax system to ease the secondary use of C&D materials, currently evolving to

make recycling materials more competitive. According to the OREE's report released in 2018 on the deconstruction, the main levers could be identified from different perspectives.

At national level, should be spread the scope of the pre-demolition audit to renovation, uplift labels recognition to better apply circular economy principles and ease the end of waste regulatory status, as quoted in the measure 37 of the FREC.

For the contracting authority, should be highlighted to regard wastes as resources, consider urban mines, and to train itself and prime contractor to recycling and recovery techniques. There should be important to put in place best practices and sign charter, communicate to spread the use of best practices and maximize potential value, incentivizing actors in the tenders. Also, deepen responsibilities, risks coverage and warranty issues. For the prime contractor, it is important to train participants and raise awareness to re-use techniques and potential.

Regarding the auditors, they should train and get certifications such as OPQTECC or OPQIBI and perform a dynamic inventory and meet stakeholders able to provide complementary information.

Finally, for the company should be emphasized train to waste sorting and management techniques to better meet customer expectations and for the local authority, could be important to create at regional level a teamwork dedicated to coordinate scheduling and link supply and demand between C&D sites.

In this sense, Waste management to be successful is at the first order a behavioral matter, the commitment and role of the contracting authority is of paramount importance. To ensure a complete recovery of the materials and wastes, the challenge is now to work in collaboration with all the value chain actors in order to define a reliable, effective and shared document of traceability.

Another country in which the management of demolition wastes is particularly important is Italy. After the 2016 earthquake in the Lazio region, the need to respond for housing for the displaced persons appeared. So, in order to restart the daily life of residents as soon as possible, various coordinating interventions of an economic and social nature and for the removal of rubbles and the reconstruction of new residences were started. In this way, two tenders were launched; the first, transport and processing of the public rubble (from public buildings) and the second, waste Separation Services, Loading and Transport, Recovery and Disposal of Rubble in the municipalities of Accumoli and Amatrice.

The main targets to be achieved in the management of emergencies were:

- Timeliness of intervention: the current legislation the day after an earthquake concerning the waste management was the same than before and no derogation was made after, as could be in the emergency cases.

- Material recovery: The waste that is generated by catastrophic events such as an earthquake can be a resource. Construction and demolition waste are materials- from construction and demolition activities from building construction, from civil engineering and road and bridge construction-. However, 90% of those materials result from demolition work and only 10% appear when building new constructions.

- Reduction of the environmental impact of the work: The distance between rubble deposit sites and reuse sites takes on fundamental significance in relation to the presence on the territory of plants authorized to manage waste. It must be mentioned that seismic events occur in territories that are not structured to receive quantities of waste equal to those generated because of collapses. For this reason, there are no immediately available solutions. It is necessary to provide special operations designed for the special conditions in which it operates. In the disgrace of the event, a value is generated: the resource of the rubble. We need to think about how to enhance it on the territory. Although it should be remembered, that before the event happens otherwise the tight schedule and the interests of the individual make it impossible to manage these phases efficiently.

- Valorization of human resources present. The situation of territories hit by earthquakes is complex for a number of reasons: Among these there is absolutely also the sense of strong disorientation that the people who live in those places have to face the radical change that their life habits undergo. This loss is evident and present in the depths of those affected. The reasoning then is that if there are conditions to enhance the people present and insert them in the industrial sector that created at the time of processing aimed at recovering the rubble, life, dignity and strength will be restored to local communities.

In this matter, the path made has nevertheless allowed those communities to understand the value of work that is linked to the value of the materials that are managing. There is important to think that the company has a strong responsibility in civil society, it could be said how this approach elevates the value of the company and people.

Finally, from Czech Republic, it was introduced the importance of the material's value. The most common recycled materials used in transport structures can be distinguished to the Construction and demolition waste (defined by Group 17 of the Waste Catalog according to Decree No. 93/2016 Coll), and Industrial secondary raw materials.

The requirements for building materials are different depending on the type of structure.

In concrete structures, there is important recycling of fresh liquid concrete residues from fresh concrete production and recycling of hardened concrete. Concrete structure remains and parts are transported to concrete recycling plants and processed by concrete mixers, crushers and screens. Recycled concrete material can be used as backfill material, material for the earth body for road and rail construction, aggregate of the superstructure or unbound construction layers of the roads, and aggregate for concrete of lower strength classes with low requirements for the quality of aggregates (base or filler layers of concrete). The focus should be placed on concrete properties and characteristics like a suitable shape index, lower bulk density, higher absorbability etc.

Regarding the transport structures foundation, geotechnics tasks in improving unfit soil/ subgrade are generally solved by treated soil. For soil stabilization, the following agents are utilized: binder (cement and lime, foamed asphalt), hydraulic road binder (mixed cement), slag, by-product in the production of iron in a blast furnace. Its properties are among the latent hydraulic additives. The quality of the slag is assessed in terms of the alkalinity module. The fine slag particles are advantageous for filling the space between the cement particles, thereby improving flow ability, porosity, durability, water- tightness and especially frost resistance of hardened concrete. After adding water, slag itself does not solidify or harden. The hydraulic properties become apparent only after the addition of the so-called activator, which is cement in the concrete. In fresh concrete improves rheological properties and viscosity. However, it adversely affects the strength increase and fly ash or stabilized mixture: In fresh concrete, fly ash improves workability and when used, the amount of water used decreases. In hardened concrete, it positively affects

carbonation and long-term strength, but short-term strength is lower. Concrete with fly ash resists aggressive environment (frost and CHRL).

Concerning railways, in Czech Republic, there are steel railways with corresponding amount of rail fastenings. There are sleepers (wood or concrete) layered in track bed.

The most important functions of ballast structure can be stated as: Structural Support, Drainage, Reduce Frost Problems, Absorb noise. Upon cyclic loading of trains and through weathering processes, ballast deteriorates by time. Recycling of a rail bed aggregate is currently carried out essentially by two technologies: the machine cleaning and the use of recycling and crushing method. This method achieves better parameters of recycled aggregate produced, as well as a smaller amount of "waste ", that is difficult to use. However, this approach is time consuming and there are relatively high transport costs.

To treat impregnated wooden railway sleepers, toxic chemicals are used to prolong their durability, resistance to weathering, rot, parasites, water and fire. In the past, especially tarry residues from the distillation of coal coke were used. Impregnated wooden sleepers can be used: for construction purposes, as a designated construction product, and for reinforcement of taxiways and courtyards. Concrete sleepers can be used e.g. for building of retaining walls and similar structures.

Finally, road pavement challenges are operational capability and bearing capacity, durability of surface course, maintainability and reparability. In the Czech Republic, the technical standard is the use of recycling C&D materials to road construction by cold and hot recycling of flexible pavement structures (rehabilitation procedures).

All these procedures remark the complexity and variability of the different materials and the task that should be done through projects like CONDEREFF.

All the information gathered through CONDEREFF project aims to provide an innovative approach regarding the construction and demolition wastes and all the issues concerning demolition audits, supervision and documentation in order to raise awareness and implement laws which could enhance the operation of society.

The editors

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CHAPTERS

CHAPTER I: CONDEREFF. CONSTRUCTION & DEMOLITION WASTE MANAGEMENT POLICIES FOR IMPROVED RESOURCE EFFICIENCY

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CONDEREFF. CONSTRUCTION & DEMOLITION WASTE MANAGEMENT POLICIES FOR IMPROVED RESOURCE EFFICIENCY

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ABSTRACT

The goal in this project is to spread the knowledge about C&D waste management in order to create an efficient way to reduce the impact of it by learning the different policies and the difficulties to achieve the goal.

KEYWORDS

Waste management, Recycling, Improving policy.

INTRODUCTION

According to the data collected it is clear that only 50% of the C&D waste is recycled while the aim is to reach the 70% by 2020. To fulfill this condition, important points have been taken into account such as the policy challenges, the EU priority waste stream and waste management protocol. In order to understand these issues, it must be clear the following points:

- Current situation of Spain
- Which are the goal and objective of the project?
- Different policies that have been addressed
- Which are the reasons to improve the policy instruments?
- How are policy improvement planned?
- The different methodologies to reach the goal

Situation of Spain related to the construction and demolition waste

In 2012, Spain generated 27 million tons of construction and demolition waste. Out of this, 19 million tons (68%) were recycled into various outlets; 4 million tons were backfilled, and another 4 million tons were landfilled, including hazardous waste that introduces serious dangers for the public health and the environment.

C&D waste management is an important issue in Spain, as the revised version of the 2015-2020 State Waste Framework Plan PEMAR2 is currently undergoing scrutiny by all regions and relevant stakeholders due to the limited recycling and processing of hazardous waste. In fact, national legislation and plans on waste management encourage and lay out a framework for regions to develop regional-wide plans and legislation adapted to their region. Regional C&D waste management plans are positive drivers; dynamic collaboration between regional and regulative authorities during the development of legislation or waste management plan revisions is furthermore another notable driver to good CDW management.

Since 1997, the region of Valencia has an Integral Waste Plan (PIR97), approved by Decree 317/1997, dated December 24, of the Consell, and amended by Decree 32/1999, of March 2, which has come to establish the guidelines and criteria to be followed with the aim of achieving an integrated and coordinated management of waste in the region.

Nonetheless, C&D waste management in the region of Valencia still faces serious regulative and administrative obstacles such as:

- Lack of regulations regarding pre-demolition audits.
- Lack of awareness of the advantages of recycled aggregates.
- Lack of stakeholders' awareness and incentives to develop, adopt and promote innovative C&D waste management products.

The goal and objectives of the project

The key goal in this project is to reach several main points that can help the improvement, such as to support the integration of the EU C&D waste management Protocol in territorial policies. To also strengthen capacity of public authority in managing C&D waste, public procurement, landfill restrictions, recycling facilities, public perception and acceptance. It is also seen as important to transfer the lesson learnt into partners regional policies.

There are some key points described as the objective of the project where the main aim is to:

1. Increase capacity to implement resource efficiency policies related to C&D waste management.
2. Enhance practices in managing C&D waste streams generation, tracing, and processing.
3. Foster the economic potential of C&D waste re-use.
4. Adopt proven C&D monitoring processes and regulation enforcement methods.
5. Improve regional chain actors' perception and confidence in C&D waste re-use potential and value.

Despite of having these clear steps, the target is not complete due to the challenges that are shown up in the waste management, such as:

- Lack of confidence in C&D recycled materials quality.
- Different approaches throughout the EU hindering cross-country comparisons & collaboration.
- Policy improvements required at different levels.

To find a reasonable solution to these challenges the steps could be:

- To improve waste identification, source and collection.
- To use a better waste logistics and an improved waste processing.
- To also take into account the quality management, appropriate policy and framework conditions.

The different policies that have been addressed

Country	Policy instrument	Managing Authority	Partner responsible
ES	Integral Plan of Waste by the Valencian Community (Decree 81/2013)	Valencia Regional Government	UPV
GR	Regional Operational Programme of Thessaly 2014-2020	Region of Thessaly	RoT
FR	Regional ERDF programme Rhône Alpes 2014-2020	Regional Council of Auvergne-Rhône-Alpes	AURA-EE
CZ	Operational Programme Environment	Czech Republic Ministry of the Environment	RRAPK
IT	POR Lazio ERDF	Lazio Region	LAZIO
AT	Investments in Growth and Employment Austria 2014-2020	Styrian Provincial Government	STYRIA
DE	Guidelines for the production and use of quality controlled recycling construction material in Saxony-Anhalt	Saxony Anhalt Ministry of Environment, Agriculture and Energy	ISW

Figure 1. Regions and policy instruments.

C&D waste management regional policies support public procurement and innovative products for recycling and waste treatment. There is a partial link of the addressed issue with the regional innovation strategy for smart specialization, as the promotion of C&D waste management supports the development of recycled materials, as well as functional projects in the construction and building sector enhancing regional competitiveness, attractiveness and the outward-looking character of the region.

The policy instruments have been collected from all the partners that the Polytechnic University of Valencia have been worked with. In the map below there is shown the different regions where the policies have been addressed.

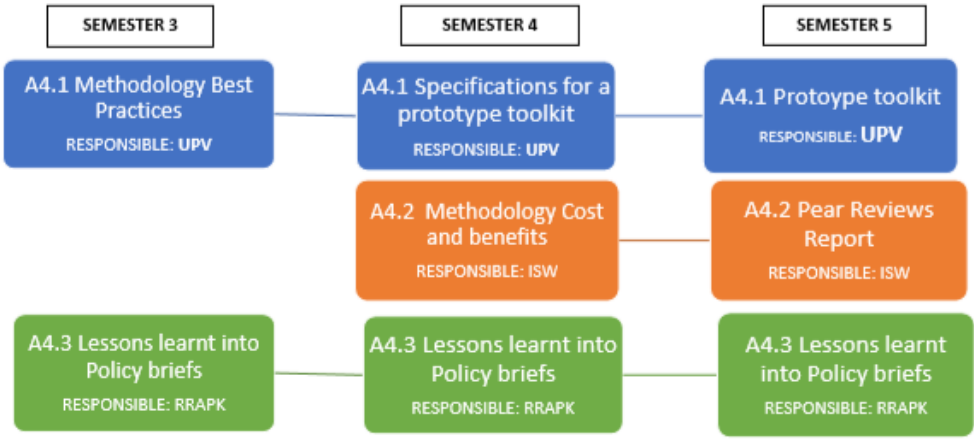
Figure 2. Regions of partners.

There are different policy instrument according to the regions: The Integral Plan of Waste by the Valencian Community, Regional Operational Program of Thessaly, Regional ERDF program Rhône Alpes, Operational Program Environment by Czech Republic, POR Lazio ERDF, Investments in Growth and Employment Austria and Guidelines for the production and use of quality. controlled recycling construction material in Saxony-Anhalt.

Country	Partner
	Polytechnic University of Valencia (UPV)
	Region of Thessaly (RoT)
	Auvergne-Rhône-Alpes Energy Environment Agency (AURA-EE)
	The Regional Development Agency of the Pardubice Region (RRAPK)
	Italian National Agency for New Technologies, Energy and Sustainable Economic Development (E N E A)
	Lazio Region (Lazio)
	Styrian Provincial Government – Department 14 – Water management, Resources and Sustainability (STYRIA)
	Institute for Structural Policy and Economic Development (ISW)

Figure 3. Different partners and their regions.

All the different policies have been scheduled in the various semesters as shown below in the table. Policies have been carried out by different responsible from different countries and all of them have as topic the different methodologies to create an effective way to reduce the C&D waste.



Reasons why the policy instruments should be improved

These different policies require an improvement which can be achieved by factors such as revising the C&D waste management protocol according to the EU. By improving the indicators that support monitoring and measurements regards to the C&D waste management. It is also important to create and improvement in public awareness and acceptance.

Other factor for improving is by exploiting new technologies and models to develop actions and products in this priority area. Promote recycling and reduce the pressures on landfills and the environment can be other key factor for the improvement.

Other factors to an improvement can be to include the measures on selection and to monitor the C&D waste management sites and facilities. Also, to take into account to support the sustainable urban development, to promote and incentivize re-use of C&D waste and to adapt measures for the selection, recycling and the re-use of C&D waste materials.

Strategy for improvement of the policy instruments

The policy instruments improvement can be achieved by following the three main points described below:

By creating new projects:

The DECREE 81/2013 describes the regulative framework for the promotion of waste management in the region of Valencia; the experience transferred to the region through the CONDEREFF project is anticipated to improve the initiation and implementation of projects in the following areas:

- Promote funding for C&D waste management projects in the region improving the processes for selection, permits and monitoring of C&D waste management sites and facilities.
- Increase the awareness of construction businesses and SMEs, by accelerating their access to information and by improving the amount/accuracy of the information provided to them regarding C&D waste management available infrastructures and processes.

By aiming an improved governance:

- Establish monitoring mechanisms and indicators for the assessment of the developed projects on the re-use and recycling of C&D waste materials.
- Employing external experts and developing collaboration mechanisms (such as a discussion platform) for the exploitation of best C&D waste management practices derived from the project according to the particular needs of the region.

By structural changes:

The Managing Authority can use the CONDEREFF experience to include in the DECREE updated provisions and measures related to the EU Construction & Demolition Waste Management Protocol, to regulate audits for C&D waste management, and to establish new forms of cooperation between public authorities and the construction industry stakeholders.

Activities held to enhance the current situation of C&D waste management

The activities dedicated to the exchange of experience are divided by the different stages, where the first stage is the collection of different methodologies, as A1, A2, A3, A4 and A5, mentioned below.

