Cluster	Renovation for social and cultural facilities							Housing						
Project Surface (m²)	1.009	3.650	4.000	4.000	160	200	255	255	290	1.200				3.350
New construction							TRUE			TRUE				TRUE
Layers with reuse	8	4	7	1	4	5	2	4	2	1				2
Project ID	#01	#02	#03	#04	#05	#06	#07	#08	#09	#10				#14
Structure														
Total mass layer (kg)	20.133	not calc.	178.130	not calc.	16.968	not calc.	not calc.	19.080	not calc.	not calc.	12.709.000	not calc.	301.674	9.308.260
Reused mass layer (kg)	8.674	0	11.590	0	1.388	0	0	2.784	0	0	98.000	0	28.915	0
Reuse rate (%)	43,08%	0,00%	6,51%	0,00%	8,18%	0,00%	0,00%	14,59%	0,00%	0,00%	0,77%	0,00%	9,58%	0,00%
Skin														
Total mass layer (kg)	1.505	18.721	23.296	not calc.	not calc.	11.325	36.883	26.157	15.966	160.414	2.517.000	not calc.	244.996	357.892
Reused mass layer (kg)	300	0	4.526	0	0	7.595	5.412	585	5.056	89.238	0	0	19.402	0
Reuse rate (%)	19,94%	0,00%	19,43%	0,00%	0,00%	67,06%	14,67%	2,24%	31,66%	55,63%	0,00%	0,00%	7,92%	0,00%
Space Plan														
Total mass layer (kg)	30.157	358.841	60.870	62.895	18.162	4.855	38.321	34.016	125.279	not calc.	1.852.000	1.343.958	62.020	1.466.998
Reused mass layer (kg)	15.468	3.744	12.770	16.540	3.095	405	3.207	2.183	2.355	0	182.000	25.686	833	63.123
Reuse rate (%)	51,29%	1,04%	20,98%	26,30%	17,04%	8,34%	8,37%	6,42%	1,88%	0,00%	9,83%	1,91%	1,34%	4,30%
Service - HVAC														
Total mass layer (kg)	8.027	13.391	22.471	not calc.	2.800	2.262	not calc.	3.310	not calc.	not calc.	32.500	32.428	43.342	43.550
Reused mass layer (kg)	61	6.952	1.990	0	825	82	0	336	0	0	0	8.500	0	0
Reuse rate (%)	0,76%	51,92%	8,86%	0,00%	29,46%	3,64%	0,00%	10,15%	0,00%	0,00%	0,00%	26,21%	0,00%	0,00%
Rule of thumb used						TRUE		TRUE			TRUE		TRUE	TRUE
Service - Elec														
Total mass layer (kg)	683	not calc.	16.207	not calc.	not calc.	not calc.	not calc.	1.018	not calc.	not calc.	10.000	not calc.	13.336	13.400
Reused mass layer (kg)	129	0	207	0	0	0	0	0	0	0	0	0	312	0
Reuse rate (%)	18,91%	0,00%	1,28%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	2,34%	0,00%
Rule of thumb used			TRUE					TRUE			TRUE		TRUE	
Service - Sanitary														
Total mass layer (kg)	248	3.702	4.424	not calc.	480	44	765	764	not calc.	not calc.	7.500	not calc.	10.002	10.050
Reused mass layer (kg)	132	1.499	824	0	405	30	30	0	0	0	0	0	0	0
Reuse rate (%)	53,25%	40,49%	18,63%	0,00%	84,38%	67,77%	3,92%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Rule of thumb used								TRUE			TRUE		TRUE	TRUE
Outdoor - Infrastructure														
Total mass layer (kg)	7.754	N/A	42.375	N/A	N/A	not calc.	not calc.	N/A	not calc.	not calc.	3.676.000	N/A	N/A	N/A
Reused mass layer (kg)	0		0			0	0		0	0	0			
Reuse rate (%)	0,00%		0,00%			0,00%	0,00%		0,00%	0,00%	0,00%			
Outdoor - Surfaces														
Total mass layer (kg)	130.947	N/A	36.964	N/A	N/A	872	not calc.	N/A	not calc.	not calc.	1.038.000	N/A	N/A	112.646
Reused mass layer (kg)	130.947		6.370			773	0		0	0	3.000			97.410
Reuse rate (%)	100,00%		17,23%			88,67%	0,00%		0,00%	0,00%	0,29%			86,47%
Outdoor - Furnishings														
Total mass layer (kg)	2.317	N/A	N/A	N/A	N/A	not calc.	not calc.	N/A	not calc.	not calc.	not calc.	N/A	N/A	N/A
Reused mass layer (kg)	1.955					0	0		0	0	0			
Reuse rate (%)	84,39%					0,00%	0,00%		0,00%	0,00%	0,00%			
Total reuse rate (when available)														
Total mass of materials (kg	201.771		384.737		38.410	19.358	75.970	84.345	141.245	160.414	21.842.000	1.376.386	675.369	11.312.795

SET, MONITOR AND REPORT ON RECLAMATION AND REUSE RATES IN CONSTRUCTION PROJECTS

A COMMON APPROACH

SET, MONITOR AND REPORT ON RECLAMATION AND REUSE RATES IN CONSTRUCTION PROJECTS

A COMMON APPROACH

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The FCRBE project aims at enhancing by 50% the quantity of materials being reclaimed for reuse in North West Europe by 2032. This guidebook has been prepared in the context of the project capitalisation (2022-23). It corresponds to the deliverable WP T4.2.1.

https://vb.nweurope.eu/fcrbe

The content of this document has been tested, promoted and validated through four live tests and three study trips (Brussels, Rennes and Utrecht) entailing the participation of contracting authorities and other construction professionals.

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Interreg
North-West Europe
FCRBE
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TABLE OF CONTENT

1° INTRODUCTION

1.1 What is this document all about?

The present document is aimed at project owners and public authorities as well as at any organisation that needs to set, measure and report on rates of material reuse in construction and renovation projects for buildings and outdoor spaces (roadworks and landscaping).

The present document sets out a framework and provides recommendations for expressing these rates.

This document is supplemented by three other reports. Together, these four reports form a comprehensive overview of all aspects relating to reclamation and reuse rates. The four documents are as follows:

1. *Set, monitor and report on reclamation and reuse rates in construction projects. A common approach.* This is the present document. It sets out the necessary definitions and presents the main methodological aspects for dealing with the issue of reuse and reclamation rates.

2. *Ex-post analysis of 32 construction and renovation works. Results and discussions.* This document sets out how we calculated and analysed the reuse rates achieved in a sample of 32 recently completed projects. These projects are grouped into 5 clusters representing various scales and types of work. The reuse rates were calculated using the method proposed in the present document *(Set, monitor and report on reclamation and reuse rate in construction projects)*. These results provide an overview of the rates that can be achieved in various contexts[1].

3. *32 detailed project sheets. Projects info, reused rates and reused elements.* This document complements the projects analysis. It details the results achieved in each project with regards to their specificities. It also provides a detailed overview of the quantity and nature of reused elements.

