Resource Efficient Use of Mixed Wastes
Case study: Democles
V2 – April 2016
# Table of contents

**Key findings**

1. **Introduction**
   1.1. Context of the initiative
   1.2. Objectives
   1.3. Results

2. **Implementation of the initiative**
   2.1. Planning of the initiative and actors involved
   2.2. Implementation of the initiative
      - 2.2.1. Steering committee role
      - 2.2.2. Step 1: Identification of actual and emerging practices in recycling of finishing work wastes
      - 2.2.3. Step 2: Realisation of on-site case studies
      - 2.2.4. Step 3: Formulation of technical and operational guidelines for on-site sorting
      - 2.2.5. Step 4: Formulation of recommendations for clients and C&D companies as well as for training
   2.3. Factors of success

3. **Lessons learned**
   3.1. Preconditions for application of the initiative – replicability
   3.2. Received ideas
   3.3. Innovation potential

4. **References**
### Key findings

**DEMOCLES, France**

**Context**

In 2012, 246.7 million tonnes of construction and demolition waste (CDW) were officially generated in France, as reported by the Ministry of Ecology, Sustainable Development and Energy. The amount of non-hazardous CDW excluding naturally occurring materials (soil) is around 65 million tonnes. The amount of CDW generated by the building industry is estimated to 38 million tonnes, including 10.2% finished work waste. Focusing on the finishing work waste, the French Environmental Agency (ADEME) estimates that more than 10 millions of tonnes per year are generated. 49% are inert waste (glass, earthenware, tiles, etc.), 48.6% are non-hazardous waste (gypsum, floor covering, wood, insulation materials, electric equipment, etc.) and 2.4% are hazardous waste (lamps, treated wood, etc.). It appears that this waste is poorly sorted and recycled, mainly for two reasons: these waste streams are composed of many different materials and they are usually collected as mixed waste. Many recycling options exist but are not widely practiced. Democles was launched in November 2014 for a duration of 18 months, in the context of the French law for the energetic transition. This national law confirms the European target of 70% recycling of CDW by 2020. First conclusions are expected by early 2016.

**Objectives**

The Democles (“Demo” for demolition and “Cles” for keys in French) project is an initiative involving all the stakeholders of the construction and demolition sector dealing with the management of finished work waste. It aims at identifying the key factors to improve the recycling rate of finishing work in order to contribute to the European objective of 70% of the CDW by 2020.

**Description**

Récylum, a French collective organism in charge of collecting electric and electronic equipment from buildings to ensure their recycling, has been appointed to coordinate the initiative. Eight organisms, representing clients, C&D companies, waste management companies, recycling industries, material manufacturers, and public actors involved in building management, compose the steering committee. The initiative is also sponsored by the French ministries in charge of sustainability and economy as well as by the French environmental agency, the ADEME.

Democles is implemented through four main steps:

- **Step 1**: Identification of actual and emerging practices in recycling of finishing work waste;
- **Step 2**: Realisation of on-site case studies;
- **Step 3**: Formulation of technical and operational guidelines for on-site sorting;
- **Step 4**: Formulation of recommendations for clients and C&D companies as well as for training.

**Key factors of success and potential for replicability**

- Involvement of all the stakeholders: when dealing with demolition waste, involving all the stakeholders, from the clients to the recycling industries, is a key factor of success to identify appropriate solutions adopted by all the parties;
- Case studies: having a diagnosis based on real case studies as well as on specific examples of how existing tools may be used is a key factor of success to identify the area of improvements and be able to formulate recommendations that are as specific and pragmatic as possible;
- Sufficient budget: important budget and human resources are allocated to this project. It is important to ensure the continuing involvement of the stakeholders and to be able to draw the conclusions.
- Public support: the involvement of the ADEME enables to make sure that the project gives conclusions that are compliant with the national waste management policies and regulations.