The second stage is the communication and the third stage is dedicated to the management of the project by the financial and technical coordination which is still ongoing according to the project data available.

Partners will also employ external expertise to:

a) Support joint working processes with expert methodologies/tools.

b) Secure an in-depth approach and analysis on territorial data.

Action plan development: the action plans aim to improve the policy instruments addressed by each partner. Each plan will detail specific actions to be implemented within the existing territorial policy context, actors to be involved in each action, timeframe, costs, and associated funding mechanisms. The project foresees 3 ways in which the action plans can improve the policy instruments:

- Direct funding towards projects that support resource efficiency through C&D waste management.
- Steer governance towards better achieving policy goals (such as evaluation methodologies & criteria).
- Suggest structural changes.

The action plans will be co-developed with the members of stakeholder groups (particularly MAs of policy instruments) and peer-reviewed by partners, who will:

a) Make suggestions on the measures proposed based on their experience, which includes actions plans in Interreg Europe projects from previous calls.

b) Provide new ideas regarding actions to improve policy instruments. In phase 2, partners will monitor and report on action plans' impact.

A.1 Methodology dedicated to the thematic studies and analysis

A 1.1 Comparative analysis of regulatory frameworks and C&D waste management and evaluation alongside the EU protocol

This activity aims to identify the different regulations in the framework of the generation of construction and demolition waste in the European Union. The Polytechnic University of Valencia (UPV).

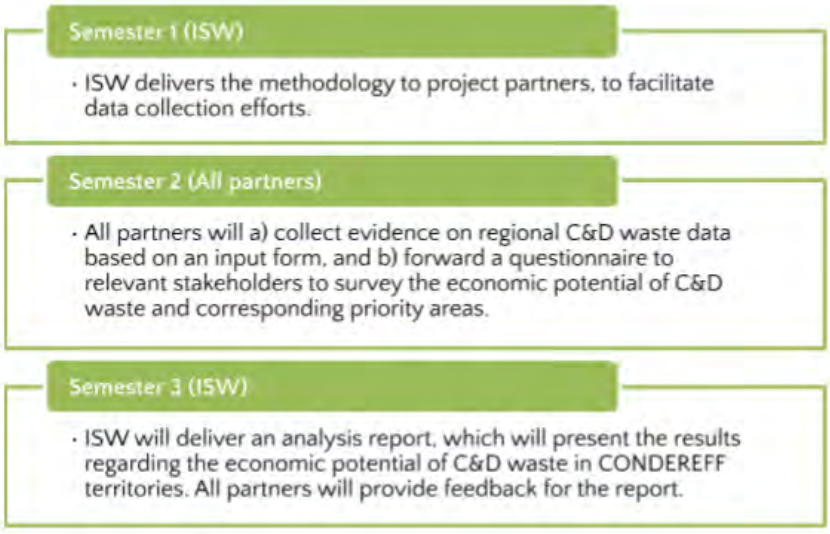
This activity aims to identify the different regulations in the framework of the generation of construction and demolition waste in the European Union.

The Polytechnic University of Valencia (UPV), as responsible for the activity, developed a methodology for partners to identify the regulations related to their countries. Secondly, another questionnaire was developed for stakeholders. This second questionnaire attempted to fulfill a survey and identify where to improve the current regulation according to the perception of different types of stakeholders depending on the processes that follow the CDW, from its generation to its destination.

A 1.2 Investigation of the economic potential of C&D waste and corresponding priority areas for regional C&D recycled materials markets

The main aim of this activity is to identify the regional C&D waste generated in the CONDEREFF partner's territories and to also make a survey about the territorial demand of re-use potential. Once the activity is implemented, there will be a report with the analysis of different regional policies to promote the recycling and the re-use of C&D waste, it will also analyze the economic market demand of different materials and finally the areas where the priority is high for using the recycled C&D waste materials.

In the figure below, it is described the steps for implement the activity:



The final result of this activity is a report which is used to facilitate an exchange of experience among partners regarding the economic potential of recycled C&D waste materials. Once the results are available, they can be discussed in the stakeholder group meetings and it can provide input for the development of the partners action plans.

The main industries exercising the demand for recycled aggregates are predominantly the road construction industry, concrete, cement and gypsum producers. In terms of the type of application, most recycled aggregates are used for low-performance applications, such as foundations or road bases. The road construction industry thus constitutes one of the most important buyers of recycled aggregates. The production of cement and concrete is similarly related to population density and the related demand for new buildings and infrastructure projects. As a result, the industry is also present in nearly all Member States since the production of concrete and cement needs to take place close to a new construction site (transporting concrete is technically or economically infeasible over long distances).

Other main point in this methodology is the market for recycled C&D waste materials:

In Europe Union, 30% of the materials used in construction are recycled materials. Case studies from Member States with high C&D waste recovery rates show that this percentage could potentially rise to 90%, which would help support sustainable construction and would lead to a range of environmental and economic benefits.

The Europe Union comprises of three separate market segments on which different companies are active and exchange resources:

A) Waste generation and collection

The market characteristics of the mineral waste generation segment differ for both construction and demolition waste. In the demolition segment, the market is largely characterized by many small firms which operate locally, though in some specific EU Member States the market concentration is believed to be high. Data on the largest demolition companies in Europe seems to suggest that the concentration under demolition contractors in the Western European countries is higher than in the Southern and Eastern European countries, which have less leading demolition companies in the top-25 of Europe. Most demolition activities are locally oriented, with relatively little cross-border provision of demolition services. For the construction waste segment, the waste is largely generated by contractors during construction works, or by construction companies.

B) Treatment of the waste

The waste processing segment is characterized by a relatively denser market concentration and larger firm sizes compared with the waste collection segment, due to the scale economies that need to be achieved to make the recycling of mineral C&D waste economically feasible. In most EU countries specialized off-site aggregate recyclers have emerged, though in some countries they are more numerous than in others, depending on the local framework conditions in place determining their operating costs.

C) The industries using recycled or reused materials

The main industries exercising the demand for recycled aggregates are predominantly the road construction industry, concrete, cement and gypsum producers. In terms of the type of application, most recycled aggregates are used for low-performance applications, such as foundations or road bases. The road construction industry thus constitutes one of the most important buyers of recycled aggregates. The production of cement and concrete is similarly related to population density and the related demand for new buildings and infrastructure projects. As a result, the industry is also present in nearly all Member States since the production of concrete and cement needs to take place close to a new construction site (transporting concrete is technically or economically infeasible over long distances).

A complementary market option worth to be explored is the potential of C&D waste in an industrial symbiosis (IS) context. In fact, a recent EC report showed that the potential of IS 8 networks that use recycled C&D waste is possible since the market structure of the EU construction and demolition market itself strongly influences the potential of IS. The fact that the mineral C&D waste market is consists mostly of many small, locally operating firms (partially also a result of the high transport costs), presents a promising factor for industrial symbiosis to increase mineral waste as a resource (since the area of operation of small and locally oriented firms could well satisfy the limits that are posed to the range of construction IS networks- approximately 35 km). For example, SMEs in the demolition segment are believed to operate with the incentive to clear the demolition site as quickly as possible, reducing the scope for on-site recycling or looking for alternative options in case an off-site recycler is located further away. Including such smaller, local actors in a network with recyclers or construction product firms could align incentives and contribute to better treatment of the waste.

A 1.2 + A 1.4 Questionnaires with the participation of the different partners

For the first part of the activity, all partners will collect evidence on regional C&D waste data based on an input form; for the second part, project partners will forward a questionnaire to relevant stakeholders to survey the economic potential of C&D waste and corresponding priority areas for regional C&D recycled materials markets.

Two survey questionnaires are developed for data collection (presented in the Annexes). The purpose of the questionnaires is to collect information on

a) The C&D waste market in partners' territories.
b) On how public authorities contribute to securing the economic potential of recycled C&D waste materials.
c) The incentives and barriers for market growth.
d) The links to industrial symbiosis and circular economy.
e) The priority areas regarding the most profitable uses of C&D waste materials.

The first questionnaire is divided into three main sections that ask for:

a) Basic information regarding the participant.
b) Regional C&D waste data.
c) Regional C&D waste market and policies.

The second questionnaire is also divided into three main sections and requires data on:

a) The participant's profile.

b) Stakeholders' views on recycled C&D waste materials demand and priority areas.

c) Enablers and barriers regarding the recycled C&D waste materials market.

The questionnaires were designed in a way that promotes

a) The collection of measurable/quantifying data

b) The provision of further insight on priorities following a ranking approach.

A 1.3 Available and required C&D recycling capacity

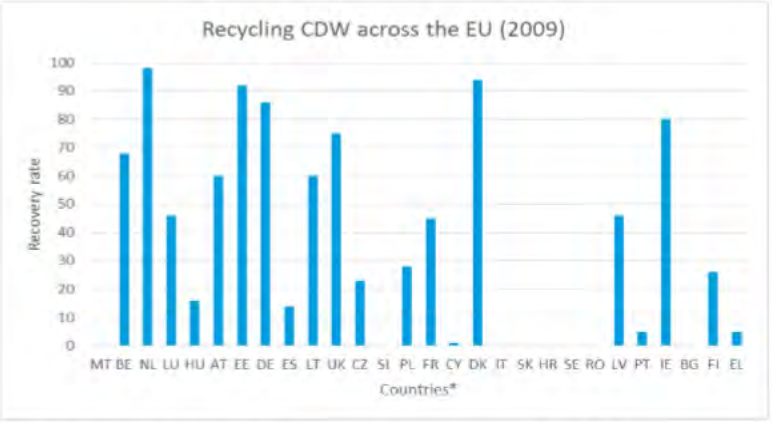


FIGURE 6: RECYCLING ACROSS THE EU / SOURCE: EUROPEAN COMMISSION 2011, P. 21-22.

Figure 4. The recycling across the EU/ Source: European Commission 2011, pp. 21-22.

This figure provides an estimation (with a high uncertainty) an average of 46% recycling rate for EU-27. However, this rate seems plausible, since it is within the 30%-60% range of estimates proposed by experts and literature24. Concerning individual MS rates, the following were indicated by the corrections:

- 6 countries report recycling rates that already fulfil the WFD target (Denmark, Estonia, Germany, Ireland, the UK, and the Netherlands).
- 3 countries report recycling rates between 60% and 70% (Austria, Belgium, and Lithuania).

- 4 countries (France, Latvia, Luxembourg, and Slovenia) report recycling rates between 40% and 60%.
- 8 countries report recycling rates lower than 40% (Cyprus, Czech Republic, Finland, Greece, Hungary, Poland, Portugal, and Spain).
- 6 countries data estimates were unavailable for calculating the recycling rates (Bulgaria, Italy, Malta, Romania, Slovakia, and Sweden).

A 1.4 Mapping stakeholder and public awareness, perception, and acceptance of C&D waste re-use potential and value.

This activity can briefly be described as an activity that aims to highlight both common and specific needs in EU in order to support the specific policies to boost C&D waste re-use and valorization.

Following this purpose and considering the critical issues that hinder a wider and uniform diffusion of CDW recycling in EU countries reported in Section 2, the methodology developed aims to investigate the Stakeholder's perception and opinion on:

- benefits related to C&D waste recycling and reuse;
- the adequacy of the recovery potential;
- difficulties/barriers;
- suggestions to improve waste recycling and reuse.

To investigate the perception of the stakeholders, it is proceeded with a survey that collects different data according to the fields.

The data collection tools are designed to describe and categorize (identification/ quantification) the C&D waste generated. To understand and analyses the C&D waste processing (supply-demand loop chain). To map the actors involved in the process of C&D waste recycling market, such as C&D waste dumping sites, stone crushing units, building material manufacturers and C&D waste processing units. And also, to prioritize the recycled materials in demand in the partnership regions.

The analysis of the data collected will be supported by a secondary literature review including information on size, population, geographical characteristics, and online articles on construction sector, to be used for an in-depth understanding of the input from the survey.

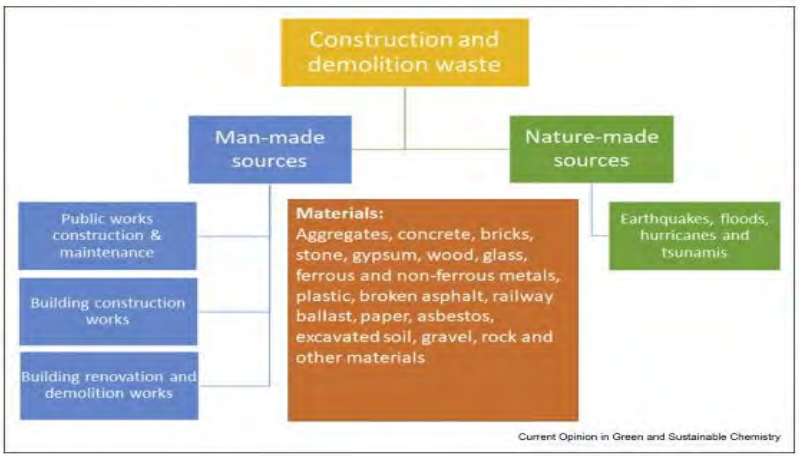
A2

A 2.1 Regional stakeholder's meetings

The stakeholder group meetings will enable participants to exchange views, identify needs and build a sustainable collaboration for both project phases. Stakeholders will be asked to provide suggestions for the action plans, ensuring their contribution in the implementation phase. They will provide input depending on their expertise, area of activities, and participation in different policy learning activities.

In the regional stakeholder meetings, the tackled topic was the C&D waste and its classification according to the source of origin:

Figure 1: Generic classification of C&D waste according to the source of origin



Source: Maria Menegaki, Dimitris Damigos. *A review on current situation and challenges of construction and demolition waste management*, Current Opinion in Green and Sustainable Chemistry, Elsevier, October 2018.

Figure 5. Generic classification of C&D waste. Source: Maria Menegaki, Dimitris Damigos. A review on current situation and challenges of construction and demolition waste management, Current Opinion in Green and Sustainable Chemistry, October 2018.

The waste generated by the construction industry can broadly arise from two sources:

- Construction: it covers waste arising from the production of new constructions. They are typically relatively well separated and uncontaminated. It represents a relatively small (e.g. 16% in Finland) share of total C&D waste.
- Demolition: it covers waste collected after the demolition of existing constructions (including those related to renovations) and includes all construction materials from a building (incl. hazardous elements). This waste stream is much larger than the construction waste stream (estimated 20-30 times

more, by weight), but is also more contaminated (e.g. with paintings and adhesives) and more mixed (due to the integration of different elements such as steel for reinforced concrete).

At this point, it is important to make clear the strategy of C&D waste in Europe for 2020. In 2016, the EU construction and Demolition Waste Protocol was introduced as guideline for the public authority, for stakeholder, among others with the goal of increasing confidence in the C&D waste management and also the C&D waste recycled materials.

In general, policies and legislation with respect to C&D waste adopt the well-known waste minimization hierarchy of 4Rs, i.e. reduce, reuse, recycle and recover.

For instance, in Germany, the national legislation governing C&D waste management requires waste generators or owners to classify, recycle and reuse C&D waste. In Spain, the national legislation defines the obligations of all the actors involved in construction. In the UK, on-site waste reduction via sorting and recycling is legitimized as necessary.

Within this context, EU territorial administrations are called by the EC to support and develop appropriate policy and framework conditions for successful C&D waste management in key areas of regional public action, such as regulatory frameworks for recycling; public procurement; selection of sites and facilities; monitoring of how permits are issued and used; public awareness.

At the same time, it should be highlighted the C&D waste management related to the supply and the demand. Crucial for the demand for the materials is the development of public infrastructure projects, which are in turn dependent on public procurement. Public administration budgets are thus indirectly important for the development of the market of recycled C&D waste. At the same time, a higher uptake of C&D waste in the future requires the development of new uses beyond present applications. Assuming a stable growth in demand for low performance aggregates (or higher performance in case the development of new applications will be successful) and therefore a potential stable growth of the secondary aggregates market, 12 the potential of recycled C&D waste has a favorable economic outlook.

Moreover, for recycled C&D waste to be feasible in various uses, legislative conditions have to be favorable, new construction works to be present in the vicinity, and a recycling facility should be close. Otherwise, transport costs would become too large and natural materials could present a cheaper option. For example, the landfill

tipping fee and the market price of natural crushed aggregates are important external determinants driving the demand for recycled materials. On the operational side, the price paid by the demolition contractor in obtaining material to the recycling plant and the gate fee at the recycling plant are determinants indicating the economic incentives to parties involved in the process.