4. *Live tests. Report on 4 operations using reuse targets.* This last document reports on live tests which allowed us to test, within ongoing projects, the methodological aspects framed in the present document.

1.2 Context

The Interreg NWE 937 FCRBE project

This document has been prepared as part of the capitalisation of the Interreg NWE 739 FCRBE project *(Facilitating the Circulation of Reclaimed Building Elements*). It should be considered as a complement to the deliverable *Procurement Strategies. Integrating reuse in large-scale projects and public procurements*[2]. We recommend that you read it before reading this document.

In the *Procurement Strategies* guidebook, we describe five procedures for integrating material reuse into different types of

1- Our analysis exclusively focuses on the reuse rate, and not on the reclamation rate. We explain why in chapter 4 of this document. We also explain the difference between reclamation and reuse rates in chapter 2.
2- FCRBE, *Reuse Toolkit. Procurement Strategies. Integrating reuse in large-scale projects and public procurements*. February 2022. Available online: https://vb.nweurope.eu/media/16916/wpt3_d_2_2_procurement_strategies_20220208.pdf

projects. These procedures have been designed to match with the requirements of public procurements.

Different ways of expressing a reuse objective

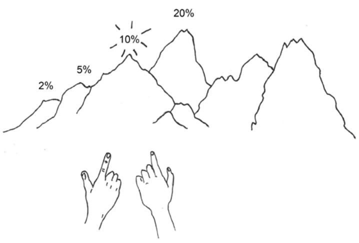
The five procedures have a common basis: the idea of clearly expressing the objective of reusing materials. This objective can then be incorporated into the procurement documents, especially when putting a project out to bid (whether in a public or private context).

We have shown that there are different ways to express such an objective:

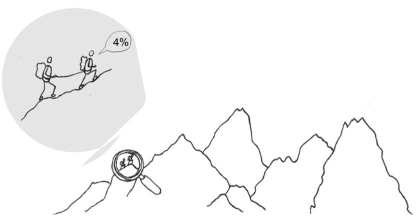
- With a more or less open degree of precision (for example, depending on whether or not the material to be reused or the application are already known).

- Either qualitatively or quantitatively.

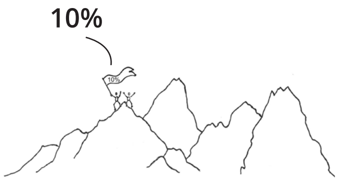
☞ Setting a quantitative objective is a special case among a range of possibilities. When such a quantitative objective is set, it is necessary to have a clear, common and transparent method defining what is being measured – and how. The present document aims to meet this expectation. It corresponds to the verb “to set” used in the title.



The second verb in the title, “to monitor”, is the counterpart of the first. It refers to following the progress towards the announced objectives. This step is essential to prevent an objective announced early on from being lost sight of as the project develops. In particular, it involves taking advantage of the main steps in the life of a project to update the progress of reclamation and/or reuse rates.



The third verb, “to report”, refers to the principle of communicating afterwards on the results achieved at the level of a project, a group of projects or even a given area. This reporting can complete the process started by the formulation of the initial objective and extended by the monitoring efforts. It shows to what extent the initial objectives have been met, exceeded or missed – and why.



Such reporting can also be carried out independently, for example to analyse retrospectively the reuse rates achieved within a sample of given projects (for example, over a given period and in a given geographical area).

Similar approaches

The idea of measuring reclamation and reuse rates is not new. In 2008, a UK guidance document on the reuse of materials already identified this as a possible strategy[1]. It proposed setting reuse rates in works contracts in order to encourage reuse.

Since then, the idea has found its way into a number of frameworks, including guidance documents on the environmental impact of construction and public space development projects. To give just a few examples, quantitative approaches to the reclamation and reuse of building materials can be found in the following frameworks:

- **GRO** ((Belgium, 2022). The GRO is a guidance tool developed by the Belgian authorities to set levels of ambition for the sustainability and circularity of construction works. One of the proposed criteria (MAT1) relates to the conservation of raw materials and is based on the principle of measuring the percentage of materials reclaimed on site.[2] This criterion combines two movements of flows that we propose to keep separate here (see chapter 4 and chapter 5). In practice, the inventory method proposed by the GRO is similar to the measurement of reclamation rates as defined in this document (see point 2.2). The unit proposed in the GRO's inventory of reusable materials is, as in this document, the kilogram (kg).

1- *Reclaimed building products guide. A guide to procuring reclaimed building products and materials for use in construction projects.* Wrap, 2008. Voir notamment p. 13: "Project Requirement [...]. To exceed a % reused and recycled content and adopt the top opportunities for good practice."
2- Agentschap Facilitair Bedrijf, GRO. *En route vers des projets de construction tournés vers l'avenir. Critères pour site et bâtiments - version 2020.*1, p. 137-139. Available online: https://www.gro-tool.be/downloads/3_Crit%C3%A8res.zip

- **Platform CB'23** (Netherlands, 2022). The *Circulair Bouwen in 2023* [Building Circularly in 2023] platform aims to provide contracting authorities with tools to facilitate the integration of circular principles into public procurement. To this end, it includes a collection of standard clauses as well as general guidance documents. In particular, the document *Meten van circulariteit*. *Meetmethode voor een circulaire bouw* sets out several formulas for measuring the contribution to the resource conservation indicator. One of these formulas concerns the reuse of materials. It is expressed in a very similar way to what we propose below for measuring the reuse rate, including the choice of metric, in this case mass (see point 2.3 and chapter 5°).

- ***European taxonomy for sustainable activities*** (2020). The European taxonomy is a classification drawn up by the European authorities. It aims to establish a list of economic activities considered to be environmentally sustainable and proposes that these should be eligible for tax benefits for investors. This measure is in line with the European Green Deal and international objectives for the transition to a sustainable and circular economy[1]. In March 2022, the Sustainable Finance Platform Working Group published a technical annex detailing the various criteria that must be met to be considered a sustainable investment[2]. As regards the construction sector, and more specifically new construction and building renovation projects, one of the four criteria relating to the circular economy stipulates that a minimum reuse rate of 15% (by mass or surface area) should be achieved (and that a total reclamation rate - reuse and recycling - of 50% should be achieved). For renovation projects, it is also stipulated that a retaining rate of 50% should be achieved. To date, these criteria have not (yet) been transposed into legal provisions. In

1- Cf. *REGULATION (EU) 2020/852 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088.* Available online : https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0852

2- Platform on Sustainable Finance: Technical Working Group, *PART B - Annex: Technical Screening Criteria*, mars 2022, p. 358-373. Available online : https://commission.europa.eu/document/download/61fc8248-289d-4985-be27-1587da2660f2_en?filename=220330-sustainable-finance-platform-finance-report-remaining-environmental-objectives-taxonomy-annex_en.pdf principle (notwithstanding the values proposed for these rates), these criteria correspond to the various concepts we develop below (see chapter 2°).

In short

Setting a quantitative reuse objective can therefore have several uses:

Depending on the time frame:

- Formulate an ambition that should be achieved in the future *(a priori*).