**Conclusion**

Expected outcomes are mainly operational recommendations in terms of tracking tools, training needs or contract specifications to facilitate on-site sorting and improve finishing work recycling. The project also aims at

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**Contacts**

- Fabienne Landeroin – Responsible of the coordination of DEMOCLES (Récylum)
gathering reliable data regarding technical and economic characteristics of the recycling chain per material. So far, six case studies have been carried out and three working groups are focusing on different issues (on-site sorting, recycling, on-site waste tracking). As of now, the involved stakeholders are convinced of the economic benefit of on-site sorting. However, recycling solutions are complex and not always developed for all the categories of waste.
1. Introduction

The Democles (“Demo” for demolition and “Cles” for keys in French) project is an initiative involving all the stakeholders of the construction and demolition sector dealing with the management of finished work wastes: private and public building management companies, construction companies, wastes management companies, wastes treatment industries, materials manufacturers, etc.

This project is innovative as it focuses on finished work wastes, a waste stream that is currently poorly recycled and extremely complex due to the diversity of the materials it may contain.

This project is an opportunity for all the involved stakeholders to promote new practices addressing the issues of finishing work management as well as answering the challenges of circular economy in order to improve CDW recycling rate.

1.1. Context of the initiative

In 2012, 246.7 million tonnes of construction and demolition waste (CDW) were officially generated in France, as reported by the Ministry of Ecology, Sustainable Development and Energy. The amount of non-hazardous CDW excluding naturally occurring materials (soil) is around 65 million tonnes. The amount of CDW generated by the building industry is estimated to 38 million tonnes, including 10.2 finished work wastes.

Focusing on recovery and recycling of non-hazardous CDW excluding soil, official statistics show a total of at least 40.4 million tonnes including backfilling in 2012. Taking these generation and treatment figures into account, France 2012 CDW recovery and recycling rate of non-hazardous CDW excluding soil can be estimated to about 63%. This figure is thus considering both building and road construction sectors, including inert wastes recovery. According to the interviewed stakeholders, the recovery rate of finished work wastes is probably much lower.

CDW management varies considerably from one site to another and many factors may affect the practices: site size, proximity to recovery/recycling and storage facilities, importance of this issue for the client, ethics and importance of the issue for the construction company...

If we have a closer look at the finishing work wastes, the French Environmental Agency (ADEME) estimates that more than 10 millions of tonnes per year are generated. 49% are inert wastes (glass, earthenware, tiles, etc.), 48.6% are non-hazardous wastes (gypsum, floor covering, wood, insulation materials, electric equipment, etc.) and 2.4% are hazardous wastes (lamps, treated wood, etc.). It appears that these wastes are poorly sorted and recycled, mainly for two reasons: these waste streams are composed of many different materials and they are usually collected as mixed wastes. Many recycling options exist but are not widely practiced.

Moreover, according to a study published in 2007 by the French Institute of the Environment (IFEN), 90% of the CDW are mixed with the following estimated recovery rates:

- 35% for the inert fraction;
- 15% for the non hazardous fraction.

Overall, in France, CDW management is an emerging issue, very dynamic in terms of technical innovation, but which also depends heavily on logistics and cost conditions. Several best practices can be pointed out:

- Good cooperation between the public authorities and the professionals, in particular via the National Waste Council;
- Some clients and local authorities are at the leading edge of CDW sustainable management and require an exemplary CDW management from their contractors and/or the use of recycled CDW in new constructions;

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1 Source: ADEME.
• Strong commitments on sustainable CDW management by several professional federations and construction companies: on-site sorting, CDW tracking…;
• Innovative CDW collection solutions such as the one enabling building craftsmen to bring CDW to construction materials distributors and get new construction materials in return;
• Existing recycling options for some specific materials such as plastic, gypsum, carpet;
• Many R&D programs on recycled materials from CDW and great financial and technical support by the French Environmental Agency (ADEME).

The main obstacles are the lack of political will, the clients interest for wastes recycling and the lack of trust in recycled materials, the lack of treatment facilities in some areas and the importance given to storage facilities which seem neither expensive nor selective enough. It is also difficult to adapt the on-site waste management practices to ensure waste sorting (appropriate containers are not always implemented). However many drivers can be used to address these obstacles, such as a binding regulation encouraging recycling facilities development as well as high recovery rates, a deterrent storage taxation system, the generalisation of the practice of allotment in call for tenders highlighting the costs of waste management and the necessity for waste tracking.

It is also important to mention that wastes treatment is an economic and social issue for all the stakeholders: CDW management represents important costs for the construction and demolition companies. Even though improving on-site CDW sorting is costly, it potentially enables to reduce the overall costs by improving recycling rates. Moreover, according to the PREDEC IDF, 10 000 tonnes of non-hazardous non-inert wastes sent to landfill create 2 employments whereas recycling these wastes would create 31 employments.