Therefore, economic incentives that contribute positively to the uptake of recycled C&D waste (e.g. high landfill taxes and stimulated demand) can create a market for larger scale aggregates recyclers. For example, market-based instruments are a method for policy makers to increase the economic viability of C&D waste recycling and the uptake of recycled products. These instruments could be:

a) A tax on landfilling; the incentive to recycle 14 increases for the generators of waste since the tax is a reflection of environmental damage and hence the social cost associated with landfilling.

b) A tax on natural aggregates which makes them costly for purchasing and makes the recycled materials price competitive for the users.

With regard to the economic incentives that stimulate companies to recycle and reuse mineral C&D waste, the main factors can be derived from the trade-off between virgin raw materials and recycled materials (mostly aggregates). When costs and prices are taken into account, virgin materials are the favored option due to the good price/quality ratio (the price of virgin aggregates is generally low), which in itself is a barrier to the uptake of recycled C&D waste. Only in densely populated areas with relatively high volume of demolition activities recycled aggregates can compete with virgin aggregates.

A3

A 3.1 Interregional workshop on using public procurement as a driver for resource efficient C&D waste management.

A 3.2 Interregional workshop on pre-demolition audits and demolition activities supervision and documentation.

A4

A 4.1 Improvement of methodologies and tools to track and trace C&D waste generated.

A 4.3 Encapsulating lessons learnt as policy briefs and participation in policy learning platforms.

B. Communication and dissemination

The CONDEREFF communication plan have been divided by different sections:

First section provides synoptic information on the CONDEREFF project, the partnership and the excepted benefits of the project.

The second section is where the communication strategy is elaborated and it presents target groups, project tailored messages, as well as the main outputs to be disseminated.

The third section focuses on the implementation of the project, describing the role of the Communication Manager (CM) and providing details on all tools and materials related to online and off-line, one-way and two-way communication. The section provides a detailed overview of the tools and materials (e.g. social media pages, poster, brochure and press releases) to be developed and deployed in order to meet the project's internal and external communication objectives.

The fourth section is where it is described the events to be organized in the context of the project and provides information on the participation of partners in third party events.

The Fifth section focuses on performance assessment of communication and dissemination objectives. This section will define key performance indicators (KPIs) to facilitate the procedure of measuring the impact/ effectiveness of all communication outputs and will establish a continuous monitoring/reporting system that will help evaluate the achievement of specific communication objectives.

Regardless having this separation by sections, there is also separation by the different type of strategy of communication, such as internal and external communication. The internal communication procedures foreseen will promote the exchange of experiences and policy learning between and within partners' organizations, increasing their capacities to:

a) Effectively implement resource efficiency policies related to C&D waste management. Respectively, the external communication to be carried out by CONDEREFF will raise public awareness, and support the collaboration

between public authorities, and stakeholders that need to be involved in the territorial planning for resource efficiency related to C&D waste management.

COMMUNICATION MESSAGES Partners will deploy brief messages addressed to various target groups, such as:- Now is the time to incorporate policy learning on C&D waste management (Policy makers)- C&D waste management: a green growth accelerator for the regional construction industry (Regional Stakeholders)- Go clean! Support recycling and smart re-use of C&D waste materials (General Public)

The different communication channels where the project outputs & results will be disseminated via 4 channels:

a) Online one-way communication (website, newsletters).

b) Online two-way communication, including interactions between target groups (social media pages, the Environment and Resource Efficiency Policy Learning Platform).

c) Public relations (3rd party events, printable materials).

d) Media relations (press releases). Each target group will be reached through the most appropriate channels (see following table).

The final step is the evaluation of the sections where the continuous monitoring will take place to evaluate the achievement of communication objectives. The project sets specific communication outputs as key performance indicators (KPIs). The communication manager will request evidence from partners on the quality of activities through relevant forms. In case of shortfalls, the communication manager will propose remedial actions

In summary it can be said that the section dedicated to the communication and dissemination evaluates the following main activities, which are the development of communication materials:

- Which tackles the development and updating of projects web resources.
- Other is the development of electronic newsletter, poster, brochure and press release.

Other activity is the implementation of communication activities:

- Compounded with the online dissemination campaign.

- Participation in 3rd party events.

The role of the participants is described as:

B 2.1 All partners will provide updates of the website and post on the project's social media pages and relevant 3rd party pages. AURA-EE will be responsible for the maintenance of the project's website.

B 2.2 AURA-EE will develop the 5th e-newsletter in EN. All partners will provide translations in own languages.

B 3.1 All partners will implement the 5th online dissemination campaign, informing the relevant target groups on concurrent project activities and latest outputs.

B 3.3 Each partner will participate in one regional or national event organized by third parties that are involved in relevant policy areas, to disseminate the CONDEREFF results.

Finally, as conclusion it can be say that the measures taken to improve the current situation and their dissemination is favorable in order to achieve the goal. Starting from the stakeholder's meetings to the different methodologies the main point is to reduce the impact of the construction and demolition waste. The aim will be reached gradually if the measures are respected by the different fields that act in C&D waste management. Despite of having technologies that separates the waste, the re-use market and a high potential for recycling, the results are not properly adequate for the study due to the different points described above. As improving measures, it is adequate to implement resource efficiency policies, to enhance the process of C&D waste management, to improve regional policies and create confidence in C&D waste re-use materials among others. These can be taken as main points to reach the desired results and recycle the waste up to 70% by the 2020.

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CHAPTER II: PRE-DEMOLITION AUDITS. LEGAL FRAMEWORK IN AUSTRIA AND PRACTICAL EXPERIENCES

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PRE DEMOLITION AUDITS - LEGAL FRAMEWORK IN AUSTRIA AND PRACTICAL EXPERIENCES

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ABSTRACT

The main objective of this paper is to outline the Austrian Recycled Construction Material Ordinance, the production and use of recycled construction material and the state of the art regarding the treatment of C&D waste in Austria.

KEYWORDS

Recycled Construction Material Ordinance, Recycled construction material, Waste prevention

INTRODUCTION

Preserving natural resources, reducing waste and pollution and creating a sustainable future – some of the many reasons why an efficient demolition and construction management is such an important aspect to limit the extent of our impact on the planet. A sustainable C&D waste policy saves costs and resources.

GENERAL FACTS

The Austrian Recycled Construction Materials Ordinance has been published in Federal Law Gazette II on June 26th of June 2015 and entered into force fully on 1st January 2016.

The main objective of this ordinance is to promote the recycling of construction and demolition waste by ensuring a high quality of waste generated during the construction and demolition activities. It shall aim to contribute to increased materials efficiency and closed loop recycling.

In particular, the ordinance applies to construction and demolition activities, the production and use of recycled materials and certain recycling materials, for which the waste status, pursuant to the Austrian Waste Management Act 2002, ends.

In general, the ordinance sets out requirements to be fulfilled during the construction and demolition procedure. Prior to the demolition activities, an audit of on-site conditions and the presence of reusable components, hazardous materials and containments has to be carried out. According to the Recycled Construction Material Ordinance, the evaluationhas to be based

on the Austrian Standard ÖNORM B 3151 “Dismantling of buildings as a standard method for demolition”. [1]

The present paper aims to give an overview of the legal and technical framework of demolition processes in Austria, and important practical aspects related to the topic.

Definitions and numbers

Construction and demolition waste are materials- accruing in connection with construction and demolition activities in building construction, civil engineering and road and bridge construction. However, 90% of those materials result from demolition work and only 10% appear when building new constructions.

The following figure illustrates the main composition of construction and demolition waste in Austria [2]

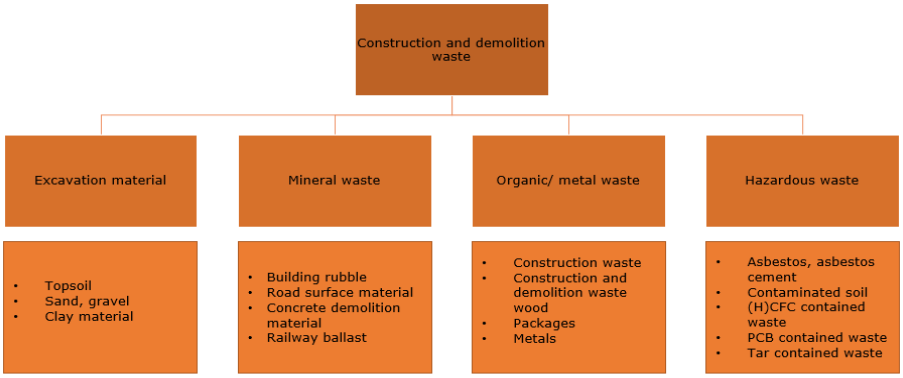

Figure 1. Composition: Construction and demolition waste [2].

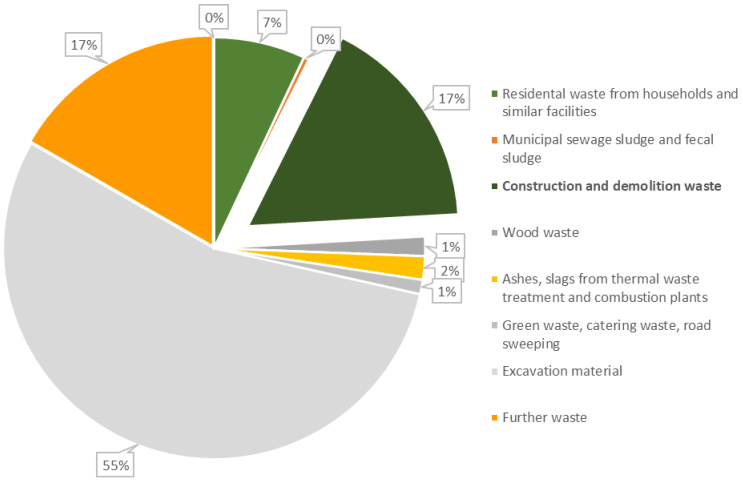

Figure 2. Waste composition in Austria (2015) [2].

In 2015, 10 million tons of construction and demolition waste have been generated in Austria. It accounts for 16,7% of all waste generated in the country and corresponds to approximately 1.160 kg per person per year. Figure 2 shows the waste composition in Austria.

In the period of 2011 to 2015, the total amount of construction and demolition waste increased, about 46%. This fact can be attributed to increased construction activities and improved reporting and statistics.

In 2015, 87% of the 10 million tons of C&D waste have been treated in a treatment plant.

The total volume of construction and demolition waste depends on the economic situation of the building construction and civil engineering industry of the country. Waste volumes are, therefore, subject to fluctuations over time and cannot be accurately predicted. Together with excavation materials, mineral C&D waste accounts for 2/3 of the total waste mass generated in Austria.

Demolition Process – Pre-Demolition Audits

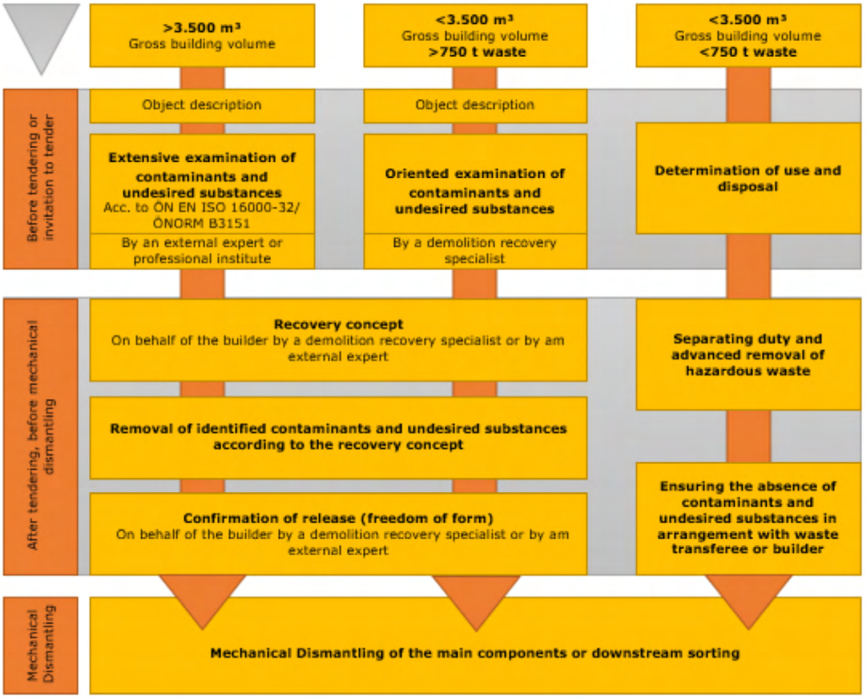

Figure 3. Control process for dismantling activities according to the Austrian Recycled Construction Material Ordinance and ÖNORM B: 3151:2014 [3].

Figure 3 illustrates the classification of building the building demolition process in Austria according to the requirements to the Austrian Recycled Construction Material Ordinance.

As shown in figure 3, an external expert or a professional institute has to carry out a so-called extensive examination of contaminants and undesired substances in case that the gross building volume of a demolition object exceeds the value of 3,500 m³. Such examination has to follow standard ÖNORM EN ISO 16000-32.

If the gross building volume of a demolition object is less than 3.500 m³ but the expected construction and demolition waste - excluding excavated material -

amounts more than 750t, then a so-called oriented examination of contaminants and undesired substances has to be carried out by a demolition recovery specialist.

In both cases, a demolition recovery concept, according to the Austrian Standard ÖNORM B 3151, has to be developed on behalf of the builder by a demolition recovery specialist or by an external expert.

The identified contaminants and undesired substances in the building have to be removed according to the developed recovery concept. The removal of such contaminants and substances has to be confirmed by the demolition recovery specialist or the external expert. This step must be documented written. The writing can be in freedom of form and has to be enclosed to the demolition documents.

After completion of the confirmation of release, the mechanical dismantling is carried out according to the recovery concept and the legal requirements.

If the gross building volume of the demolition object is less than 3,500 m³ and the occurring construction and demolition waste is less than 750 t, the possible use or disposal of C&D waste has to be determined prior to demolition. Furthermore, hazardous waste has to be removed in advance and collected separately. Assurance, that the leftover waste is free of contaminants and undesired substances in arrangement with the waste collecting company or the builder, has to be given. As the last step, the mechanical dismantling of the main components will take place.

The documents concerning the demolition process have to be kept on file for a minimum of seven years. Additionally, the documents have to be submitted to the authorities when required

Separation duty

Hazardous and non-hazardous waste, C&D waste and other waste occurring have to be separately collected on-site. Furthermore, excavated soil, mineral waste, excavated asphalt, wood waste, metal waste, plastic waste and residential waste have to be separately collected. If the separation on-site is not possible, due to technical reasons or disproportionate costs, the separation has to be executed at an authorized treatment plant.

An efficient waste separation helps the company to save costs. Therefore, enough and appropriate collecting devices, such as containers, hollows etc., are required on the construction site. The choice of the appropriate collecting device has to be made in coordination with the authorized disposal company. In order to achieve an optimal

solution, type designations of the collecting must be provided, and the site workers must get a proper instruction.

The builder and the building contractor are responsible for the separation of the construction and demolition waste. Furthermore, the builder is responsible for the supply of the required area and establishment [3].

Production and use of recycling- construction material

By applying the required quality-assured deconstruction and demolition process, high quality recycled construction & demolition material, which is a valuable secondary raw material, can be gained. Types of waste which are authorized to be used as a raw material for the production of recycled construction materials are listed in the Recycled Construction Materials Ordinance, Annex 1. A contamination with hazardous substances (for example asbestos or superficial mineral fiber) shall be avoided as far as possible, in order to obtain a high-quality material. Waste fractions, where a contamination is known or suspected, are not allowed to be used for the production of recycled construction materials.

For the quality-assurance process, following steps are necessary:

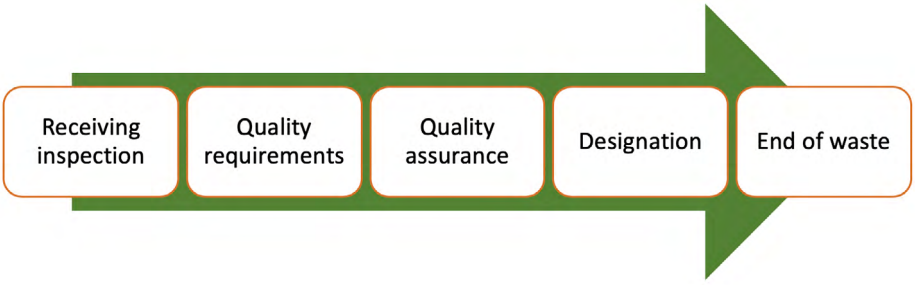

Figure 4. Quality-assurance process for recycled construction material [3].