- Communicate on a result achieved in the past (*a posteriori)*.

- Monitor the progress between these two moments (continuous evaluation).

Depending on the scale at stake:

- A building or public space construction or renovation project, or part of it (cf. point 5.1).

- A whole area.

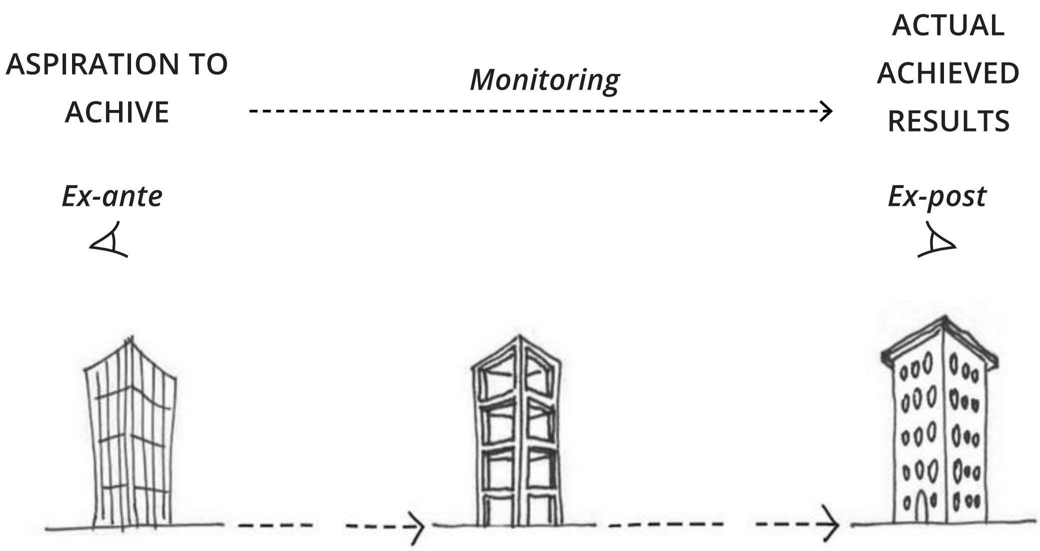
Depending on the framework of the project:

- Voluntary approach to limiting environmental impact by reusing materials.

- Incentive framework, for example with a view to obtaining environmental certification or being considered as a sustainable investment.

- Regulatory framework, for example to meet internal requirements set by an organisation or requirements set by public authorities.

These different uses can of course complement each other.


ASPIRATION TO ACHIVE
Monitoring
ACTUAL ACHIEVED RESULTS
Ex-ante
Ex-post

2° DEFINITIONS

The elements of the method proposed here draw on important distinctions between different concepts. These are defined in the present section.

2.1 Stock vs. flows - preservation rate

☞ A first key point is to clearly distinguish stock from flow logic.

In our approach, the *stock* corresponds to pre-existing developments that are the subject of transformation projects. This “stock” is constituted by the range of materials that make up buildings, roads, public spaces…

Foreseen projects will transform to some extent these existing stocks:

- Minimally if the project involves only light renovation work.

- In a much more substantial way if the work involves a major renovation of an existing development or even a complete demolition followed by a reconstruction.

☞ In any case, the transformations of the existing stock can be measured and expressed as a preservation rate[1].

☞ Whatever their nature, the planned works will indeed entail movement of materials – hereinafter referred to as *flows.* These involve both outgoing materials (i.e. everything that is removed from the original building: flow out) and incoming materials (i.e. everything that is brought to the site to carry out the new work: flow in).

In this logic, the stock corresponds to what does not move. In other words, the part of the existing facilities that is preserved, that remains in place, that is not put into circulation.

☞ From a circular economy and responsible resource management perspective, the primary objective should be to maximise the preservation of the stock. By extension, this means minimising the generation of flows (out and in). This should always be seen as the preventive approach to be considered as a priority.

Preservation rate

The preservation rate can be expressed according to the following formula:

$$\textit{Presevation rate}\ (\%) = \frac{\textit{Quantity of retained building}}{\textit{Quantity of original building}}$$

According to this approach, a full demolition scenario would result in a rate of 0 % since the mass of the non-demolished building would be equal to 0 kg.

In contrast, a light renovation scenario, which largely retains the structure, envelope, and some of the finishes, can reach a relatively high preservation rate. For example, a project that aims to achieve a 90 % preservation rate should be understood as a project in

1- Obviously, transformation work also has an impact on other aspects: energy consumption, greenhouse gas emissions, changes to biodiversity, etc. We are focusing here on the issue of material flows.

which 90 % of the materials making up the original building will be preserved and kept in place during the conversion work.

In a new-built project taking place on an empty plot, the materials preservation rate would be irrelevant since there would be no pre-existing stock.

2.2 Flow out - reclamation rate

The outflows correspond to all the materials and components that are removed from the original building during demolition and renovation work.

Flows out can take different forms depending on the nature of the original materials and components, but also on the demolition practice. These can be very expeditious and destructive, in which case they will tend to generate more mixed waste, or, on the contrary, be more careful and preserving, allowing for the proper reclamation of building materials and elements.

Reclamation rate

The reclamation rate refers to the fraction of materials and elements extracted from the original site that are carefully reclaimed with a view to being reused for a new purpose (whether on the same site or on another site, and whether or not they are processed by a professional reclamation company). This rate can be expressed as follows:

$$\text{Reclamation rate (\%)} = \frac{\text{Quantity of material reclaimed for future reuse}}{\text{Total quantity of disposed materials}}$$

We include in the reclamation rate elements dismantled from the original building that will be reused in the new work (i.e. same-site reuse scenario). However, in accordance with what is indicated above, we exclude materials and components that are not dismantled, that remain in their original place and that therefore participate in the efforts to retain the existing stock.

Detailed breakdown of the flow out

To give a more complete picture, it is also possible to calculate the fractions of disposed materials that are subject to:

- Recycling.
- Energy recovery.
- Landfilling.

This breakdown builds on the waste management hierarchy set out in the European Directive on waste[1]. Applied to each project, this breakdown, which measures the fractions reclaimed for reuse, recycled, recovered as energy or landfilled, gives a good overview of the efforts undertaken to ensure responsible resource and waste management.

2.3 Flow in - reuse rate

Renovation and construction works result in a flow of incoming materials. These are all the materials and components that are used on the site to carry out the planned works.

Reuse rate

What we are interested in here is the proportion of materials reused in the course of these works. It is then possible to express the reuse rate as follows:

$$\text{Reuse rate (\%)} = \frac{\text{Quantity of materials reused during the works}}{\text{Total quantity of materials used for the works}}$$

This rate includes materials that were reclaimed from the original building and reused on the same site. However, it excludes

1-*DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives, and DIRECTIVE (EU) 2018/851 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 amending Directive 2008/98/EC on waste.*

materials and components that have been retained in place in an effort to preserve the stock.

Detailed breakdown of flow in

To give a more complete picture, it is possible to break down the flow in into different fractions, according to their nature or origin:

- Bio and geo-based materials (minimally transformed and sustainably managed).