In this context, Democles aims at identifying the key factors to improve the recycling rate of finishing work in order to contribute to the European objective of 70% of the CDW by 2020. There are many existing initiatives to explore and an important need for homogenisation and professionalization of the practices.

1.2 Objectives

Democles aims at:
• Identifying the operational and economic difficulties related to on-site sorting and the treatment solutions;
• Defining a common and reliable framework for on-site sorting of finishing work wastes to develop recycling at a reasonable cost (including waste tracking by all stakeholders, from the client to the waste management company);
• Formulating practical and operational recommendations to be used by clients and C&D companies for wastes management (taking into account wastes management in call for tenders, wastes management tracking, etc.);
• Formulating some recommendations regarding the necessary training for on-site sorting (on-site trainings of C&D workers, work managers, etc.).

The issue is to make sure that all the stakeholders understand each other, the scope and the vocabulary are clearly defined and that the initiative outcomes are operational to ensure the perenity of the approach.

To reach these objectives and take into account the above issue, the initiative involves 28 stakeholders of the entire value chain. A steering committee is coordinating the project, four working groups are working on specific issues and up to 10 demolition sites are object to case studies in order to test and analyse some tracking tools as well as on-site sorting practices and treatment solutions.

The covered scope is demolition works. Construction works are not covered. It should be noticed that construction and demolition waste don’t necessarily encountered the same issues:
• Construction waste is produced by the construction company, who, as a producer, is liable for taking in charge the waste. The construction company is also able to act directly on the construction waste prevention through eco-design for example.
• Demolition waste is the responsibility of the demolition company, who has no leverage on waste prevention. The client is usually not involved in the waste management and doesn’t appear on the waste notes, issued between the demolition company and the waste management company (except...
for asbestos waste for which specific regulation applies). It is thus more difficult to implement sustainable waste management practices on demolition sites.

1.3. Results

The project is still on-going: the first conclusions are expected during the first quarter of 2016. However, here are the main achievements so far:

- Six case studies have been carried out: technical and economic data regarding generated, sorted and recycled wastes have been gathered. An economic and technical analysis is currently performed based on the collected data. This analysis aims at comparing the announced recycling rates to the real ones and assessing the economic impacts and the operational conditions for recycling.

- The four working groups have been working on the following issues:
  - A working group composed of demolition companies is leading a reflection on the on-site sorting: what are the economic and operational difficulties and what are the solutions?
  - A working group composed of recycling industries is focusing on recycling: what are the recycling options per waste categories and the associated costs? An economic modelling is in progress.
  - A working group composed of building management companies and C&D companies is studying the existing incentive tools as well as the needed tools to facilitate on-site waste tracking.
  - A last working group is focusing on training: they are thus working on training offers and confronting them to the actual training needs to issue some recommendations.

As of now, the involved stakeholders are convinced of the economic benefit of on-site sorting. However, recycling solutions are complex and not always developed for all the categories of wastes. For example, there are currently no recycling solutions for carpeting whereas there is a high potential for recycling.

Expected outcomes are mainly operational recommendations in terms of tracking tools, training needs or contract specifications to facilitate on-site sorting and improve finishing work recycling. The project also aims at gathering reliable data regarding technical and economic characteristics of the recycling chain per material.
2. Implementation of the initiative

In this section a practical approach on the implementation of the initiative is presented.

2.1 Planning of the initiative and actors involved

Democles was launched in November 2014 for a duration of 18 months, in the context of the French law for the energetic transition. This national law confirms the European target of 70% recycling of CDW by 2020. First conclusions are expected by early 2016.

Récylum, a French collective organism in charge of collecting electric and electronic equipment from buildings to ensure their recycling, has been appointed to coordinate the initiative. Récylum is dedicating 1 part time employee to the project. The budget is estimated to 500 000 euros and 2 full time employees. The project is financed by the ADEME, Récylum, Ares Services, GTM Bâtiment and Nantet.