Receiving inspection

The producer of the recycling construction material is obligated to carry out a visual control upon acquisition of the waste. In particular, the producer has to verify, if the waste is suitable (sorting accuracy, free of contamination) for the manufacturing of the recycling construction material.

The documentation of the examination of contaminants and undesired substances, the recovery concept and the confirmation of release are required for the control [3].

Quality requirements

The producer of recycling construction materials is obligated to observe the quality requirements, which are fixed in the Recycled Construction Materials Ordinance. Furthermore, the constructional requirements, according to the state of the art, have to be fulfilled and observed. Admixture with natural rock material is only allowed, when the mixing ban is observed [3].

Quality assurance

According to the Recycled Construction Materials Ordinance, the environmental compatibility has to be given all time during the procedure of recycling constructions materials. This quality assurance is taking place in one out of three procedures:

- Standard process.
- Single batches.
- Quality assurance for particular typesof waste (Special aggregates from traffic areas, steelworks slags, technical bulk material) [3].

Designation of the quality-assured recycling construction materials

The produced materials have to be explicitly indicated as recycled materials. The designation has to follow Appendix 2 and to refer to the quality classes given therein.

If the recycled materials are transferred to third parties, information concerning designation, the application range and banned uses have to be indicated obligatory. This information has to be indicated on the packaging itself or, in case of a material without packaging, on a supplementary sheet.

Additionally, the designation has to be given on the invoice and on the delivery note [3].

End of waste of the quality-assured recycling construction materials

The end of waste state, due to the Recycled Construction Materials Ordinance is only intended for recycled construction materials of the quality class U-A. Materials with those characteristics lose the waste status as soon as the producer hands them over to third parties.

Recycled construction materials from another quality class are only allowed to lose their waste status, according to the Austrian Waste Management Act 2002, when they are used or installed as permitted.

Recording and reporting duty

Producers of recycling construction materials are legally obligated to document such procedures (Austrian Waste Management Act 2002 and Waste Balance Ordinance). The record has to conclude data concerning the type, quantity, origin and fate of the waste. In this context, the deliveries of recycled building materials must be documented, so that the evaluation and control of the quantities of recycled building materials and recycled construction products manufactured and delivered are made possible.

Excavated soil

In order to reuse excavated soil, a characterization as a basis is required.

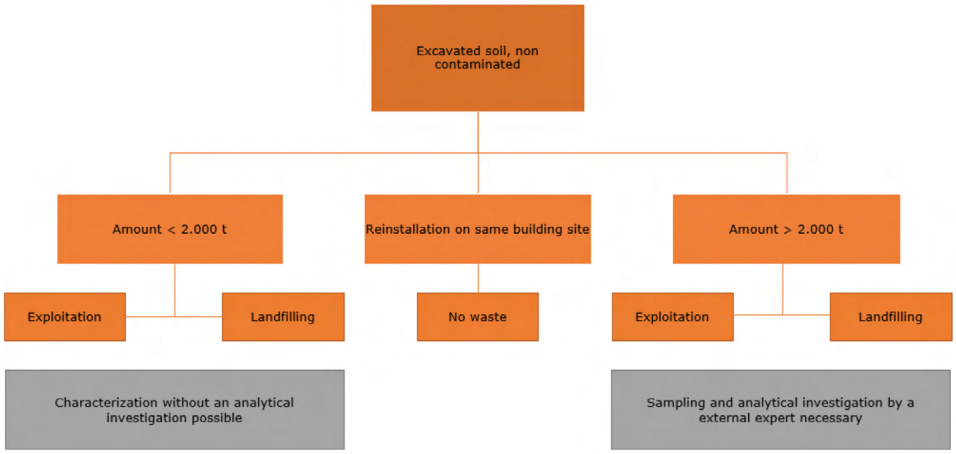

Figure 5. Process of excavated soil characterization [3].

As seen in Figure 5, an external expert is required to carry out a sampling of the material and an analytical investigation. Whenever an amount of more than 2.000 tons of uncontaminated excavated soil is reached. The characterization procedure and its results are determined in a so-called, assessment certificate [3].

In-practice problems

Construction and demolition activities have a significant impact on the environment, as a high quantity of waste is generated in the construction sector. One major

reason is the lack of awareness already during the planning phase of the building. Furthermore, there is a lack of information regarding the structure of the existing buildings. Also, the reuse of building components is complicated, when buildings are made up of bonded materials [2].

During construction and demolition activities, problems may occur on a daily basis. The main faced issues are the occurring danger during demolition activities due to hazardous substances, the mixing of the different materials and landfilling at the end of the demolition process.

Hazardous substances are in first instance harmful to workers on the building site. For example, negative health issues may be the consequence, when workers are exposed to asbestos contaminated materials.

Mixing of different upcoming materials is also a main problem, as costs will increase due to an incorrect separation.

Landfilling is connected to a lot of negative impacts if landfilling is not performed according to the legal requirement. In such cases, adverse health impacts and pollution of soil, ground water etc. can occur.

Hazardous waste

Synthetic mineral fibers (SMF)

Synthetic mineral fiber, also known as “man-made mineral fiber” is a general term describing a number of fibrous materials. Those materials are made from glass, rock, alumina and silica, for example glass wool, mineral wool or ceramic fiber. SMF are used as a response to the banning of asbestos. The materials are mainly used for thermal and acoustic insulation in buildings.

Due to the disintegration of SMF during the processes of installing, refurbishment or demolition, negative short- and long-term health impacts can affect the human body. Inhalation of synthetic mineral fibers has harmful impacts, especially on the lungs. Further known health effects are upper respiratory tract irritation, as well as skin and eye irritation [4].

The classification in Austria of SMF appears in hazardous or non-hazardous waste. The substances are non-hazardous, if there are no hazardous properties. Non-hazardous mineral fibers are classified under the category “mineral fibers”, SN 31416, of the Austrian waste catalogue.

When the substances exhibit hazardous properties, they get classified under the category SN 31437 “asbestos waste, asbestos dust” of the Austrian waste catalogue.

Asbestos

Asbestos is a naturally occurring substance, which has been used mainly for insulation or other construction materials for decades, due to its durability, heat and chemical resistance. Those aspects were responsible for a versatile use of the material. When it comes to asbestos, the main problem is that, once it gets released into the air it causes dangerous exposure. Asbestos gets into the body through inhalation and expelling the substance, once they are in the human body, is extremely difficult to decompose. The fibers can have harmful effects on human health such as inflammation, scarring or genetic damage of the body cells. This can lead to pleural mesothelioma and lung- cancer. Therefore, asbestos is defined as highly toxic. Due to those negative impacts on the health conditions, the use of asbestos has been forbidden in the year 1990 [5].

In Austria, asbestos was used until the end of the 1980s. Since the year 2004, it occurs mainly as waste. Until 2015, the rise of asbestos cement – the most common asbestos-containing waste- has quintupled [2].

Table 1. Amount of asbestos waste in tons [2].

SN	Waste	2004	2015
31412	Asbestos cement	12.600	64.800
31437	Asbestos waste,Asbestos dust	1.600	340

Asbestos waste is defined as hazardous waste. The landfilling is only permitted, when a proper pretreatment is fulfilled. Under specific circumstances, the deposit of asbestos waste on landfills for non-hazardous waste is allowed.

The following Table 2 shows the amount of asbestos waste, which has been deposited in Austria in the year 2015.

Table 2. Asbestos on landfill in tons [2].

SN	Waste	2015
31412	Asbestos cement	64.800
31437	Asbestos waste, Asbestos dust	340

Reuse-investigation

According to the Austrian Waste Management Act 2002, the principle of Austrian waste management is the five steps waste hierarchy.

Figure 6. Five step waste hierarchy [2].

As Figure 6 shows, the reuse of waste should be prioritized. Reuse means to use the product for the same purpose, for which it was initially conceived.

The reuse of construction and demolition waste should gain more value as it decreases both the use of material and energy resources and the amount of waste. Furthermore, it can be seen as the most economical way to reduce waste and minimize environmental impacts.

A high percentage of the construction and demolition waste in Austria is inert and non- hazardous, which means that it is potentially reusable.

Improvements

As a proper improvement to enhance the reuse of C&D waste would be the use of the B2B – model. B2B is defined as the process of transporting the waste form one building directly to the next building site. The ideal way to perform this solution is without an intermediate storage.

This system saves an enormous amount of costs for both sides. Furthermore, it minimizes waste and substitutes primary [6].

Waste Prevention Program 2017

The Federal Ministry of Sustainability and Tourism in Austria (BMNT) has recently published a revision of the Waste Prevention Program 2011, containing a multitude of individual measures which need to be carried out in order to ensure a successful waste prevention policy.

The “Prevention of construction and demolition waste” is defined as one action area out of five. This area consists of two packages: package 1: “Low-waste construction and extending the useful life of buildings” and package 2: “Design and reuse of parts of buildings”.

The first package defines strategies to minimize the use of construction materials for the buildings [2].

- Pilot projects and other measures in other to develop low-waste construction techniques and technologies.
- Preparation of teaching materials and learning aids (concerning principles, planning techniques, technologies and techniques for low-waste construction).
- Implementation of the topic “low-waste construction” in planning phase.
- Awareness raising activities in cooperation with building guilds (to persuade master-builders, architects, planning offices to focus on low-waste construction”).
- Promotion of the extension of useful life of buildings.
- In the area of education and on the extension of the useful life of buildings: promoting the exchange of know-how and experiences.
- Exchange of know-how and experiences on the recyclability of components and building parts [2].

Package 2 defines strategies to enhance the design and reuse of parts of buildings:

- “Promoting flexible buildings (“eternal envelope, flexible interior”).
- Developing basic principles for standardizing a building material information system. Alternatives to the current building pass, including the main components of a building, are to be reviewed.

Standards for a building material information system should be defined

The inclusion of these data in a central register operated by Statistics Austria should be reviewed.

- Developing standards concerning a waste prevention design, the avoidance of harmful substances and impurities and the reparability and reusability of building components and materials.

- Including principles of waste prevention and reuse in professional and university education.
- A stakeholder process concerned with increased reuse of building components.
- Promoting the use of recycled building materials, e.g. through inclusion in specifications of works, especially in public procurement.
- Pilot projects concerned with urban mining and the reuse of building components.
- Funding research/development and pilot projects concerned with surveying, documenting, extraction and commercial exploitation of entire building components arising from the demolition of buildings.
- Verifying the possibility of tying housing subsidies to the share of recycled construction products used in the buildings. Verifying possibilities to green the funding models and in particular those related to building rehabilitation.
- Recommendations to implement the obligation for developing a waste management concept for the construction site in the provincial building regulations" [2].

In order to better establish reuse in Austria, other markets for reuse products have to be defined. Furthermore, it is important to ensure that reusable waste equipment is delivered to reuse-shops. Reuse should be better implemented in public bodies (public procurement). The development of reusable (repairable) products and support services in the context of reuse should be promoted [2].

CONCLUSIONS

Both the Austrian Recycled Construction Material Ordinance (2016) and the Waste Prevention Program 2017 are suitable to foster the move towards circular economy in Austria. Especially the Recycled Construction Material Ordinance provides clear instructions and procedures for a quality-assured recycling of C&D waste. Both documents also aim to increase the volume of reused waste. The current challenge is, however, to better transfer these provisions into the daily practice of the building sector. To get this done, better dissemination of specialist information and targeted awareness raising activities are highly needed.

The construction and demolition waste management policy should be evaluated and, if necessary, developed further, in order to guarantee efficient resource management and waste prevention. The EU-project CONDEREFF is the ideal platform to initiate the necessary steps.

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CHAPTER III: REUSE OF BUILDING MATERIAL IN TRANSPORT STRUCTURES (CZECH REPUBLIC)

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REUSE OF BUILDING MATERIAL IN TRANSPORT STRUCTURES (CZECH REPUBLIC)

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C&DW IN CZECH REPUBLIC

The most common recycled materials used in transport structures can be distinguished to the Construction and demolition waste, and Industrial secondary raw materials. Into the Construction and demolition waste, the following materials can be counted: cement-concrete recycled, underlying recycled pavement, brick recycled, asphalt recycled and compound recycled; while the second group can be divided as follows: slag (blast furnace s., foundry s.), fly ash, fly ash stabilizer, cold dump, used tires and coal tailings.

It is remarkable that the Czech Republic has an overall good track record in the recovery and recycling of C&D waste. However, the amount of recycled C&D waste used in building materials is estimated to be around 10%, compared to raw materials used. The main reason for this is that using recycled materials is a financially viable solution only when the source is located near the construction site.

Moreover, CDW management is often non-compliant in terms of waste management (Deloitte, 2015). The Czech Inspectorate of Environment found non-compliance during their inspections of landfill operations; the most common issues involved sites exceeding their defined active (uncovered) area of a landfill; the storage of waste containing asbestos outside designated area of the landfill; poor functionality of surface water drainage system along the landfill; and the carry-over of light waste components.

Further to the shortcomings identified above, authorities expect an increase in the amount of CDW generated (including excavated soil from contaminated sites). Given the current construction activities, authorities are currently estimating and monitoring the development of CDW production,and expect an increase of around 10% by 2020.

Construction and demolition waste defined by Group 17 of the Waste Catalog according to Decree No. 93/2016 Coll. is sorted by to the following groups:

- 17 0100 - Concrete, coarse and fine ceramics and plaster and asbestos products 17 0200- Wood, glass, plastics.
- 17 0300- Asphalt, tar, tar products 17 0400- Metals, metal alloys.
- 17 0500- Soil extracted.
- 17 0600- Insulating materials.
- 17 0700- Mixed building and demolition.

During recent years, the waste reuse was changed in manner according to Table 1. In 2017, 8 987 tons of 24.925 tons came from construction waste.

Table 1. Reuse of building material between 2007 and 2014 [1].

	year	2007	2008	2009	2010	2011	2012	2013	2014
Total	**[kt]**	14264	15365	14883	15210	13239	13447	14004	15916
Recyclation	**[kt]**	2943	2932	2503	2475	2647	3300	3797	4110
Reuse on ground	**[kt]**	6796	7939	8225	5555	5221	5300	5686	7654
Recultivation	**[kt]**	1048	1922	566	480	1007	987	1031	752

Figure 1 shows the percentage of construction waste constituents of the Czech Republic in 2017. The majority is represented by extracted soil with 70 %.

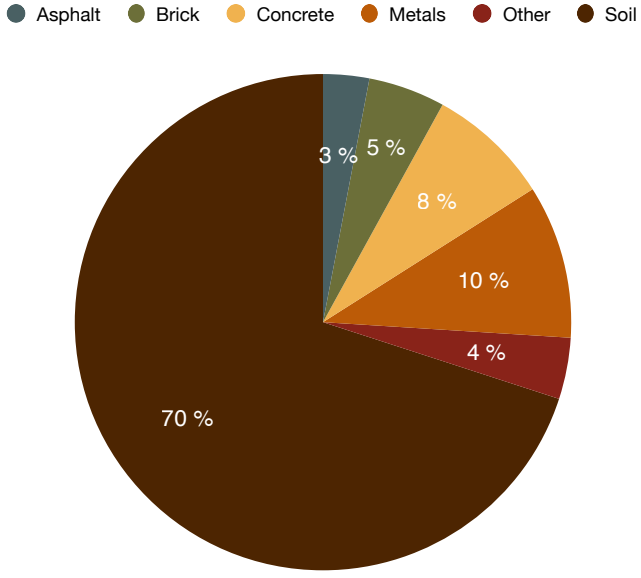

Figure 1. Percentage of construction waste constituents of the Czech Republic in 2017 [1].

Waste generated by enterprises according to their economic activities in 2017 can be seen in Figure 2; CDW represents 43% of all waste production. The secondary raw material generation approximately 22% of secondary raw material originates from building materials.