- Materials with a recycled content (percentage of recycled materials in the composition of a material or component).

- New materials.

- Etc.

This breakdown provides an overview of the efforts made to source sustainable and low-impacting materials – an aspect that can be decisive in reducing the environmental impact of construction projects.

2.4 Absolute or relative value?

As the formulae above show, we propose to express the measure of reclamation and reuse efforts as a ratio between different material flows.

Why work in relative rather than absolute terms?

The main reason is that it allows for addressing a wide variety of situations and project scales. It also allows for a form of comparability between different projects, which may be very different in terms of absolute quantities. It is therefore a clear way to report on the efforts undertaken in each project.

☞ However, this approach assumes that two values are known: (1) the quantity of materials reclaimed and reused, and (2) the total quantity of materials evacuated (including non-reclaimed waste) and used (including new materials or materials from sources other than reuse). In practice, this second part can be time consuming as it involves measuring all materials disposed of and used during the works (we will see below how these flows can be subdivided).

In some contexts, it is possible to set a reuse target in absolute quantity. For example, ask for 10 tonnes of bricks to be reused in a particular masonry work. This approach can be relevant when the batch of materials to be reused and the needs to be met are clearly identified. However, it loses comparability. It is indeed not known whether these 10 tonnes represent a small or a big fraction of all the materials involved. 0,1 % ? 50 % 99,9 % ?

2.5 Beware of confusion !

It is crucial to make a clear distinction between stock and flow management. Mixing these two logics creates confusion and can make it impossible to compare different projects. It also distorts the debate on the subject.

EXAMPLE:

Let’s consider a building of 100.000 tonnes.

The renovation project enables preserving 60.000 tonnes of the original building.

Of the 40,000 tonnes of waste, 32,000 tonnes are sent for recycling, 6,000 tonnes are disposed of as final waste (incineration and/or landfill) and 2,000 tonnes of materials are reclaimed for reuse.

The renovation works also required 60,000 tonnes of materials, of which 1,000 tonnes came from the reuse sector.

The way to communicate about this project should take the following form:

STOCK	**Preservation**	Original building (t)	100.000
		Retained parts (t)	60.000
		Preservation rate (%)	60 %

FLOWS	OUT	Total weight OUT flows (t)	40.000
		Reclaimed materials (t)	2.000
		Reclamation rate (%)	5 %
	IN	Total weight IN flows (t)	60.000
		Reused materials (t)	1.000
		Reuse rate (%)	1,7 %

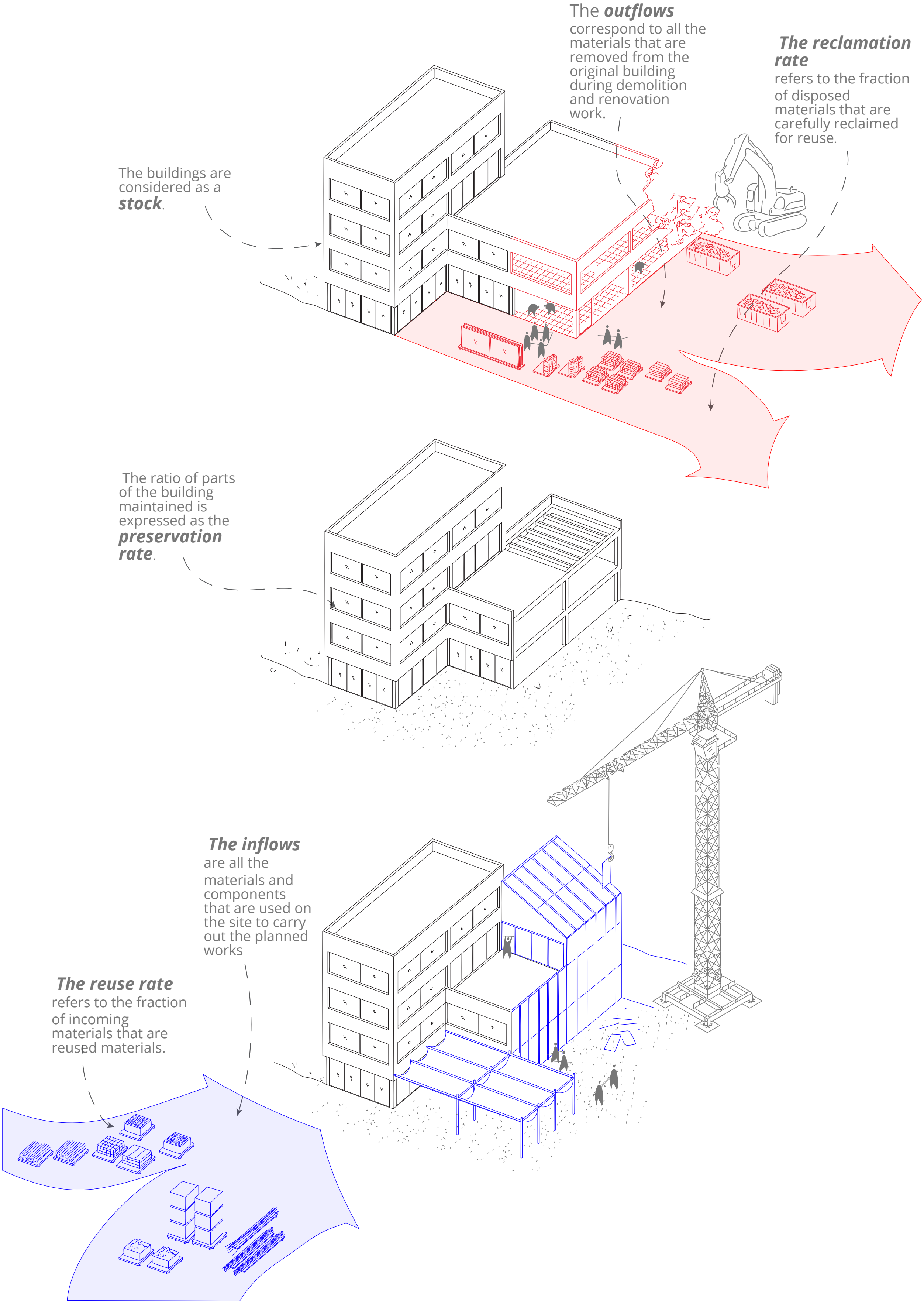
The table of the flows could be further broken down. For the flow out, based on the available data, this would give :

- Recycling rate = 80 %
- Rate of ultimate waste = 15 %
- Reclamation rate = 5 %
- Total = 100 %

However, the following aspects must be avoided in order to maintain precision and transparency:

- Mixing preservation and reuse rates.
- Mixing reclamation and reuse rates.
- Mixing outflows and inflows in general.
- Mixing reclamation and recycling rates.
- Use vague expressions such as ‘recovered materials’, which can refer to potentially very different factions (from materials being reclaimed for reuse to materials being incinerated with energy recovery)
- ...