Eight organisms, representing clients, C&D companies, waste management companies, recycling industries, material manufacturers, and public actors involved in building management, compose the steering committee:

- AICMAC, association of construction materials manufacturers;
- AMF, association of French mayors;
- CNL RQ, national neighbourhood association liaison committee;
- FIEEC, federation of communication, electronic and electronical industries;
- Récylum, collective organism approved by national authorities within the producer responsibility scheme;
- SNED, national union of demolition companies;
- SRBTP, union of building recyclers;
- UNTED, national union of economists of the building sector.

The initiative is also sponsored by the French ministries in charge of sustainability and economy as well as by the French environmental agency, the ADEME. Other stakeholders are involved in the working groups: Ares services, FILMM (national union of mineral wool insulation materials manufacturers), GTM bâtiment (subsidiary of Vinci Construction France), Iceb, IDF Démolition, Nantet, Nexity, Paprec Chantiers, Placoplatre, Siniat, SNRMP (national union of plastic material recycling), région Ile-de-France, région Rhône-Alpes, Solover, UPB (union of building plastics), Lyon, Vinci VIE, Etablissements Publics Fonciers IDF, Logements Français, Bouygues Immobiliers. In total, around forty organisations are involved in the Democles initiative.

2.2 Implementation of the initiative

Democles is implemented through four main steps:

- Step 1: Identification of actual and emerging practices in recycling of finishing work wastes;
- Step 2: Realisation of on-site case studies;
- Step 3: Formulation of technical and operational guidelines for on-site sorting;
- Step 4: Formulation of recommendations for clients and C&D companies as well as for training.

To implement these four steps, four operational working groups have been set up:

- “On-site sorting” – this working group composed of demolition companies is leading a reflexion on the on-site sorting: what are the economic and operational difficulties and what are the solutions?;
- “Finishing work materials recycling” – this working group composed of recycling industries is focusing on recycling: what are the recycling options per waste categories and the associated costs? An economic modelisation is in progress.
- “Clients and C&D companies” – this working group composed of building management companies and C&D companies is studying the existing incentive tools as well as the needed tools to facilitate
on-site waste tracking: they are thus working on training needs, call for tender paragraphs, allotment options.

- “Training” – this working group is working on training: what are the required skills and the population to be trained?

### 2.2.1. Steering committee role

The main role of the steering committee consists in reviewing the work performed by each working group. One of the key area of attention is to challenge the ideas of the groups according to the economic interests of all the involved stakeholders.

It should be noticed that gathering all the stakeholders involved in the demolition waste management is a first, as the stakeholders usually work as follows:

- Clients with project management companies;
- Project management companies with demolition companies;
- Demolition companies with waste management companies;
- Waste management companies with the recycling industries.

By gathering all the stakeholders, DEMOCLES aims at delivering a global perspective of the all the steps through the entire process. The professional associations involved in the steering committee express their support by signing a Charter of commitment detailing the purpose of the project and the role of the steering committee.

The steering committee should meet 6 times during the project. The agenda is sent prior to each meeting and minutes are written and shared after the meeting. As an example, the agenda of the meeting organized in June was the following:

- Feedback on the previous meeting’s minutes;
- Introduction of new partners;
- Work performed by two groups (clients and project management companies; on-site sorting).

At this stage of the project, no outcome has been made public yet.

### 2.2.2. Step 1: identification of actual and emerging practices in recycling of finishing work wastes

The objective of this first step is to gather the specifications of the recycling industries. To do so, two different tools are used:

- Litterature review:
  - ADEME’s studies
  - The union of building recyclers (SRBTP)'s guide on the conception and management of C&D waste treatment facilities²
    - The Web application of the French building association (FFB)³
- Questionnaire: stakeholders have been consulted thanks to a questionnaire gathering the following informations:
  - Stakeholder’s characteristic;
  - Waste types treated;
  - Waste acceptance criteria;
  - Treatment;
  - Collection’s area covered;
  - Market opportunities for the produced recycled material;
  - Identification of the waste stream on construction sites.

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³ Source: [http://www.ffbatiment.fr/Files/pub/Fede_N00/NAT_COMMUNIQUES_DE_PRESSE_3220/5bee6d1379db487396068971d61ae4b6/PJ/2015-01-07-application-dechetsBTP.pdf](http://www.ffbatiment.fr/Files/pub/Fede_N00/NAT_COMMUNIQUES_DE_PRESSE_3220/5bee6d1379db487396068971d61ae4b6/PJ/2015-01-07-application-dechetsBTP.pdf)
13 recycling industries have been identified: WEEE, lamps, carpeting, plastic (PVC), gypsum, gypsum with insulation material, glass, wood, ceramic, metal, windows and doors, tiles.