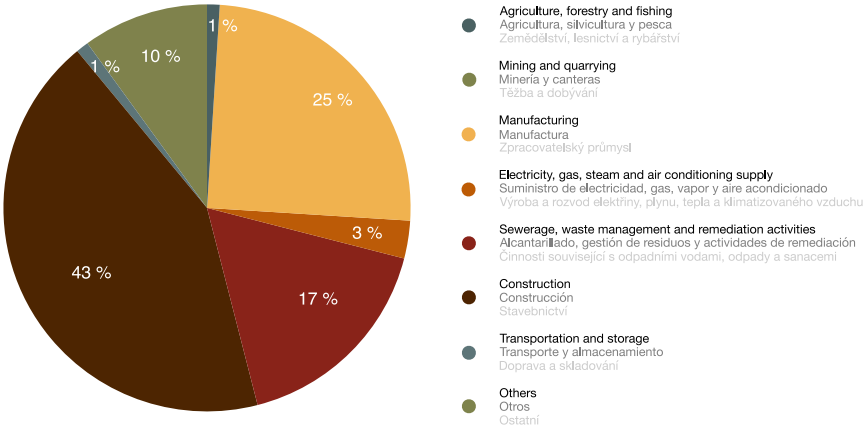

Figure 2. Waste generated by enterprises to their economic in 2017 [2].

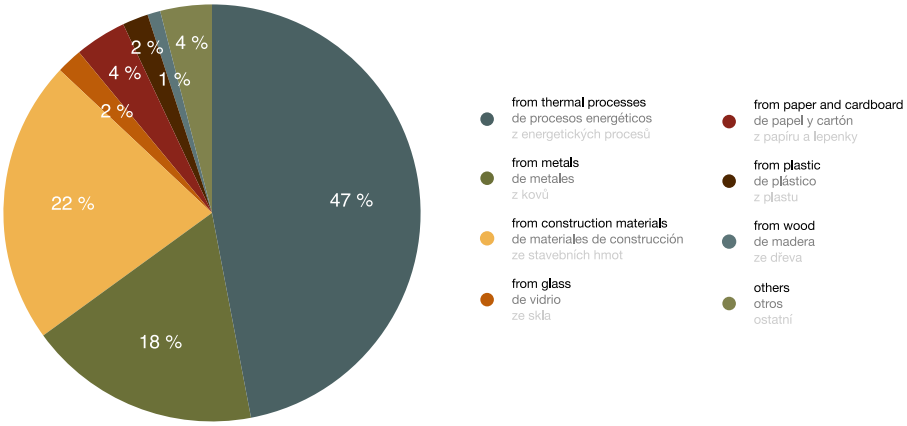

Figure 3. Secondary raw material generation in 2017 [2].

Requirements for building materials

The barriers that prevent the introduction of circular principles into construction practice include the general distrust of construction products from secondary raw materials. It is therefore essential that the recycled material reach properties comparable to the raw material. This includes mechanical strength and stability, fire protection, hygiene, health and the environment, safety in use, noise protection, energy saving and heat protection.

Criteria for assessing industrial waste for use in construction are technical quality, environmental burden, economic advantage of using recycles and psychological moments. The psychological moments of accepting materials (accepting waste in structures) that, in addition tothetechnical-sciencecriteriaofqualityandenvironment alburdenoftencomefromirrational elements, or from competing elements.

Concrete structures

Concrete is a high-energy and raw material demanding construction material. It is also the most widely used building material. Globally, the volume of concrete produced annually is estimated at 9 billion cubic meters, of which 9,000,000 cubic meters per year in the Czech Republic. Approximately2.5billion tons of cement are produced every year around the world, accounting for about 5 percent of the total CO2 emissions. Production of each ton of traditional Portland cement results in the release of one ton of carbon into the atmosphere.

Recycling of fresh liquid concrete residues from fresh concrete production

Lifetime cycle of the concrete begins with production, thus the waste from concrete includes also liquid concrete residues. This waste is primarily produced by daily cleaning of concrete mixers, concrete autoclaves, concrete mixing plants and prefabricated units. Special recycling devices for dissolution and dispersion of liquid fresh concrete residues are needed in this process - (i.e. sorting to aggregate and sludge water).

Recycling of hardened concrete

Concrete structure remains and parts are transported to concrete recycling centers or concrete plants and processed by concrete mixers, crushers and screens. Recycled concrete material can be used as backfill material, material for the earth body for road and rail construction, aggregate of the super structure or unbound construction layers of the roads, and aggregate for concrete of lower strength classes with low requirements for the quality of aggregates (base or filler layers of concrete). Application of secondary materials can be incorporated by application of admixtures to concrete, application of artificial porous aggregate, and the use of cement with added waste materials.

The focus should be placed on the following concrete properties and characteristics:

- a suitable shape index, lower bulk density and higher absorbability,
- effect on fresh concrete consistency,
- compressive strength and modulus of elasticity is 10- 20%lower,
- creep coefficient is up to 50%higher,
- and higher shrinkage by 20-40%.

And the following weaknesses should be taken account:

- occurrence of variable properties,
- uncertainty of age,
- uncertainty of composition,
- uncertainty of chemical and mechanical exposure,
- and limitation of the maximum grain size to 16- 22mm.

Application of waste admixtures in concrete production Comparison of technical and technological parameters of light weight artificial aggregates used in the Czech Republic can be seen in Table 2.

Table 2. Comparison of technical and technological parameters of light weight artificial aggregates used in the Czech Republic [3].

Name	Fraction (mm)	Bulk density (ρ_s)	Crush resistence (MPa)	Share of waste materials (%)	Production temperature (°C)
Rugen	4/8	500-1200	2-20	60-100	≥5
	8/16	400-1000	1-12	60-100	≥5
SioPor	0,1/1	120-160	0,08	0	300
	0,63/2,5	60-100	0,03	0	300
	2,5/4	60-80	0,03	0	300
Poraver	2,4/4,8	145-230	1,3	100	900
Liapor	0/2	575	4	0	>1100
	0/4	450	2,1	0	>1100
	4/8	450	1,7	0	>1100
	8/16	275	0,6	0	>1100

Fly ash is produced by high-temperature combustion of pulverized coal. It contains more than 50% glassy phase (note: the greater the content, the more ash is reactive).

The use of fly ash has an effect on the color of the concrete. In fresh concrete, fly ash improves workability and when used, the amount of water used decreases. In hardened concrete, it positively affects carbonation and long-term strength, but short-term strength is lower. Concrete with fly ash resists aggressive environment (frost and CHRL).

Blast furnace slag has a very similar chemical composition to cement,but differs in its percentage. Slag is a by-product in the production of iron in a blast furnace. Its properties are among the latent hydraulic additives. The quality of the slag is assessed in terms of the alkalinity module. The fine slag particles are advantageous for filling the space between the cement particles, thereby improving flow ability (similar to micro-silica), porosity, durability, water- tightness and especially frost resistance of hardened concrete. After adding water, slag itself does not solidify or harden. The hydraulic properties become apparent only after the addition of the so-called activator, which is cement in the concrete. In fresh concrete improves rheological properties and viscosity. However, it adversely affects the strength increase.

Transport Structures Foundation

Geotechnics tasks in improving unfit soil/subgrade are generally solved by treated soil. In the Czech Republic primarily technical standards TP 94-Treated soil and ČSN 73 6133- Road earthwork – Design and execution are used. For soil stabilization, the following agents are utilized:

- Binder – cement and lime, foamed asphalt.
- Hydraulic road binder (mixed cement).
- Slag.
- Fly ash or stabilized mixture.

During the construction is needed to provide laboratory and field test like moister content determination and compacting ratio (Proctor modified test). Also technological condition like ground water protection with drainage layer, levelling and compacting level should be monitored.

Railways

Material used on railways in Czech Republic

In Czech Republic, there is approximately 31 000 km of different types, mostly 49 E1, 60 E2, i.e. over 200 thousand cubic meters of steel rail with corresponding amount of rail fastenings. There are approximately 25 million sleepers (wood or concrete) layered in track bed of 25.4 million cubic meters of ballast fraction 31.5 - 63 mm. Also the structural layers of the substructure body – aggregates and bound courses represent huge amount of material.

More than 5 million tons of aggregate from the railway bed have been recycled at the end of 2017, whichisapproximately3.5million cubic meters of material. This amount corresponds to 3 years of usual production for railway structures in our quarries. Overview of recycled aggregate amount between 1999 and 2017 can be seen in Figure 4.

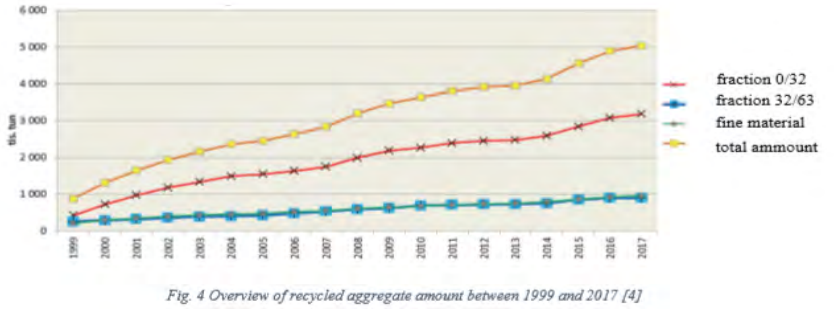

Fig. 4 Overview of recycled aggregate amount between 1999 and 2017 [4]

Figure 4. Overview of recycled aggregate amount between 1999 and 2017 [4].

Reuse and material handling of railways structure components:

1. Gravel bed

- Rolling bed recycling(partly).
- Recycling into structural layers(often).
- Recycling" to other earth structures (only marginally).
- Landfill.
- Hazardous waste landfill.

2. Structural layer material

- Recycling to structural layers.
- Recycling to other earth structures.
- Landfill (probably mostly).

- Hazardous waste landfill.

3. Prefabricates from concrete or reinforced concrete

- Sleepers (mostly as other prefabricated elements of similar material, possibly for low frame and retaining walls).
- Others.
- Impregnated wood- sleepers (hazardous waste).
- Other matter- similar to other constructions.

Ballast layer

The most important functions of ballast structure can be stated as: Structural Support (Resist vertical, lateral and longitudinal forces, Support sleepers, Reduces tresson subgrade), Drainage, Reduce Frost Problems, Absorb noise. A typical cross section of the rail body can be seen in Figure 5.

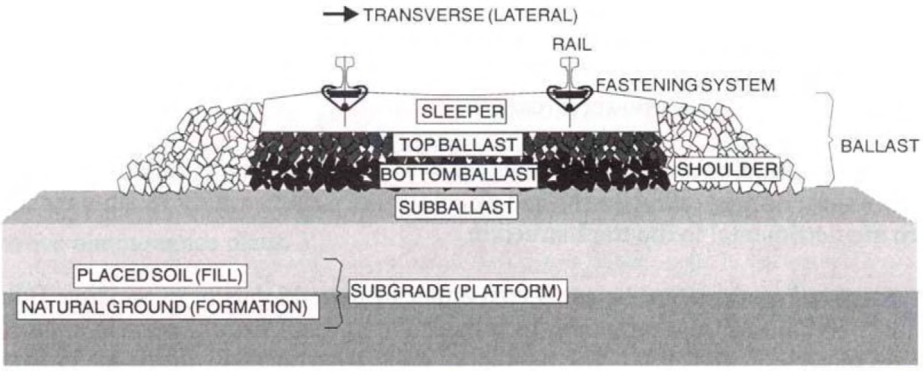

Figure 5. Conventional permanent way structure [5].

Upon cyclic loading of trains and through weathering processes, ballast deteriorates by time. Recycling of a rail bed aggregate is currently carried out essentially by two technologies: machine cleaning, and recycling and crushing method. Also rail assembly technology is used.

Machine cleaning is used mainly during the work of continuous maintenance of the superstructure, carried out without the removal of the rail grate. It is performed by ballast cleaners or also called undercutters. The advantage of this method is speed and simplicity, however it exhibits worse efficiency

With in the use of **Recycling and crushing method**, the track be dis completely excavated with wheeled rotary excavators and transported by trucks to a recycling base. Sorting of aggregate is performed on vibration screens with supercritical vibrations of the sorter. Crushing is performed by a conical or reflective crusher. This method achieve better parameters of recycled aggregate produced, as well as a smaller amount of„ waste", that is difficult. On the other hand, this approach is time consuming and there are relatively high transport costs.

Rail assembly technology combines the advantages of better quality of aggregate produced by recycling by crushing and sorting with a shorter time needed. The rail units allow the complete recovery of the ballast bed, or the rehabilitation of the substructure layers using recycled material, without dismantling the rail grate. The principle of the work of the serolling recycling and remediation units involves the removal of gravel in the axis, its comprehensive recycling with the sorting and crushing of excavated material, and its further direct use both back to the railway superstructure and a part of the possible remediation layers of the rail way substructure.

Railway sleepers

To treat impregnated wooden railway sleepers (to impregnate them), toxic chemicals are used to prolong their durability, resistance to weathering, rot, parasites, water and fire. In the past, especially tarry residues from the distillation of coal coke were used. Due to possible negative impacts, there is a need for specific regime, both during their lifetime and after their end.

Impregnated wooden sleepers can be used:

- for construction purposes, in accordance with a construction project, as a designated construction product (e.g. staircase for outdoor use),
- as a bridge in accordance with a construction projecton other line constructions than on railway lines (as a designated construction product),
- for reinforcement of taxiways and courtyards.

Concrete sleepers can be used e.g. for building of retaining walls and similar structures.

Roads

It is estimated that more than 90% of the 5.2 million kilometers of European paved roads and highways are surfaced with asphalt. Also, about 44% of goods are transported by road in the EU. Road pavement challenges are operational capability and bearing capacity, durability of surface course, maintainability and reparability. In the Czech Republic, the following technical standards are primarily used:

- TP 210- The use of recycling C&D materials to road construction.
- TP 208- Cold recycling of flexible pavement structures.
- TP 209- Hot recycling of flexible pavement structures.

Road pavement constructions (flexible and rigid) can be described according to Figure 6, while pavement lifecycle can be described as seen in Figure 7.

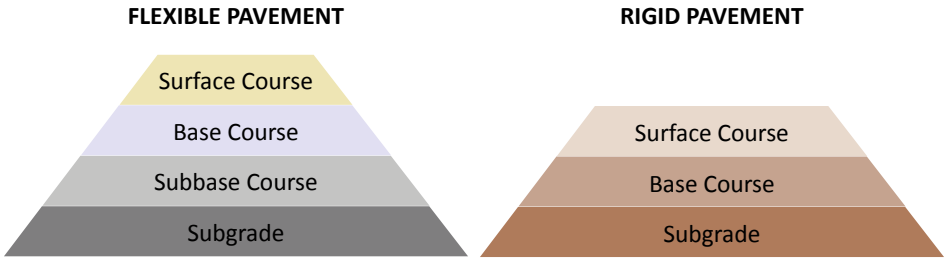

Figure 6. Road pavement constructions [6].

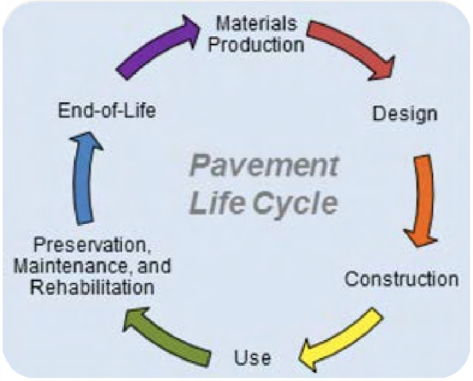

Figure 7. Pavement Life Cycle [7].

Composition of recycled materials

The composition conditions for recycled materials of roads are described as follows:

- **Concrete recycled: Rc ≥ 90 %;** (Ru + Rb) ≤ 6 %; Rg ≤ 1 %; (X + Y + FL) max 3% and FL max 1 %.
- **Pavement recycled: (Rc + Ra + Ru) ≥ 95 %;** Ra max 30 % and (X + Y + FL) max 5%.
- **Masonry recycled: (Rb + Rc + Ru) ≥ 90 %;** (X + Y + FL) min 10%.
- **Mixed recycled – (X + Y + FL) ≤ 10%**
- **Reclaimed asphalt material / R-material - Ra > 95 %;** (Rc + Rb + Ru + X + Y + FL) = 5%.
- **Recycled asphalt - 30 % < Ra < 95%**
- Other Particles (X), Other nonC Particles (Y), Floating Particles (FL).

Where: **Rc =** Concrete, products, mortar products, masonry; **Ru =** Unbound, natural and hydraulic bound aggregates; **Rb =** Burnt and sand-lime masonry elements, Masonry items, aerated concrete; **Ra =** Asphalt material; **Rg =** Glass; **X =** Adhesion (clay and dirt), Diverse metals (ferrous and non-ferrous), non-floating wood, plastics and rubber, gypsum plaster

The most important material is recycled bituminous aggregate–R-material, which can be used without the addition of a new binder for recycled use for low-load pavement course and base course, or with the addition of a hydraulic binder (cement, lime or slag) for the underlying underlays of all types of roads, for pavements, parking lots, etc. CRmB- Crumb Rubber modified Bitumen helps to reduce traffic noise, reduces stopping distance (skid resistance), creating ruts and cracks in the road and layer thicknesses.