Set, monitor and report on reclamation and reuse rates in construction projects



THEY DID IT :

Estimating preservation, reclamation and reuse rates during the preliminary project phase (Live test at Wiltz)

Exterior of the builing - Wiltz © Rotor

As part of the renovation of a building by the Luxembourg Housing Fund, in the context of the conversion of a former industrial site in Wiltz (Luxembourg), an estimate of the preservation, recovery and reuse rates was calculated at the preliminary design stage.
This calculation was based on the recommendations of the present method. It made it possible to clarify and prioritise the various circular ambitions already present in the dynamics of this exemplary project.
The attention paid from the outset to preserving as much of the existing building stock as possible has resulted in a very high preservation rate. The attention paid to the possibilities of reclaiming and reusing materials was also reflected in objective data, which made it possible to support certain approaches, such as the one initiated by the project owner to retain as much as possible of the natural slate of the existing roof (a batch contributing significantly to the preservation rate).

This operation gave rise to a FCRBE live test. To go further, see *Live tests. Report on 4 operations using reuse targets.*

Survey of potentially reusable materials: cast-iron radiator - Wiltz © Rotor

Survey of potentially reusable materials : slate tiles- Wiltz © Rotor

3° WHEN IS IT RELEVANT TO SET A QUANTITATIVE TARGET?

In this chapter, we discuss different cases where it is interesting to use quantitative reclamation and reuse targets.

3.1 Pros and cons

In general, the use of a quantitative target in a project development approach has pros and cons that need to be carefully weighed before opting for this approach:

+	-
- Translates a general intention into a clear objective. - Allows comparison of different offers. - Allows for flexibility in how to achieve the objective. - ...	- May induce bias according to the measurement units (see point 5.1). -Requires a rigorous framework (definitions, methods, targets, etc.). - Requires additional steps and procedures. - Award criteria need to be carefully weighted. - ...

3.2 Incentive or contractual?

A distinction must be made between two cases :

1. The objectives are incentive-based. They are internal objectives, specific to a project. They make it possible to give a common direction to the parties involved and to support certain decisions, but do not constitute an element of appeal should they not be achieved. Example: a private project owner decides to set internal reuse or reclamation targets in order to give shape to its ambition to develop more circular practices.

2. The objectives are contractual. The aim here is to make the objective determining when awarding a contract. The objective may be included in an award criterion or as a technical specification for the contract. The objective may be fixed (a percentage to be achieved) or open (in which case the percentage is left to the tenderers' discretion). It is also possible to formulate minimum thresholds, which bidders must meet anyway, while inviting them to surpass these values (and, where appropriate, to award better points to tenders offering better performance).

☞ In any event, setting the rates is crucial: if they are too low, they may not encourage service providers to make the best efforts or miss out on certain opportunities; if they are too high, they may discourage bidders from submitting an offer. In some cases, it is possible to establish these values in dialogue with the market. This is an appropriate way of benefiting from the tenderer's experience.

Setting contractual targets require solid preliminary studies :

- For **reclamation targets**, most of the uncertainties about the reuse potential of the elements concerned must be resolved. This is largely based on a good inventorying campaign: see chapter 4°.

THEY DID IT :

A competitive dialogue to establish reuse rates with bidders (Live test in Utrecht)

In the context of roadworks, the City of Utrecht wanted to set quantitative targets to encourage bidders to reuse materials. Despite a good preparatory study of the materials available for reuse on site, the City of Utrecht found it difficult to express an appropriate target for new developments. This was because they lacked knowledge of a potentially crucial variable: what supply options were available to bidders? To overcome this obstacle, the City of Utrecht decided to adapt the procedure for awarding the contract. Instead of a traditional call for tenders, they opted for the competitive dialogue procedure. This allows the bidders to be involved in a discussion on the achievable rates, while taking into account the many factors involved (technical, economic, etc.). In this case, the reuse rates will be set in dialogue with the main parties concerned.

This operation gave rise to a FCRBE live test. To go further, see *Live tests. Report on 4 operations using reuse targets.*

- For **reuse targets,** the values set need to be plausible, particularly in the light of the experience of the parties involved, the type of project, the economic, logistical and technical conditions... This requires setting a clear framework and a series of rules: see chapter 5°.

3.3 Favourable conditions for a contractual reuse objective (flow in)

- Design and Build (D&B) contracts. In this context, designers and contractors are invited to work closely together from the outset and can easily test different ways of achieving (or even exceeding) a quantitatively targeted objective. Other contracting procedures, such as competitive dialogue or innovation partnerships, make it possible, where appropriate, to include contractors in the discussions on setting an appropriate rate. In general, public procurement procedures that allow for negotiation can be useful in clarifying any misunderstandings[1].

- When the contracting authority has been able to carry out a preliminary market study to find out about the possibilities offered by the local context[2].

- Where project teams are well equipped to substitute new materials for reclaimed ones, not only in the design phase but also possibly during construction.

- When the client is prepared for bidders to propose different ways of meeting the target.

- When the client is well equipped to monitor this objective throughout the contract implementation.

1- On these issues, see FCRBE, *Reuse Toolkit, Procurement strategies. op. cit*. In particular sheet "F13. Opting for a procurement procedure that allows negotiation", p. 131-134.
2- FCRBE, *Reuse Toolkit, Procurement strategies. Op. cit.* In particular sheet "F8. Conducting a prior market consultation", p. 99-101.

- Where the value of the targets could be carefully weighted beforehand (e.g. through an analysis of the reuse market, an inventory of reusable materials available, etc.).
- When the parties involved in the project (including the project owner) have a good knowledge of reuse practices and some experience in this field.

If these conditions are not met, it may be more prudent to express reuse targets in an incentive-based way, or even in a form other than a quantitative target (e.g. qualitatively).[1]

☞ In some cases, particularly if the reuse target becomes a strong contractual element, it may be wise to set relatively low targets but ensure that they are met, rather than aiming too high and being disappointed that they are not (especially if this entails penalties).

☞ It is also possible to let bidders commit themselves to a target that they feel is achievable (see the example presented above).

☞ In any case, this does not prevent quantitative monitoring along the way and reporting on the achieved results at the end of the project.

3.4 Points of attention

Setting a reuse target, especially if it becomes a determining factor in the comparison between several offers, is not a light exercise. It is an approach that has been tested in a few projects and on which there is not yet much feedback. A few points of attention deserve to be highlighted in particular.

Ensure comparability

If the reuse objective is translated into an award criterion that is used to compare different offers, it is crucial that such a comparison is actually possible. This means that it must be clear what is to be measured, in what unit, in what detail, on the basis of what assumptions and from what sources (see chapter 5°).

1- See FCRBE, *Reuse Toolkit. Stratégies de prescription. Op. Cit.*

☞ The risk is that if each bidder takes a slightly different approach, the comparison exercise becomes impossible.

For example, calculating the mass of materials (assuming that this is the indicator chosen) often involves a conversion process starting from a surface unit, a given thickness and the density of the material. Data relating to the density of standard materials is often expressed as a range between low and high values. It is therefore important to ensure that all tenderers use the same data for the same material. Slightly different data can also be found depending on the source. It is important to ensure that all tenderers use the same data sets.