This focus group is also working on the waste processing in order to optimize waste recycling. For instance, glass or lamps can’t be collected as a mix with other wastes. The performed work enables to challenge the current on-site collecting practices, and raises the issue of on-site sorting.

Costs are also studies: the objective is to identify the recycling solutions with limited costs as well as the emerging solutions, keeping in mind that the limit is the landfilling cost. Treatment costs as well as waste management costs (on-site sorting, appropriate collection and storage) are taken into account.

2.2.3. Step 2: Realisation of on-site case studies

Case studies are one of the key factor of success of DEMOCLES. They aim at:

- Identifying the generated waste (quantities and characteristics; ratios of generated quantities per square meter per waste type);
- Establishing the time needed for selective demolition and on-site sorting of finished work waste;
- Defining the time needed for waste transportation;
- Gathering the key tools used by clients and C&D companies to anticipate waste management.

For each case study, common tools have been defined to gather homogenous data on finishing work generation, sorting and potential for recycling. The objective is to collect technical as well as economic data to assess the feasibility of the recycling options per materials.

The tools defined under DEMOCLES and to be used on each case study are the following:

- “Case studies specifications”: this document sets the scope of the case studies:
  - Waste streams covered: finishing works waste (walls, floors, roofs), excluding asbestos and lead waste as well as building’s structure inert waste;
  - Case studies covered: heavy remediation work, demolition sites;
  - Buildings covered: min. 1000 m² buildings, housing, hotels and tertiary activities buildings are eligible.
- “Case studies data”: this document aims at collecting the qualitative and quantitative data of each case study, including:
  - General information on the case study: date, involved stakeholders, number of workers, building’s characteristics, surface;
  - And for each step of the demolition work: action (demolition, sorting, evacuation, prestorage, preparation), waste characteristics (wall, floor, roof, equipment, etc.) and measurements (surface, weight), allocated time, needed tools to perform the action.
- “Clients and management companies data”: this document enables to gather the information regarding waste management (preliminary studies to establish the specifications, tracking documents).
- “Table of data”: this tool is used to track waste evacuations (containers, weights, destination).

The stakeholders of Democles want the initiative to be as operational as possible. On-site case studies appeared to be a key factor of success to gather real data and identify on-site practices and operational opportunities for recycling.

It was initially planned to study up to 10 projects. So far, the involved stakeholders have volunteered for 6 projects that have been studied in the first semester of 2015. These case studies cover remediation works with a preliminary demolition step. They are split according to the occupation of the building, which impacts the logistic, and according to the usage, giving information on the building’s conception and potential materials:
Based on the data collected on-site by each stakeholder, Récylum is analysing these data to assess the performance, the technical conditions as well as the economic feasibility of recycling options per materials. So far, it appears that solutions may exist for some materials and be economically interesting but specific conditions should be implemented during the on-site sorting to enable the recycling. For other materials, sorting may be easy and quantities could be important enough to study a recycling option but none exists. Another interesting finding is that it appeared difficult to obtain the construction date of the buildings whereas this information is key to identify the potential materials used in the buildings construction.

<table>
<thead>
<tr>
<th>Focus on one case study</th>
</tr>
</thead>
</table>
| **Building characteristics** | Hotel  
| | 40 rooms, 4 floors  
| | Surface: 2934 m² |
| **Remediation work** | Demolition of floors covers  
| | Demolition of light walls  
| | Demolition of walls covers and ceilings  
| | Demolition of the bathrooms  
| | Evacuation of the equipments |
| **Waste sorting** | Waste were sorted into 3 containers: woods, inert waste, non hazardous waste  
| | Waste were evacuated from the building using conveyer and a telescopic bucket |
| **Recycling options** | Wood waste were recycled by ECO3BOIS, a company created by SERFIMRECYCLAGE and EGGER. Wood waste are recycled into wood panels.  
| | Non hazardous waste, collected as a mix, were evacuated in a sorting facility that separates paper, cardboard, plastics according to their colors and characteristics, gypsum, inert waste, polystyrene, wood, iron, other metal. The resulting recovering rate is over 78%.
| **Results** | 77% of the collected waste were recovered. |
### 2.2.4. Step 3: Formulation of technical and operational guidelines for on-site sorting

Based on the experience of the involved stakeholders as well as on the lessons learned from the case studies, this part of the project aims at formulating technical and operational guidelines for on-site sorting. The first step consists in comparing the waste streams managed on each case study to be able to draft general guidelines. Three indicators have been defined:

- Generated waste per surface (quantitative and qualitative data);
- Real recovery rate compare to potential recovery rate if better logistic was implemented;
- Total cost including selective demolition, transportation, treatment costs.