Asphalt mixtures in combination with CRmB can be divided into the following products:

- SMA (Stone mastic asphalt)
- AC (Asphalt concrete)
- BBTM (Bétons bitumineux trèsminces)
- PA (Porous Asphalt)

Disadvantages of these product are: high requirements for bitumen rubber materials (shape and size) – quality control req.; construction – temperature req.; req. tostore.

Also modified bitumen – bio-fluxing bitumen / bio-derived industrial waste (lignin and bio- binder from vegetable oil) and aggregates substitution (high rates of RAP and C&DW) should be mentioned here. The combination CDW with bio-derived industrial waste can be seen in Figure 8.

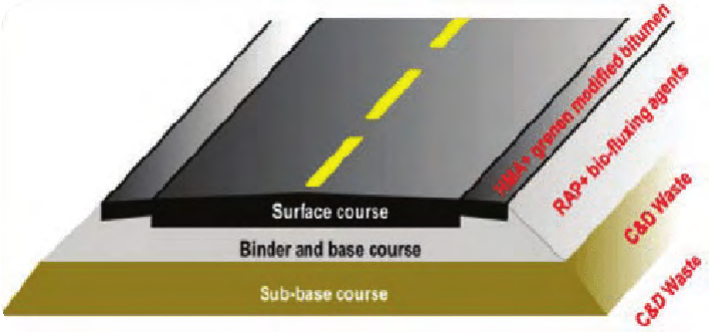

Figure 8. The combination CDW with bio-derived industrial waste [8].

In case of base bounded courses, the following products can be used according to binder used:

- Bounded courses with cement (SC)
- Bounded courses with slag (SS)
- Bounded courses with fly ash (SP)
- Bounded courses with hydraulic road binders (SH)

Rehabilitation Procedures

Rehabilitation procedures can be divided according to the mixing place (in-plant process and in-place / in-situ process) or technology temperature (cold and hot recycling).

In-plant process: reclaimed asphalt pavement and crushed stone are transported to a mixing plant located in the vicinity of the construction site. Here the milled material is mixed with binders(orRAP)toproduceanewconstructionmaterialmixwhichisreusedeitheronthesame or on a different construction site.

In-situ process: cold recycler granulates the existing pavement while mixing in binders and water homogeneously at the same time.

Cold recycling: process involves milling and granulating damaged asphalt layers which are then rebound, placed again and compacted. The cold recycler mills and granulates the existing asphalt pavement, injects binders and water in precisely

metered quantities and mixes all three in a single operation. The new base layers produced in this in-situ process are distinctive for their exceptionally high bearing capacity.

Hot in-place recycling: is a method in where the existing pavement is heated and softened, and then scarified/milled to a specified depth. Approximately 85 % of truck transports and about 70 % of virgin mix are saved in comparison to conventional methods using milling machines and road pavers. Provided that the lower pavement layers are intact in terms of bearing capacity, hot recycling is the most economical and environmentally friendly rehabilitation method for asphalt surface courses.

RAP is recycled as „aggregates and binder" with the use of the following approaches:

- **RESHAPE:** existing asphalt surface is heated and scarified to a specified depth; scarified material is combined with aggregate and/or recycling agent; and re-compacted. A new overlay or treatment is placed on surface.
- **REPAVE:** simultaneous combination of surface recycling with a HMA/WMA overlay placed and compacted at the same time.
- **REMIX:** scarified RAP is combined with virgin HMA and mixed in a pug-mill then placed and compacted as a single mix/lift.
- **REMIX PLUS:** like remix, but new surface is performed in 2steps.

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CHAPTER IV: LAZIO INTERVENTION IN THE AREA HIT BY THE EARTHQUAKE IN 2016

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LAZIO INTERVENTION IN THE AREA HIT BY THE EARTHQUAKE IN 2016

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Waste and Land Reclamation Unit

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ABSTRACT

The main objective of this paper is to outline the phase of intervention in the management of rubbles after the earthquake occurred in Lazio in 2016 encompassing the human, social and economic aspects of this tragedy. A focus has been made on the re-use of the materials generated by the earthquake for the building of the new temporary homes constructed on site for the residents after the selectively collection of rubbles.

KEYWORDS

Matter recovery after earthquake, Rubbles management.

INTRODUCTION

The tragedy that occurred in the province of Rieti, especially in the Municipality of Amatrice and Accumuli caused 390 casualties. Along with the difficulties encountered with the rescue of the wounded and survivors, often left without relatives, added the need to promptly intervene on the reconstruction of the houses in order to restart the daily life of residents as soon as possible. To respond to these dramatic problems, the Lazio region coordinated various interventions of an economic and social nature and for the removal of rubbles and the reconstruction of new residences. The paper briefly reports some data on the management of rubbles and their partial use for reconstruction.

General facts

After the earthquake and the preliminary rescue of the survivors by the civil protection, the Lazio region had to promptly respond to the need for housing for the displaced persons. Although most of the earthquake victims were relocated in hotels or hosted by their relatives, it was necessary to rebuild houses in situ in order not to leave the affected towns uninhabited and reorganize a social fabric. Thus, Lazio Region launched two tenders;

1. Transport and processing of the public rubble (from public buildings).
2. Waste Separation Services, Loading and Transport, Recovery and Disposal of Rubble in the municipalities of Accumoli and Amatrice.

In the presentation, it has been reported the experience of a company, GARC Spa, that has been awarded contracts for lots of both tenders. For the first tender the CARG Spa installed a line processing at the processing sites while for the second tender installed two lines for the materials' enhancement similar to that used in the previous tender.

Definitions and numbers

Table 1. Activities performed.

Activities performed | Data updated as of 31/10/2017	Tons (t)
Rubble entering the Carpelone quarry site of Posta	99.841,52
Rubble entering the Terracino quarry site of Accumoli	22.300,56
Recycled aggregate and sand used in Sae areas	79.168,52
Selected wood transported to recovery plants	932,26

Activities performed | Data updated as of 31/10/2017	Tons (t)
Selected iron transported to recovery plants	465,55
Sheath disposal	17,86
Bulky waste disposal	184,04
Activities performed | Data updated as of 31/12/2017	**Tons (t)**
Rubble worked and removed from populated centers	55.540,07
Material transported to recovery at the Rieti plant	47.573,27
Material transported to recovery at Assisi plant	6.353,64
Wood coming from selection transported to recovery plants	665,54
Iron coming from selection transported to recovery plants	709,56
Sheath disposal	9,66
Bulky waste disposal	224,68
Disposal of used tires	3,72

The main targets to be achieved in the management of emergencies were:

- Timeliness of intervention.
- Material recovery.
- Reduction of the environmental impact of the work.
- Valorisation of human resources present.

Timeliness of intervention

The current legislation the day after an earthquake concerning the waste management was the same than before and no derogation was made after, as could be in the emergency cases.

Material Recovery

The waste that is generated by catastrophic events such as an earthquake can be a resource. With regard to this statement, the concept of resource is a […] means by which a need is satisfied, a necessity: available means; what constitutes a source of wealth (from the Italian vocabulary Garzanti).

Construction and demolition waste are materials- accruing in connection with construction and demolition activities in building construction, civil engineering and road and bridge construction. However, 90% of those materials result from demolition work and only 10% appear when building new constructions.

Reduction of the environmental impact of the work

The issue of distance between rubble deposit sites and reuse sites of the same takes on fundamental significance in relation to the presence on the territory of plants authorized to manage waste.

Also on this issue, we must start from a fact: seismic events occur in territories that are not structured to receive quantities of waste equal to those generated because of collapses. For this reason, there are no immediately available solutions. It is necessary to provide special operations designed for the special conditions in which it operates. In the disgrace of the event, a value is generated: the resource of the rubble. We need to think about how to enhance it on the territory but it should be remembered that before the event happens otherwise the tight schedule and the interests of the individual make it impossible to manage these phases efficiently.

Valorisation of human resources present

This is perhaps the most delicate issue but also, for us, more exciting. The situation of territories hit by earthquakes is complex for a number of reasons.

Among these there is absolutely also the sense of strong disorientation that the people who live in those places have to face the radical change that their life habits undergo. This loss is evident and present in the depths of those affected. The reasoning then is that if there are conditions to enhance the people present and insert them in the industrial sector that created at the time of processing aimed at recovering the rubble, life, dignity and strength will be restored to local communities. From our experience started in October 2016, about 50 people have found insertion paths in the industrial waste recovery sector. We work with engineers, surveyors, administrative employees, operators of earth-moving machines, drivers, and specialized operators.

These people have learned new topics related to environmental sensitivity, the value of materials, compliance with regulations, corporate responsibility. We believe that the path we have made has nevertheless allowed those communities to understand the value of work that is linked to the value of the materials we are managing. We like to think that the company has a strong responsibility in civil society, we can say how this approach elevates the value of the company and people.

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CHAPTER V: STATE OF ART OF THE PRE-DEMOLITION AUDIT IN FRANCE

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STATE OF THE ART OF THE PRE-DEMOLITION AUDIT IN FRANCE

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ABSTRACT

This note depicts at a glance the situation in France when addressing the issue of the pre-demolition audit, to understand the need for effective audit practices and the main forces at play hindering the implementation of recycling and re-use practices.

KEYWORDS

Pre-demolition audit, Resources and wastes inventory.

INTRODUCTION

The presentation aimed at giving an outlook of the situation in France when talking about pre-demolition audit, through answering to the following questions:

- What is the pre-demolition audit for?
- What change does imply its integration in the demolition process?
- What are the current best practices in France?
- What are the main levers and barriers to massify practices, what's at stake to go further?

In a first time the presentation went through the context in France when addressing the wastes issue, making also a parallel with the situation in the Auvergne Rhône-Alpes region.

Second, the focus was made on the role and necessity of the pre-demolition audit to lead the whole value chain towards a circular economy and therefore reduce environmental impact.

Third, a global view of the situation was made, giving the current state of the regulatory framework on pre-demolition audit and the current best practices commonly used and quoted.

Fourth, conclusions of the French initiative DEMOCLES were presented, providing an insight of the recommendations stemming from the project, from the definition of the needs to the performance of the audit and of the characterization of materials, crossed with other best practices coming from BELLASTOCK and ROTOR.

Finally, some perspectives were given to raise current barriers and ease the development of re-use and recovery practices.

Some elements about the context in France

The distribution of C&D wastes if like a Pareto distribution between Building works on the one hand and Public works on the other. This Pareto distribution is reversed whether we look at the sales or the wastes volume generated.

	FRANCE	AURA REGION
C&D activities	**€150bn (2018)** • Building => €105bn (70%) • Public works => €45bn (30%) http://www.actionbtp.com/chiffres-clefs.html	**€20.7bn (2016)** (14% FR) • Building=> €15.7 bn (76%) • Public works => €5bn (24%)
CDW	**1st waste stream - 228Mt (2014) => 67% of total !** • Building => 42Mt (≈20%) • Public works => 186Mt (≈80%) https://www.ademe.fr/sites/default/files/assets/documents/fiche_-technique-dechets-batiment-2017-09.pdf	**1st waste stream - 27Mt (2016)** • Building=> 5t (≈20%) • Public works => 22Mt (≈80%)
Public procurement	**€37,7bn (2017) (Cde du BTP)** • Building=> 17.8Mds € (17% of sales) • Public works => 19.9Mds € (44% of sales) https://www.lemoniteur.fr/article/collectivites-locales-les-depenses-btp-repartent-enfin-a-la-hausse.1985419	**€5bn (2016)** (13% FR; 24% AURA) • Building=> 2.4Mds € (15% of sales) • Public works => 2.6Mds € (52% of sales) Source: PRPGD

Figure 1. Key figures of the C&D sector in France and Auvergne Rhône-Alpes region.

With a share of hazardous wastes between 2% and 3% of total CDW, the potential for recovery is extremely high, hence the need for audit competencies and specific inventory.

Today 42Mt of CDW are generated in France in the building industry with a recovery rate of about 60%, including around 11Mt of finishing work wastes with a recovery rate of 46% (5Mt). Recovery rate of finishing work was recorded below 35% in 2016 and has increase up to 46% in 2018. This can be assigned to a better tracking of wastes and to endeavors devoted since then to develop recovery throughout the value chain.

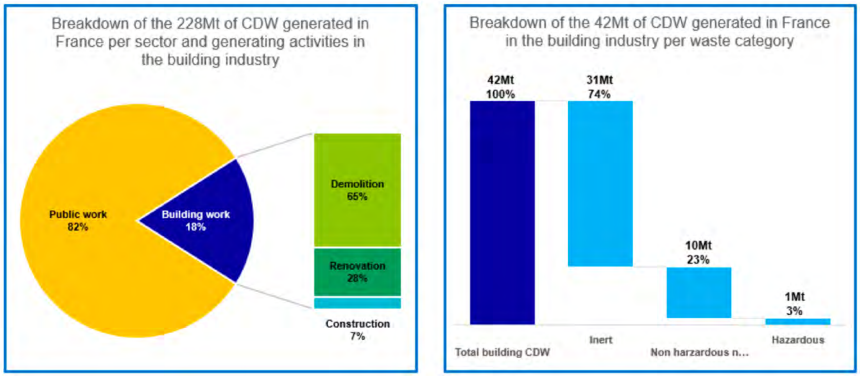

Figure 2. Demolition, renovation and construction, and building industry wastes breakdown in France.

Pre-demolition audit is a cornerstone to pave the way to material recycling and re-use

From the outside, audit and specific inventory appear as a key step towards closing the loop for a circular economy, facing nonetheless some barriers. Below is depicted the value chain, from the building design to the re-use of its materials and components in another life-cyle, audit and resources characterization being the mean by which to re-inject those resources in the loop.

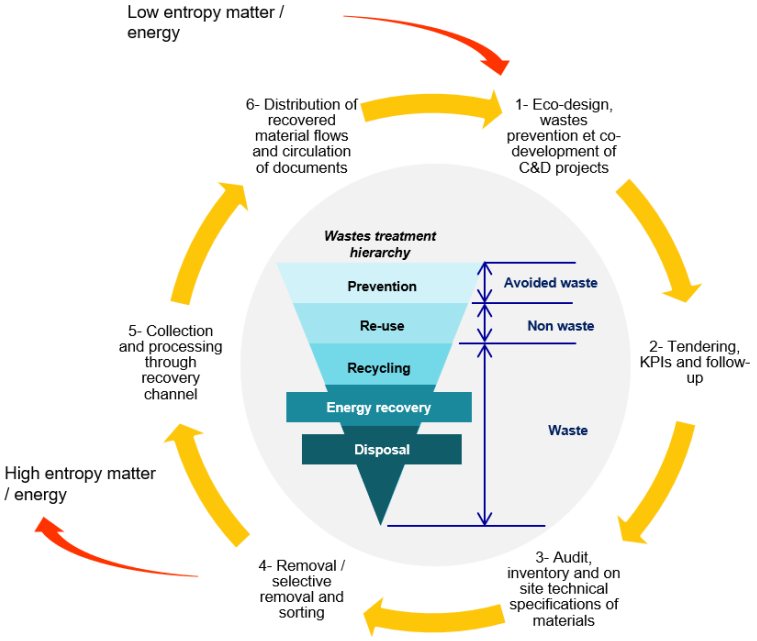

Figure 3. Key steps towards a circular economy, reducing extraction and throwing out of matter / energy from and in the environment.

Targeting re-use is the eco-friendliest way of doing, a mean to an end when the necessity to build does appear. This recovery option entails several challenges:

- **Organizational:** creation of new partnerships, behavioral change, responsibilities and ethic, trust and warranty.
- **Technical:** with no or new standards to be defined, practices mostly empirical based on savoir-faire.
- **Logistical:** collaboration, shared planning and equipment, storage area, containers and collection process.

- **Cultural:** new project structure, new work package and allotment, local distribution channels showcasing local resources.
- **Economical:** economic forces should be oriented to give a competitive advantage to materials of secondary use, new mechanisms of taxes and compensations should be designed.