Erosion of the ambitions

When tendering, it is tempting for bidders to make announcements. Once selected, intentions may get eroded during the course of the project and the actual results may not match the initial ambitions.

In some cases, these deviations are linked to *force majeure* or to broader decisions that have forced a thorough review of certain aspects of the project. Despite all the precautions taken upstream, designing and executing a construction project remains an undertaking subject to many uncertainties. Reuse practices are no exception to this rule. To a certain extent, they even add a certain amount of uncertainty.

☞ In other cases, however, these deviations have to do with a lack of effort to achieve the expected results. To avoid this, it is important to keep a close eye on this aspect. For example, at each stage of project development, ask for an updated table of the quantities of reused materials. This will ensure that the project is on track to meet the target and, if necessary, take corrective action.

In some projects, there is a phenomenon of erosion of ambitions of about 50% between the first sketches and the final result. This should not necessarily be seen as a failure. It is possible that these setbacks will provide a valuable learning experience for a future operation. It is also possible that the initial ambitions were too high.

At the very least, it shows that there may be a gap between the initial intentions and the final result.

☞ It is therefore appropriate to provide for fallback solutions. In the design phase, one could plan for more reused batches than strictly necessary to reach the target. In the event some options should be dismissed later on, it would not jeopardise meeting the contractual target.

On the contracting authority's side, it is important to have a clear understanding of the more or less ambitious nature of what is required, and to provide an appropriate framework (avoiding, for example, excessively heavy penalties for particularly innovative and ambitious objectives).

4° RECLAMATION RATE: HOW TO SET, MONITOR AND REPORT ON IT

The aim of this chapter is to propose a systematic approach to setting a reclamation rate (flow out).

4.1 Big variations depending on the existing built environment

In order to set a reclamation rate, it is necessary to draw on the reuse potential of the elements that will be removed during the renovation work.

However, this potential varies greatly from one building or development to another, depending on their era, type, degree of maintenance, condition and the work to be carried out. In practice, this potential can also depend on contingent factors such as the planning, the experience of those involved and budgetary constraints.

☞ The potential of a material to be reused is a factor that is rarely linked to choices over which the project owner and designers have direct control. More often than not, it is a legacy of previous decisions made during the design, construction and operation of the original facilities.

For these reasons, it is difficult to predict relevant indicative rates. Therefore, in the analysis of the 32 completed projects, we did not calculate reclamation rates.

4.2 The importance of the reclamation audit and complementary studies

The best way to set a reclamation rate is to carry out an inventory of the reusable elements before each intervention in the built environment.

We have produced a comprehensive method for doing so as part of the Interreg NWE FCRBE project.[1] Since it is available online, we will not go into detail here.

Assess the reuse potential

In broad terms, the purpose of conducting a reclamation audit is to assess the potential of materials to be reclaimed and reused. In practice, this depends on several criteria, including :

- Is there a demand for these materials? This demand can come from the renovation project (same-site reuse), from the market (professional dealers) or from other ongoing construction sites. The existence of this demand depends on the type of material, its condition, the quantity in place... All these aspects must therefore be examined. At the same time, it is useful to identify potential buyers, for example by sounding out market interest, actively seeking outlets, etc.

- Can the materials be dismantled without damage? Some types of layout make reclamation difficult or even impossible. If necessary, dismantling tests can be carried out. They are a good way to estimate the loss rate, and to check the technical and financial feasibility of the operation.

1- FCRBE, *Reuse Toolkit. The reclamation audit. A guide to creating an inventory before demolition of potentially reusable products*. Decembre 2022. Available online : https://vb.nweurope.eu/media/19516/fcrbe-inventory-guide-en.zip

- Are the materials likely to contain or have been contaminated by harmful substances? If so, this can be ascertained by cross-referencing with the inventory of toxic substances or by characterisation tests.

Set reclamation rates

When the audit has been thoroughly carried out and is conclusive (i.e. there is a demand for the materials, they can be dismantled and they do not present a significant risk), it is then possible to use the conclusions of this audit to set reclamation targets for the batches of materials with the highest potential.

These targets can be set according to the common units applied for the various types of materials. For example:

- 80% of washbasins - count in pieces.

- 60% of timber frame - by volume (m^3) or mass (kg).

- 75% of natural stone flooring - in surface (m^2).

When setting these targets, a loss factor must be taken into account since some construction materials will inevitably be damaged or broken during dismantling. This factor can be estimated during dismantling tests. If in doubt, it is better to aim for a low target, even if the results turn out to be higher in the end.

☞ If the targets are contractual, it is imperative to monitor the batches that are effectively reclaimed during the works. It is recommended to make a recurrent point during the site meetings and to record the progress but also any deviations in the minutes.

At the end of the operation, it is important to prepare a final report. It should indicate precisely all the batches that have been reclaimed for reuse. It must specify the quantity and, where appropriate, their actual destination (possibly supported by documentary evidence: invoices, photos, etc.).

For this final report, it is interesting to use mass as a common unit so as to enable comparisons between the different batches and the total flow out. To obtain the reclamation rate, this report must then be compared to the total quantity of materials and components removed from the site. This data is usually available since it is connected to waste management obligations (transport slips, waste register, recycling certificates, etc.).

When undertaking a same-site reuse operation, it is useful to complete this report with a detailed list of the batches of reclaimed materials. It should contain information to facilitate :

- The identification of the materials (numbering of pallets, storage system).

- The detailing of the quantities actually reclaimed, as well as the condition of the materials (possibly sorted into quality classes).

This detailed slip is a valuable source of information for the organisations that will design a project with these elements, and those who will install them. It is also a record of the work carried out by the company responsible for the reclamation operations, attesting to the proper execution of its mission.

What if the reclamation audit is not complete?

In practice, it is possible that the investigations cannot be carried out in full due to lack of time, anticipation, resources, etc. For example, no contact could be made with potential buyers to gauge their interest, dismantling tests could not be carried out because the building remained occupied until the day before the work was due to start, or the inventory of reusable materials could not be cross-referenced for the presence of asbestos.

In these cases, the degree of certainty as to the reuse potential will necessarily be lower. It is therefore not advisable to establish too ambitious reclamation rates in order to avoid placing companies under an obligation that is impossible to fulfil in practice.

☞ However, it is still possible to encourage companies to make their best efforts in terms of reclamation of reusable materials, for example through an obligation of means.[1]

Finally, it is also possible (although relatively rare) that the audit campaign concludes that there is no reuse potential at all. In other words, the audited building does not contain any reusable elements (or at least not under the current conditions). In this case, it is of course not relevant to set quantitative reclamation targets either.