No outcome has been made public yet.

### 2.2.5. Step 4: Formulation of recommendations for clients and C&D companies as well as for training

The last part of the project aims at defining the objectives and the tools for the clients and the C&D companies. Even though the C&D company is responsible for the demolition waste, the implication under this responsibility is not well understood by all the stakeholders.

The main following issues have been raised:

- Communication and information regarding waste management responsibility should be improved;
- Existing tools that the C&D companies may use should be assessed;
- The practice of waste diagnosis should be analysed: waste diagnosis is a regulatory tool defined by Decree n°2011-610 du 31 mai 2011 and according to a study from the national union of demolition companies (SNED) only 12% of working sites comply with this obligation.

The objective is also to identify how to improve waste management efficiency, through a simplification of the administrative requirements for instance.

So far, the on-going analysis of 12 waste diagnosis shows that:

- There are important gaps between the data given in the waste diagnosis and the real waste generation, both in terms of waste characteristics and quantities: the training of the people in charge of waste diagnosis probably needs to be improved;
- In some cases, the project management doesn’t allow the reconciliation between the waste diagnosis and the generated waste, as most of the waste are evacuated as a mix.

The national union of demolition companies (SNED) has set up a waste management software to perform waste registration and reconcile the data with waste diagnosis.

#### Focus on the tool SOGED – Management organization and waste evacuation scheme

This tool is a contractual document required by the management company. It defines the recovery options prior to the work.

DEMOCLES aims at analyzing some examples of this scheme and a first insight shows that these schemes are mostly used to list different recovery options per waste streams without being specific to the concerned work and without analyzing the potential for recovery.

Preliminary outcomes include:

- The responsability of each stakeholder must be clearly defined and could be as follow:
  - The client is responsible for the waste and takes into account waste management costs and tools in its specifications and budget;
  - The project management company identifies the different materials and waste streams, assess the potential for recovery identifying clearly the potential waste treatment options and ensures waste tracking during the project;
  - The demolition company takes into account the assessed waste generation in the organization of its work, knows the chosen recovery options, tracks the waste;
The waste management company suggests appropriate containers, establishes traceability and calculates the recovery rates.

- Two improvements have been pointed out:
  - Project management companies need to improve their knowledge in waste management (identification, recovery potential assessment, tracking);
  - Waste management companies should suggest more appropriate options to facilitate waste recovery (containers, waste tracking data).

2.3 Factors of success

Even though the project is still on-going, the following key factors of success may be highlighted:

- Involvement of all the stakeholders: when dealing with demolition waste, involving all the stakeholders, from the clients to the recycling industries, is a key factor of success to identify appropriate solutions adopted by all the parties;
- Case studies: having a diagnosis based on real case studies as well as on specific examples of how existing tools may be used is a key factor of success to identify the area of improvements and be able to formulate recommendations that are as specific and pragmatic as possible;
- Sufficient budget: important budget and human resources are allocated to this project. It is important to ensure the continuing involvement of the stakeholders and to be able to draw the conclusions.
- Public support: the involvement of the ADEME enables to make sure that the project gives conclusions that are compliant with the national waste management policies and regulations.
3. Lessons learned

C&D projects involve various actors. DEMOCLES, by involving all the stakeholders, aims at facilitating the definition of each player’s responsibility and scope of actions. Good practices exist but still need to be developed to become common practices.

3.1. Preconditions for application of the initiative – replicability

In order to replicate such an initiative, it is important to ensure that the initiative is collective, involving all the stakeholders and operational, in order to develop ready-to-use solutions and tools.

The recommendations need to be based on operational data and must include the economic perspective to convince all the players and to ensure their feasibility.