A regulatory framework currently being reviewed, a set of best practices to be spread out to massify their use

The regulatory framework in place since 2011 will be reviewed in 2019, to enlarge the perimeter, dematerialize the system, strengthen competencies and train professionals. Decree n° 2011-610 of May 2011 the 31st relating to the audit for waste management arising from demolition of building categories:

- Art. R. 111-43. - Pre-demolition audit is mandatory for building exceeding 1000m² of surface or having hosted farming, industrial or business activities and having been used as storage, manufacturing or distribution area for hazardous materials as describe in the article R. 4411-6 du code du travail.
- Art. R. 111-44.- A building demolition is an operation aiming at destroy at least a majority part of a building structure.
- Art. R. 111-45.- The contracting authority has to realize an audit focusing on wastes stemming from an operation of demolition and previously to the permit application if the operation is submitted or previously to quotation acceptance or procurement procedure.
- Art. R. 111-46. – The audit mentioned provides the type, quantity and location within the perimeter inherent to the operation of demolition and considering the materials, construction products and components part of the building, and giving priority to alternatives for re-use on-site, and if not possible, information and alternatives on recovery channel with type, quantity and recovery potential or disposal.
- Art. R. 111-47. – For the audit, the contracting authority calls on a professional who has subscribed to an insurance policy specific to this kind of operation. The professional must not be linked to the contracting authority, neither to a company likely to realize the operation (entirely or partially) and which present a potential threat to its independence and impartiality

- Art. R. 111-48. – The contracting authority has to hand over the audit to whom is in charge of the operation of demolition.
- Art. R. 111-49. – Once the work is achieved, the contracting authority has to draw up an inventory check form, informing about the will of the different volumes of materials and waste, the form is handed over to the national agency of the environment "ADEME" who is in charge of reporting to the ministry of construction every year.

To meet the objectives of the regulatory framework, a set of best practices were presented, as depicted in the chart below. This is the role of AURA-EE to gather those best practices and spread them out through workshops and conferences so that to massify and ease their use in territories.

Table 1. Set of best practices presented.

Deep dive on the main steps towards an effective and comprehensive pre-demolition audit, based on the conclusions of DEMOCLES

The following steps start from the definition of the needs to the performance of the audit and of the characterization of materials and is crossed with other best practices coming from REPAR#2 (BELLASTOCK, CSTB, ADEMA) and ROTOR.

- Audit step #0- DEMOCLES conclusions define as a starting point to clarify actors' responsibilities, in particular those of the contracting authority which, as a cornerstone, is the CDW owner and producer.
- Audit step #1 – Recovery potentials and material outflows should be, if not planned at that stage, at least been considered. This induces sourcing, cooperation and co-development times.
- Audit step #2- To be effective, the set of clauses goes along with well defined selection criteria and should be goal-oriented (bonus-malus system).
- Audit step #3 – Identify potentials for re-use and recovery, in conformance with the EU methodology, to couple volume and 2nd life function of materials and components (structural, diverted use, backfilling).

Audit step #0- DEMOCLES conclusions define as a starting point to clarify actors' responsibilities, in particular those of the contracting authority which, as a cornerstone, is the CDW owner and producer.

Waste management to be successful is at the first order a behavioral matter, the commitment and role of the contracting authority is of paramount importance.

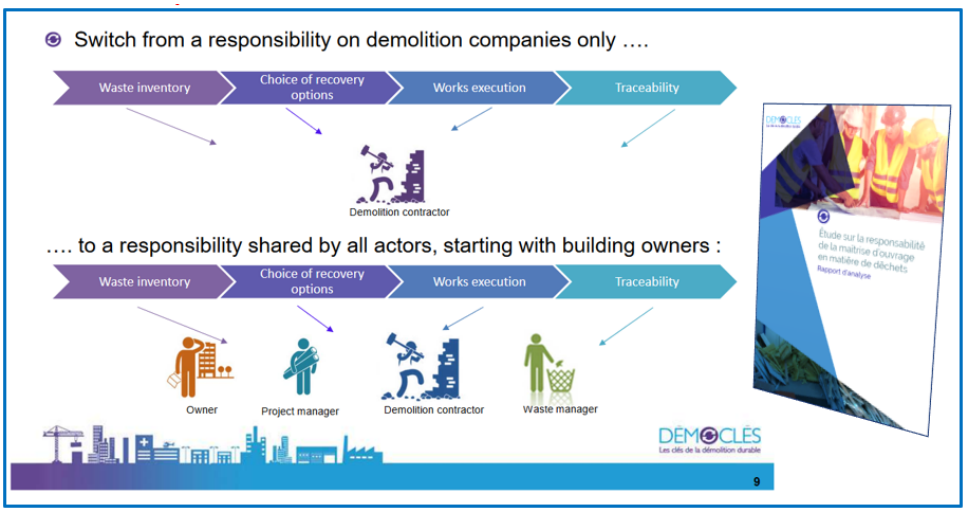

Figure 5. Audit step #0 – DEMOCLES conclusions.

Audit step #1 – Recovery potentials and material outflows should be, if not planned at that stage, at least been considered. This induces sourcing, cooperation and co-development times.

Effort starts from the definition of the needs, requires sharped knowledges of the value chain actors and activities, and uncommon planning skills going far beyond construction site.

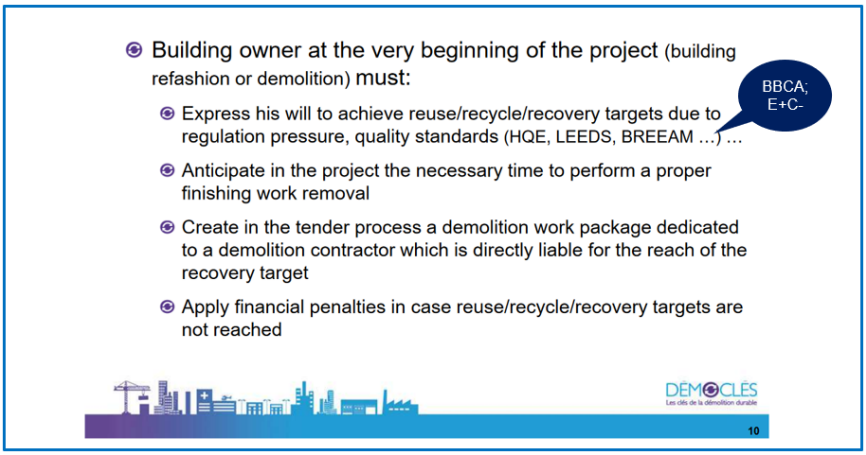

Figure 6. Audit step #1 – DEMOCLES conclusions.

Audit step #2- To be effective, the set of clauses goes along with well-defined selection criteria and should be goal-oriented (bonus-malus system).

DEMOCLES, an on-the-shelf toolbox to prepare bills of specifications, trigger wastes reduction and recovery solutions and reduce environmental impacts.

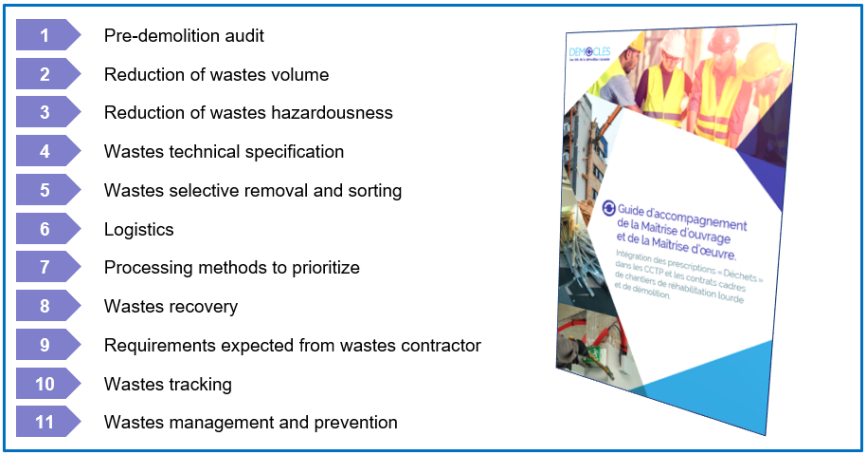

Figure 7. Audit step #2 – DEMOCLES conclusions.

Prime contracting bill of specifications must include a chapter on pre-demolition audit, specifying the regulatory framework to comply with and the different steps of the process (stakeholders, documents, timeline). Some examples are given below, concerning four topics.

DEMOCLES (1/4): Pre-demolition audit

Topics	Topic 1 : PRE-DEMOLITION AUDIT
Tender(s) concerned	Prime contractor
Legitimacy (for clause presence)	The audit is a pre-requisite to anticipate and control waste prevention, generation and management. It does concern all type of wastes.
Stakeholder(s) concerned and accurate description of the approach to be undertaken	As part of its answer to the call for tenders of project contracting, the latter realizes a wastes audit which has to comply with specific regulatory framework conditions regarding pre-demolition audit (29).
Project stage	Response to call for bids, prime contracting work package.
Follow-up tool(s) and document(s)	Pre-demolition audit delivered by the contracting party.
Main dedicated clause(s) / tender	Clauses from topics 3 to 8.
Example of clause and wording	

"Obligation of wastes audit or of its verification", to be included in the bill of specifications concerning the prime contracting assignment

As part of the scope of the prime contracting, the contracting party must realize a pre-demolition audit of the work site, in compliance with the conditions of the decree n° 2011-61 of the 31st of May 2011 and of the CERFA form n° 14498*01 regarding the required pre-demolition wastes audit mandatory for particular building categories.

With this aim in mind, the contracting authority (or its representative) should pass on all the documents relevant in its possession and will allow the working company to access to the site so that to take note of the location and of the materials be present in the site. The visit of the site is mandatory and is part of the response procedure.

Figure 8. Recommendation of DEMOCLES concerning the pre-demolition audit.

DEMOCLES (2/4): reduction of wastes quantity

Topics	Topic 2 : REDUCTION OF WASTES QUANTITY
Tender(s) concerned	Prime contractor
Legitimacy (for clause presence)	Cope with regulatory framework objectives.
Stakeholder(s) concerned and accurate description of the approach to be undertaken	• The prime contractor will find out re-use solutions so that to reduce the number of tons of wastes (32). • Alternatives for recovery and re-use should be reported in tender documents.
Project stage	Response to call for bids, preparation of demolition operations.
Follow-up tool(s) and document(s)	• Technical file of the prime contractor mentionning the measures undertaken to make re-use of materials on-site. • Final check-up will compare the effective re-use of materials.
Main dedicated clause(s) / tender	Clauses of topics 3 and 11.
Example of clause and wording	

"Reducing of the quantity of wastes generated", to be included in the bill of specifications

In conformance with the regulatory framework, the prime contractor will promote the re-use of materials directly on-site. The actions undertaken will be reported once the operations achieved.

Figure 9. Recommendation of DEMOCLES concerning the reduction of the quantity of wastes.

DEMOCLES (3/4): reduction of wastes noxiousness

Topics	Topic 3 : REDUCTION OF WASTES NOXIOUSNESS
Tender(s) concerned	Working company.
Legitimacy (for clause presence)	Cope with regulatory framework objectives.
Stakeholder(s) concerned and accurate description of the approach to be undertaken	The working company must identify precisely the different CDW categories being present on site and pay attention to do not mix them. The company has to take appropriate measures to sort the different CDW streams.
Project stage	Removal and storage steps.
Follow-up tool(s) and document(s)	SOGED mentionning the measures taken to avoid mixing inert, hazardous and non hazardous non inert wastes.
Main dedicated clause(s) / tender	Clauses of the topic 8.
Example of clause and wording	

"Reducing of the noxiousness of the wastes", to be included in the bill of specifications (promote flexibility through several levels of requirement)

In conformance with the article L541-7-2 of the Code of the environment, the tenured company in charge of performing the deconstruction will take all the measures necessary to do not mix hazardous wastes between them or with non hazardous wastes. Preventive measures when removing materials or equipment should be taken, as long as during storage and logistic steps. The company will take care of reporting all the measures taken in the SOGED.

Figure 10. Recommendation of DEMOCLES concerning the reduction of the noxiousness.

DEMOCLES (4/4): wastes characterization

Topics	Topic 4 : WASTES CHARACTERIZATION
Tender(s) concerned	Working company.
Legitimacy (for clause presence)	Cope with regulatory framework objectives.
Stakeholder(s) concerned and accurate description of the approach to be undertaken	The working company must identify the wastes per category (inert, hazardous, non hazardous non inert) and pass on the information to third parties allowed to carry out wastes thereafter. In case of hazardous wastes, a Certificat d'Acceptation Préalable (CAP) is mandatory for each type of hazardous waste, and is valid during maximum one year. For certain kinds of outlet like ISDND (32), a CAP certificate is required before transfer. It is the same for ISDI (34) and equivalent. In any other case, the wastes owner will ask to the outlet its bill of specifications to verify compliance between inputs and treatment capacity.
Project stage	Removal and storage steps.
Follow-up tool(s) and document(s)	Certificat d'Acceptation Préalable (CAP) and any other document required per intermediary and final recovery steps.
Main dedicated clause(s) / tender	Clauses of topics 4, 7, 8, 9 and 10.
Example of clause and wording	

"Wastes characterization"

In conformance with the article L541-7-1 of the Code of the environment, the tenured company in charge of performing the operations will ensure that all of the following steps are done properly:

- Characterization of wastes based on their nature, before transfer towards intermediary or final treatment plant allowed to take in charge and paying a particular attention to hazardous wastes.
- Take all the necessary measures required in terms of storage, labeling and logistic.
- Transmit the certificates (CAP) that are mandatory and any other document coming from others outlets so that to pass them on to the contracting authority or prime contractor.

Figure 11. Recommendation of DEMOCLES concerning the wastes characterization.

Audit step #3 – Identify potentials for re-use and recovery, in conformance with the EU methodology, to couple volume and 2nd life function of materials and components (structural, diverted use, backfilling).

Wastes audit should be turned into technical specifications and material inventory to scale up trickle-down effects, paving the way to high recovery potentials. Below is the process proposed in the EU guideline, enriched with best practices techniques.

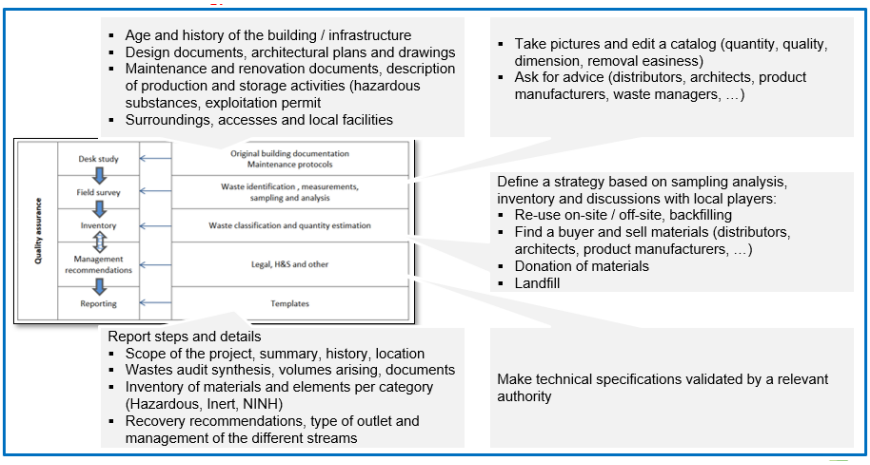

Figure 12. Recommendation of DEMOCLES concerning the reduction of the noxiousness.

Then different documentation forms for the materials inventory were presented, comparing for instance the ones provided in the EU guidelines on the pre-demolition audit and those of the project REPAR#2 led in France.

To ensure a complete recovery of the materials and wastes, the challenge is now to work in collaboration with all the value chain actors in order to define a reliable, effective and shared document of traceability. In that perspective, the on-going activity of the project DEMOCLES focuses on this issue. Below are depicted some regular checkpoints throughout the demolition process that would be necessary to reinforce the effectiveness of the monitoring system, based on the process provided in the EU guideline.

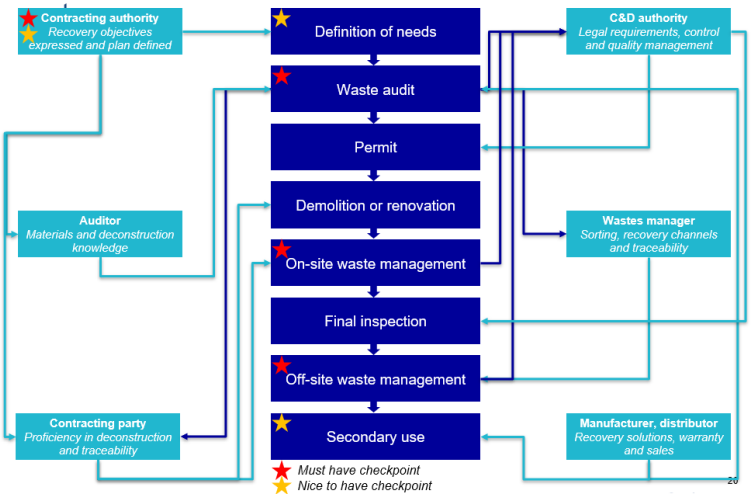

Figure 13. Traceability is the current challenge being worked out by DEMOCLES.