1- Rotor, *Handbook for offsite reuse. How can reusable materials be extracted from public buildings?* 2015. Available online: https://opalis.eu/sites/default/files/2022-02/Vademecum_offsite_reuse-Rotor.pdf. See also Rotor, *Maximiser la récupération des matériaux réutilisables. Formuler des objectifs de récupération dans un marché de travaux.* 2022. Available online (not in English): https://opalis.eu/sites/default/files/2022-02/Rotor-Maximiser_la_recuperation-2022.pdf

THEY DID IT :

Minimum reclamation rates in a demolition contract (Pilot Operation Nextmed - SERS)

Tiles dismantled and conditioned for transport © Luc Boegly

In this renovation project of an old hospital building dating from the beginning of the 20th century, a reclamation operation was organised for materials with a high reuse potential. For batches of materials with confirmed potential, the setting of reclamation rates made it possible to ensure the good cooperation of the company.

The contracting authority, the SERS (Strasbourg public development company), accompanied by Rotor as part of a FCRBE pilot operation, first carried out an inventory of elements with a high reuse potential as well as some dismantling tests. Several lots were identified as priorities because of the quality of the materials, their large quantity and the interest they showed for professional dealers. This interest was confirmed by contacting several companies active in the reclamation sector and likely to offer markets for these materials.

Following this feedback, SERS formulated specific clauses in the specifications for the demolition works indicating their wish that these lots be carefully reclaimed by the company to allow their subsequent reuse.

Some lots were linked to an obligation of result: for these, the companies had to achieve minimum reclamation rates. These rates were taking into account a margin to offset the risk of damage or potentially unforeseen difficulties. Tenderers were also encouraged to go further. When submitting their bids, they could commit to reclaiming other batches listed in the inventory or to exceeding the minimum reclamation rates set.

The contracting authority took these aspects into account through an award criterion. Bidders who committed to reclaim more materials would score higher for this criterion. During the execution of the contract, a document tracking the quantities of reclaimed materials was established and updated as the operations progressed.

At the end of the operation, the company provided a full report on the results of the reclamation operations to the contracting authority. This report enabled the calculation of the reclamation rate: 4,8 % (48.6 tonnes of materials could be reclaimed for reuse out of 1021.3 tonnes of materials evacuated from the site).

Penalties were provided for in the specifications in the event of non-submission of evidence of reuse and of non-compliance with the quantities put forward by the company in their offer.

6.2. Engagement environnemental

6.2.1. Les engagements de réemploi

- Déclare avoir pris connaissance du CCTP et notamment de son article « Prévention des déchets : Réemploi » précisant les obligations du titulaire en termes de réemploi.
- S'engage à respecter les taux de réemploi minimum obligatoire :
  80% du nombre de radiateurs de type 1.1 et 1.2
  50% du volume de bois de charpente (surface toiture)
  50% de la surface de faïences murales de type 1
- S'engage, conformément à son offre, à réaliser les taux de réemploi suivants :
  - 80..% du nombre de radiateurs de type 1.1 et 1.2 (80% minimum),
  - 50..% du volume de bois de charpente (50% minimum),
  - 50..%de la surface de faïences murales de type 1 (50% minimum),
  - Autres (type et quantités à préciser) : ....

Extract from the Nextmed project specifications. To be consistent with the definitions proposed here, the expression " reclamation rate " rather than " reuse rate " should have been used...

Measuring environmental benefits

Is it possible to measure and express the environmental benefits associated with decisions to maintain a building in its existing state and/or to reclaim materials for reuse ? Several approaches are possible. Although these have not been applied to the 32 projects analysed, we propose here two approaches that could help project owners to position themselves on these issues.

Theoretical life span (TLS)

☞ A first line of approach is to ask whether the planned work will result in the premature removal of elements that are still functional. As indicated above, it is primarily the audit/diagnosis of the elements that can be reused that will make it possible to judge this, taking into account all the specific contextual elements.

To underpin this thinking, it is also possible to draw on studies that have established the theoretical life span (TLS) of a certain number of construction elements. This data is compiled in databases such as *INIES* (in France) or the *Label Bas Carbone* (LBC, also in France). It should be noted that these theoretical lifespans are used in the context of life cycle analysis and are therefore, as their name suggests, theoretical estimations. These data would benefit from being supplemented by effective sustainability studies carried out for certain categories of materials, which are more representative of the reality in the field.

Removal may be considered potentially premature if the materials in question have not yet reached the end of their life cycle. In this case, if it is not possible to keep them in place (which is the priority and should be studied first and foremost), the possibilities of recovering them with a view to reuse should be very seriously investigated.

Please note ! Exceeding the TLS does not mean that the component is no longer fit for use. Depending on how elements are used, maintained and stressed throughout their life cycle, they are likely to retain their function beyond their theoretical lifespan (otherwise, it would be imperative to dismantle all old monuments whose component parts have well exceeded their lifespan - to push reasoning to the point of absurdity). In the same way, elements are of course likely to be subjected to stresses or events that make it impossible to keep them in place despite the fact that they have not reached the end of their lifespan (think, for example, of fires, specific pollution, etc.).

This approach is therefore only a first approximation. It is primarily a means of raising awareness of premature disposal. More detailed analyses need to be undertaken to study the potential for maintenance and/or reclamation in more detail.

Depreciation

To take this a step further, it would be possible to account for a form of carbon depreciation, so that a ‘carbon penalty’ would be applied if an element was removed prematurely. We could then calculate a proportion of the total impact of the life cycle that has not been completed.

The calculation would once again remain theoretical, but would be in line with the logic of standardised life cycle analysis. In any case, it would be necessary to ensure that the method was not abused and did not give rise to rebound effects, where exceeding the depreciation period would justify the replacement - and disposal - of components that were still perfectly fit for use.

5° REUSE RATE: HOW TO SET, MONITOR AND REPORT ON IT

The aim of this chapter is to propose an approach for establishing reuse rates (flow in).

As mentioned above, the notion of reuse rates can be used at different points in time :

- Upstream, to formulate an ambition for a project to come *(ex ante*).

- Downstream, to communicate on the results of an achieved project (*ex post*).

We describe here an approach that mainly concerns the first scenario (*ex ante*). In this case, it is crucial to precisely define four major factors :

1. What part of the incoming flow of materials does the objective relate to? Is it the entire flow? Only part of the flow for specific applications or construction layers? Specific materials?

2. What unit(s) should be chosen? Will the flow be measured by mass? By volume? By financial volume? By one (or more) expression(s) of its environmental impact?

3. What level of detail is expected? In other words, how accurately are we going to measure the flow? In broad strokes or down to the smallest bolt?

4. What is the target rate? In other words, what is the quantitative target that we are trying to reach?

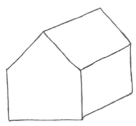
In the following parts, we discuss each of these factors in detail. In general, we assume that the intended use is that of setting an ambition upstream of the project *(ex ante* approach). For details of an approach geared towards communicating the results achieved (*ex post*), we invite readers to consult the following documents: *Ex-post analysis of 32 construction and renovation works as well as the 32 detailed project sheets.*

5.1 Determine the part of the flow in concerned by the reuse target

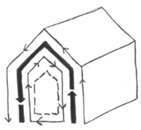
The reuse rates achievable depend very much on the type of application in the building. For example, some structural applications (e.g. a foundation sole) are rarely, if ever, made of reused materials. On the other hand, for interior finishes, it is often relatively easy to substitute reused materials for new ones.