Furthermore, dialogue between all the various parties on a construction site (from the client to the industrials using recycled materials) is essential in order to:

- Understand the scope of responsibility and intervention of each actor;
- Set objectives and associated working framework in coherence with operative feasibility;
- Discuss the objectives and the implementation of waste recovery.

3.2. Received ideas

One of the major issues of DEMOCLES project is to overcome received ideas about the difficulty of setting up an organisation capable of meeting organisational, economic, social and environmental challenges.

In this industry, the weight of habit is one of the main barriers to remove.

The below table shows a few received ideas and the associated answers, resulting from the discussions between the project stakeholders.

<table>
<thead>
<tr>
<th>Received ideas</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responsibility issues</strong></td>
<td><strong>FALSE:</strong></td>
</tr>
<tr>
<td>« Waste management is solely the responsibility of construction companies and/or waste managers »</td>
<td>Construction waste management is the responsibility of all stakeholders, starting with the client. The client is required to characterize their waste (beyond the diagnosis). Other stakeholders (such as prime contractor, construction firms, waste managers) are required to ensure proper waste management and are co-responsible in light of the regulations in force.</td>
</tr>
<tr>
<td><strong>Economic issues</strong></td>
<td><strong>FALSE:</strong></td>
</tr>
<tr>
<td>« Sorting on a construction site is expensive »</td>
<td>The 6 construction sites evaluated show that a selective dismantling allowing an effective recovery of waste has the same cost as mixed waste treatment. The economic analysis has highlighted hidden costs not taken into account by companies when they choose treatment and recycling schemes. Indeed, a significant part of the sub-trade elements are “naturally” sorted. Conditioning them for disposal as mixed waste</td>
</tr>
</tbody>
</table>
means extra handling an additional handling and therefore extra costs.

However, only six building sites have been tested so far, so caution must be taken as the economic analysis of waste management is related to the specificities of each site. But this is indicative of the economic feasibility of implementing a more ambitious waste management policy and a methodology with selection criteria for the different actors.

Environmental issues

« Disposing mixed waste enables their recovery »

**FALSE:**
The recovery rate of non-hazardous mixed waste on a sorting center in France is estimated at less than 35%.

To the extent possible, sub-trade waste generated on a construction site must be disposed separately in order to avoid their mutual contamination, which is an obstacle to recovery: glass, gypsum, WEEE, carpeting, PVC flooring…

Social issues

« Waste management does not require specific training »

**FALSE:**
The work of the DEMOCLES project have shown that waste management is an under-treated issue during work preparatory phase. Hence, it is necessary to train the different actors:

- Prime contractors
- Waste diagnosticians
- Works supervisors
- Team leaders
- Waste managers

3.3. Innovation potential

Communication and information are indeed necessary to change things. However, in order to improve construction waste management, some innovations are essential.

Such a project may produce outcomes that will facilitate the development of innovative solutions through:

- A better knowledge of demolition sites to improve on-site waste management and suggest better containers and storage solutions. Indeed, it implies that waste managers put in place alternatives to skips in order to offer waste recovery solutions coherent and adapted to each building site. This would require a modification of the current logistic model (conditionning, transport, traceability);
- A better knowledge of waste streams to develop recovery options;
- A better collaboration between all the players to improve waste identification, management and tracking. This requires the creation of collaborative waste management monitoring tools, in order to:
  - Secure legal aspects for each actor;
  - Anticipate waste management as early as the work preparation phase;
  - Ensure regular monitoring of waste management during the execution phase;
  - Simplify document management during waste tracking.
4. References

Contacts
- Interview with Fabienne Landeroin – Responsible of the coordination of DEMOCLES (Récylum)
- Interview with Guillaume Pillet – Project engineer (Nantet, Serfim Recyclage)

Sources of documentation
- Press release on Democles
- Tools developed under Democles project: Case studies specifications, Case studies data, Clients and management companies data, Table of data
- Powerpoint presentation of the case study presented by Nantet, Serfim Recyclage
- Waste diagnosis, decree n° 2011-610 du 31 mai 2011
- Demolition work, recommendations UNTEC – SNED http://www.dechets-chantier.ffbatiment.fr/
- Work produced by the French building association, Fédération Française du bâtiment http://www.dechets-chantier.ffbatiment.fr/
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