At the end, the idea is to deliver a formal documentation form (CERFA from) to the authority, the national agency for the environment (ADEME). Today the rate of return of this CERFA form remains quite low.

CONCLUSIONS

The presentation aimed at giving at a glance the main barriers in France when talking about wastes audit:

- Low level of knowledge of the regulation among local authorities?
- An urgent need to train auditors, initiatives are marginal, who is supporting the costs?
- Contracting authorities are the cornerstone and must be trained to prescribe recovery solutions in tenders, behavioral change is needed.
- Tracking system is to be developed and must stem from a common agreement between value chain actors, what, when, how, who.
- A taxe system to ease the secondary use of C&D materials, currently evolving to make recycling materials more competitive.

The presentation list also the main levers identified, as quoted in the OREE's report released in 2018 on the deconstruction:

At national level

- Spread the scope of the pre-demolition audit to renovation.
- Uplift labels recognition to better apply circular economy principles.
- Ease the end of waste regulatory status, as quoted in the measure 37 of the FREC.

For contracting authority

- Regard wastes as resources, consider urban mines.
- Train itself and prime contractor to recycling and recovery techniques.
- Put in place best practices and sign charter, communicate to spread the use of best practices.

- Maximize potential value, incentivize actors in the tenders, pay attention to skills.
- Create dedicated work package for secondary use of materials.
- Deepen responsibilities, risks coverage and warranty issues

For prime contractor, train participants and raise awareness to re-use techniques and potential.

For auditors

- Train and get certifications such as OPQTECC or OPQIBI.
- Perform a dynamic inventory and meet stakeholders able to provide complementary information.

For company, train to waste sorting and management techniques to better meet customer expectations.

For local authority, create at regional / city level a teamwork dedicated to coordinate scheduling and link supply and demand between C&D sites.

For the whole, make use of data to quantify and qualify potential for recovery and exchange information with actors.

ACKNOWLEDGMENTS

Thanks to DEMOCLES, BELLASTOCK, ROTOR, OREE and all other actors quoted in this note for sharing their contributions.

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OREE-COMMENT MIEUX DÉCONSTRUIRE & VALORISER LES DÉCHETS DU BTP ? 2018

CHAPTER VI: ENVIRONMENTAL REQUIREMENTS FOR MAINTENANCE WORK AND WASTE MANAGEMENT SERVICE PROCUREMENT IN THE COMUNIDAD VALENCIANA

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ENVIRONMENTAL REQUIREMENTS FOR MAINTENANCE WORK AND WASTE MANAGEMENT SERVICE PROCUREMENT IN THE COMUNIDAD VALENCIANA

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ABSTRACT

The documents of Green Public Procurement (GPP) drafted by the European Economic Community are a guide for the administrations in order to apply the sustainability criterion in the public tenders and their different areas.

In this paper are analysed the environmental requirements for works and services in the Valencian Community regarding the management of Demolition and Construction Waste (CDW).

The main results show the limited specification with regard to the environmental requirements existing for the waste recovery for the CDW generated in works of different administrations.

Also, it shows an example for the use of recycled aggregates as an application of the environmental improvement criteria in the operation of non-hazardous waste plant managed by S.A. Agricultores de la Vega de Valencia (SAV).

This article is part of the research field regarding the recycling and recovery of CDW as a collaboration between the S.A. Agricultores de la Vega de Valencia (SAV) company and the European Project CONDEREFF (Construction and demolition waste management policies for improved resource efficiency).

KEYWORDS

GPP, CDW, Environment, Tenders.

INTRODUCTION

Green Public Procurement (GPP) criteria

The basic concept of GPP is based on having clear, verifiable, justifiable and ambitious criterion for products and services, focused on the life cycle and a base of a scientific evidence. Since 2008, there has been developed at the European Union advisory guidelines for the inclusion of ecologic requirements in the documents of public tenders of different areas. The sectors for which exists guidelines with the Green Public Procurement Criteria are:

- Interior cleaning services.
- Computers and monitors.
- Copy paper and graphic paper.
- Electrical and electronic equipment used for the health-care sector (EEE health care).
- Electricity.
- Food and catering services .
- Furniture.
- Garden products and services.
- Image printing equipment.
- Design, construction and management of office buildings.
- Paints, varnishes and road markings.
- Design, construction and maintenance of roads.
- Sanitary faucet.
- Lighting of roads and traffic lights.
- Services and textile products.
- Toilets and urinals for discharge.
- Road transport.
- Wastewater infrastructure.
- Water based heaters.

SAV

S.A. Agricultores de la Vega de Valencia (SAV), is a work and services company founded in 1900 which develops its activity in the field of the Environment, from the cleaning of public and private spaces, the integral management of waste and infrastructure maintenance.

SAV collaborates with the research on recycling and recovery of CDW for the European Project CONDEREFF, as an integral part of the circular economy process of CDW.

SAV has some main activities such as:

- Urban Services.
- Integral Water Cycle.
- Waste Transportation and disposal.
- Conservation of natural spaces.
- Landscaping.
- Integral Maintenance and cleaning of buildings.

Municipal demolition and construction wastes

The most of CDW are generated by the construction, demolition and deployment services sector (supply and sewage, telecommunications, electricity supply, gasification and others).

The CDW collected through home repairs are a municipal competition and generally are delivered into eco-parks. Also, exists another source of municipal CDW production as cleaning plots. Figure 1 provides the municipal CDW cycle.

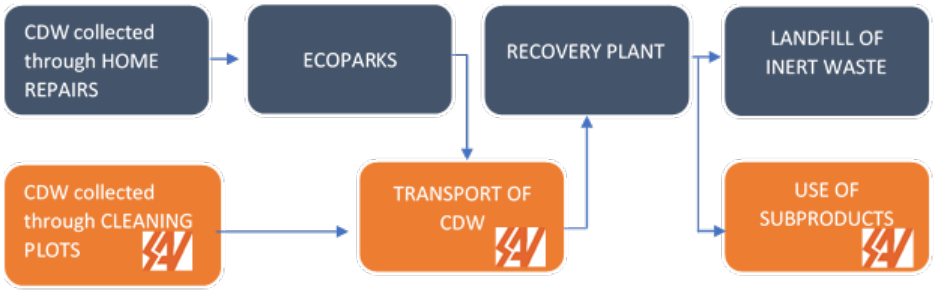

Figure 5. Process of the CDW of municipal competence.

OBJECTIVE

The initial objective of this study is to contextualize the requirements in terms of CDW recycling of public tenders in the Valencian Community and to study its relation with the GPP, as well as to show a case of environmental improvement as a result of the application of criteria in order to CDW recovery.

METHODOLOGY

The process of search and analysis in order to address the existent relation between the public administration of the Valencian Community and the CDW is divided into two stages which are shown in Figure 2.

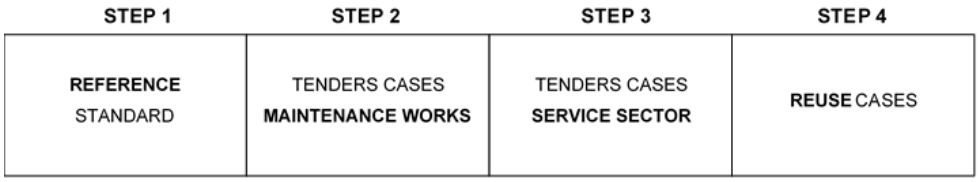

Figure 6. Environmental requirements analysis process for CDW.

RESULT

Through the process of analyzing environmental requirements in different fields directly related to public administration, it can be obtained a context about the current status with respect to CDW.

Normative

Three main norms have been studied in order to check what environmental criteria and requirements establish and what is their relationship with GPP.

The main regulation to review is the Orden PCI/86/2019, January 31 establishing the Green Public Procurement 2018-2025 and it is directly related to the European criteria and the existing guides. Compliance is responsibility of all the public authorities.

Secondly, Law 9/2017, November 8 about Public Procurement establishes in its Article 202 that, in the Specific Administrative Clauses, at least one of Special Performance Conditions must be concerning to social or environmental issues.

Environmental considerations must pursue:

- Reduction of greenhouse gas emissions.
- Maintenance or improvement of environmental values of the object of the contract.
- Sustainable Water management.
- Promotion of the use of energy from renewable sources.
- Ecological production.
- Garden products and services.

In addition, non-compliance with these considerations may be penalized.

Finally, the Integral Waste Plan (IWP) that directly regulates CDWs, object of our case study, is studied as the main norm in Valencian Community. This results in the environmental criteria being established in the specifications of particular administrative clauses. Among them, the use of recycled aggregates is specified with one of the criteria to be assessed in the award.

Tenders for Maintenance Works of Valencian Community

In addition to checking the general regulations, different regional and local public tenders have been studied to check the level of detail regarding existing environmental requirements in their specifications.

The tenders studied cover maintenance and reform works at regional level in Valencian Community and at local level in several municipalities. Some of the tenders are described as:

- Rehabilitation of the spaces of the sacred place of Arnau de Villanova Hospital (Generalitat Valenciana- Department of Health).
- Conditioning of the CV-4501 road (Vega road) between CV-455 and San Antonio (Requena City Council).
- Improvement of electrical safety, accessibility and storm drain in the public school Dr. Vicente Trenco (Moncada City Council).
- Adaptation/Extension of the IES Alcalans Public Center (Montserrat City Council).
- Works of the Socio-Cultural Sport Center (Mislata City Council).

Tenders for Municipal Waste Collection Services

Municipal waste is the responsibility of municipalities and as established by current regulations in the Valencian Community, CDWs from households are also his responsibility.

Different tenders for municipal waste collection have been studied seeking references to environmental requirements regarding RCD. In all the cases it is observed that the different municipalities do not the management of RCD different from what is strictly related to the management of Ecoparks.

However, cleaning and rubble removal services for municipal sites are very common. During the last 3 years, SAV has transported a total of 8,625.40 tons to CDW recovery plants 170904 code from the metropolitan area of Valencia.

It it also remarkable other organisms that take part into the process of recovery of C&D waste, and it is divided by the categories and their importance:

Public administrations: City hall and each autonomous region.

Project Management: competent technicians in charge of the direction and control of the execution of the work.

Designer: person who designs the project, requested by the promotor and it is subjected to the technical urban planning.

Waste manager: Public or Private person or entity, registered by authorization or communication that performs operations that make up waste management.

Contractor or owner: a physical entity who has a C&D waste in his possession and does not have the status of waste manager.

Promotor or Producer: person who has urban license in construction or demolition work.

It must be taken into account the various guided steps for achieving the objective and as one of the main points is the consideration of reuse, valuation or disposal operations to which the waste generated in the work will be used:

The development of activities for the valuation of construction and demolition waste will require prior authorization from the residue's entity of the Comunitat Valenciana, under the terms established by Law 22/2011, of July 28.

The authorization may be granted for one or more operations carried out, and without prejudice to authorizations or licenses required by any other regulations applicable to the activity. It will be granted for a certain period of time, and me be renewed for certain successive periods.

The authorization will only be granted after inspection of the facilities where the activity is to be carried out and the qualification of the technicians responsible for its management and of what is required of the professional training of the personnel in charge of its operation. Recycled aggregates that are required ass a product of a construction and demolition waste recovery operation require that the technical and legal requirements for the intended use to meet.

The legislation of the Autonomous Region or Communities may exempt from the administrative authorization regulated in paragraphs 1 to 3 of article 8 of RD 105/2008, the holders who are responsible for the recovery of non-hazardous construction and demolition waste in it work in which they have been produced, fixing the types and quantities of waste and the conditions in which the activity can de dispended with the authorization.

Other point to highlight is the different measures for the separation of the waste on site. According to the normative, different steps appear in order to reach the efficiency in C&D waste reuse management.

It should be clear that C&D waste must be separated into the following fractions, when, individually for each of these fractions, the expected amount of generation for the total work exceeds the following quantities: for concrete it is 80tons, masonry is 40tons, metal is around 2 tons, wood and glass are on 1ton and both plastic and paper is half ton.

This separation must be carried out by the owner of the C&D waste within the work in which they are produced. When due to lack of physical space the owner can entrust the separation to an external waste manager in order to separate the fractions in a treatment facility.

CASE OF CDW REUSE

As a company aware of the environment and sustainability, SAV applies environmental criteria in his comprehensive waste management services, seeking improvements on a voluntary basis.

An example is the use of CDW in the non-hazardous waste disposal plant (NHW), whose research has been carried out thanks to SAV's collaboration in CONDEREFF project.

Objectives and Experimental Plan of use of CDW

During the operation of the NHW disposal plant, access is facilitated to heavy trucks which must go from the entrance of the plant to the discharge point.

The main objectives are:

- CDW reuse for provisional roads.
- Minimization of waste by recycling.
- Study the viability of materials in situ.

To deeply reach to this objectives, it is necessary to implement actions such as waste minimization by use of recycled materials. To optimizing use of natural resources and also to study the viability of the experiment in situ.

The basic needs required for the construction and use of provisional roads are stability for heavy traffic, drainage capacity during heavy rains, speed and ease for the construction process.

The stages of the experimental plan are search of recycled material production plants, selection of the supplied material and on-site testing of the selected material.

Results of the experiment

The experimental plan have been based on the search of European List of Wastes, on selection of the recycled materials for the road construction. Also take into account, the in-situ tests for the construction of temporary roads.

Once the appropriate materials have been selected according to the basic needs, it is carried out a test in situ with 4 samples. The recycled material is placed in the transit areas of heavy vehicles on the layer of bales + refining + compacted clay + road base layer. To this effect, the following earth-movement machinery is used: loader, 3-axle truck, scraper, compactor and irrigation tank (Images 1, 2 and 3).

Image 1, 2 and 3. Extended, compacted and crushed debris irrigation.

The effectiveness of crushed debris for the construction of provisional roads is evidenced, thus the triple objective is achieving.

It has been identified the lack of legislation that establishes the recycled aggregates characterization according to their composition and granulometry, which would increase the possibilities of commercialization and his use in construction and maintenance activities.

The lack of a specific market results in the disparity of prices and qualities of recycled material which are established by each plant based on individual conditions such as: the production capacity of the plant, distance to the population centers, climatology, number and type of process necessary for the manufacture of the material, waste generated after production.

In order to carry out effective recycling situations, the implementation of environmental criteria must be considered when contracting requires, among others, a series of support measures:

Control, by the contracting entity, of compliance with the environmental criteria specified in the contracts.

Development by the Government of Finance and Public Administration and Environment Areas of the necessary measures for the implementation of this Code.

Training of municipal administration employees on the proper use of products, equipment or systems acquired with environmental protection criteria.

Also take into account the fact of evaluation and monitoring of the process. Analyze the evolution of the measures adopted and the results obtained, informing citizens of the progress in sustainable purchasing policy.

Some of the main results after studying the different cases have been the material characterization if its poor or non-existent. There have been excellent drainage performance during periods of heavy rain with type 7. Also remarkable the fact that

a high cost of transport exists compared to the material, between 64.10% up to 88.7% respect to the total price.

CONCLUSIONS

The continuous updating of the normative and the regional nature of the present article should be taken into account, therefore, the results are limited and not extrapolated to the rest of territories.

In most cases of works and maintenance tenders analyzed are certain clauses that directly transcribe the Special Conditions of the Public Sector Procurement Law. There are no clauses directly related to the European Community GPP.

The municipal nature of waste management greatly diversifies the actions regarding environmental requirements, in the worst case setting a different criterion for each municipality.

For future tenders, public administrations must take into account the experiences and real cases of environmental improvements implementation, as well as defining clauses that encourage the research in the course of long-term contracts.

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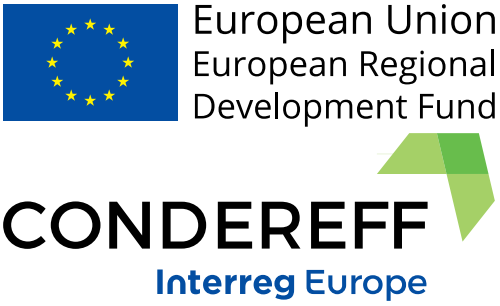

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