On this basis, it may be worth setting differentiated targets for different applications.

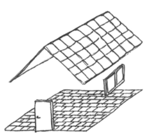
In what follows, we discuss three possible approaches:



1. Establish a reuse rate for the entire project: this means that the target rate concerns the entire flow of incoming materials.



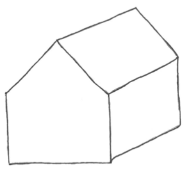
2. Establish a specific reuse rate for each area of application or layer making up a development: in other words, the rate(s) targeted are for specific parts of the incoming material flow. This approach makes it possible to establish separate values for the different parts identified.



3. Establish a reuse rate for specific batches of materials.

These three options are not the only ones available. There are other valid ways of defining the scope to which the reuse rate applies. For example: according to the different lots within a contract[1], the different sections of a specifications book, the different phases of the works, the different trades involved... In practice, all these approaches are quite comparable to the 'per layer' option that we discuss below. It should therefore be possible to transpose these broad principles to specific cases.

For all incoming materials



Setting a reuse rate for the entire flow of incoming materials has certain advantages, but also certain disadvantages.

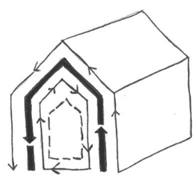
The main advantage lies in the simplicity of communicating the objective, both with the various project stakeholders and externally. Aiming, for example, for a 10% reuse target, calculated in mass, has the merit of being a very clear and simple target to articulate. It leaves many possibilities open as to how to achieve it: it is possible to concentrate all efforts on a specific large item, just as it is possible to disseminate a bit of reuse throughout all the works. This type of open-ended objective also allows for seizing opportunities that arise during the course of the works, which might not have been considered with a more specific or limited objective.

However, as mentioned above, the reuse rates that can be achieved depend very much on the type of application in the building. Setting a target for the whole project does not allow to adjust the efforts according to the type of application. In addition, it may increase the bias associated with the use of certain units in the formulation of the target (see section 5.2). Finally, it involves calculating the total mass of the entire project, which can represent quite a substantial amount of work.

1- We are referring here to a principle of allotment within a contract. Not to be confused with the expression "material lot" used as in "material batch".

+	-
- Simple objective to communicate (internally and externally). - Leaves open many possibilities for achieving the same end. - Enables opportunities to be seized during execution.	- Does not allow for adjusting ambitions according to different applications within the building. - May reinforce biases induced by the choice of unit. - Requires measuring the entire in-flow (including for parts of the work not concerned at all with reuse).

Per layer



This approach builds on a concept formulated by Stewart Brand in his book *How Buildings Learn: What Happens After They're Built* (Viking Press, 1994). He sets out to distinguish between different constituent layers in the built environment and shows that these are subject to different patterns in terms of the frequency with which they are renewed.

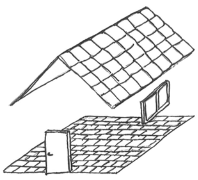
This proposal has subsequently been widely taken up in Design for Deconstruction studies. These stress the need to keep these layers independent in order to limit waste during renewal operations and to avoid, for example, the renewal of a single internal partition leading to the demolition of the structure to which it is attached.

☞ On this basis, we can use this subdivision to set reuse rates for different layers. This makes it possible to calibrate the objectives, taking into account the more or less innovative and complex nature of the approach. Aim for low rates for more complicated layers (such as the structure) and higher rates for less complex layers (such as interior finishes), for example.

The “per layer” approach also makes it possible to adapt to different types of operations. Typically, a new construction concerns all the layers whereas a light renovation only concerns the internal layers.

This is the approach adopted to analyse the 32 completed projects.

For specific lots



It is also possible to set reuse targets for a specific type of material in the project - whether it is used for several applications or for a very specific application. For example, request that a certain fraction of all stone flooring be sourced from the reuse sector.

This makes it possible to be both quite precise for what regards the application and at the same time leave some leeway as to how to distribute these materials within the project. This enables a buffer if achieving the full surface area seems difficult.

☞ When they have been thoroughly researched in advance and become very specific, targets of this type lend themselves well to being translated into technical specifications. It is then no longer a question of making it a point on which bidders are invited to take a position but rather a basic requirement of the contract[1].

1- About setting technical requirements for reuse, see FCRBE, *Reuse Toolkit. Procurement strategies. Op. Cit.*

THEY DID IT :

Differentiated rates depending on the targeted applications (Live test in Brussels)

As part of the preparation of a call for tenders for the design and construction of a new building to house a sustainable and circular business incubator, Citydev (a Brussels-based public developer) decided to set reuse rates for different parts of the works. The chosen approach goes beyond a division into theoretical layers, since it encompasses very specific 'areas of use' such as external joinery, internal joinery, wall coverings, sanitary fittings, etc. This subdivision makes it possible to set specific targets. Another distinctive feature of this approach is that it distinguishes between reuse rates that are regarded as minimum requirements and others that are regarded as opportunities that bidders can choose to activate in order to score higher points in the evaluation. This approach also makes it possible to adopt units of measurement specific to each area. For example, some objectives are measured in terms of price, others in terms of surface area, and still others in terms of number of units.

This operation gave rise to a FCRBE live test. To go further, see *Live tests. Report on 4 operations using reuse targets.*

5.2 Define units

With which metric should reuse rates be measured? This is an eternal question that has no definitive answer. There are indeed several valid ways to do this:

- By mass of material (kg).
- By volume of material (m^3).
- Based on the financial volume of reuse operations (in monetary units or as a percentage of a budget).
- On the basis of a calculation of environmental impacts and potential benefits (with various units associated with various indicators).

In this section, we discuss these various options.

Mass

Mass is a very useful base metric for several reasons:

- It is a physical property that lends itself well to the measurement of the quantity of material (and is part of the International System of Units).
- It is relatively easy to measure it in an objective way.
- Measuring the mass is a necessary step when it comes to undertake subsequent environmental impact assessments (life cycle analyses, etc.).

Limits of the mass

A first limitation is practical: today, the material flows circulating in a construction or renovation project are rarely measured directly in mass. Most of the time, quantity surveys and other detailed bills of quantities use specific units for each type of material (surface, volume, per piece, running metre, etc.). Measuring the mass therefore requires conversions to be made.

A second limitation of expressing target in mass is the bias it may induce in favour of the most weighty elements. This will be especially the case when bidders are put in competition on this performance or if there are economic incentives linked to reaching performance expressed in mass. Project developers could then develop strategic behaviours that prioritise the reuse of heavy materials (natural stone, bricks...) to the detriment of comparatively lighter elements (certain types of wood, insulation...). While these approaches are justified from the perspective of a mass target, they may be more questionable in other respects: environmental benefits, support for innovation, development of the reclamation market, aesthetics, etc.

Volume

Volume is a common unit for some applications: masonry, pouring concrete, etc. For specific reuse targets in such applications, it may be possible to use volume as the base unit. This makes it possible to rely on available data, without having to make any conversion.

Limits of the volume

For applications that are not usually measured in volume, an additional conversion is necessary.

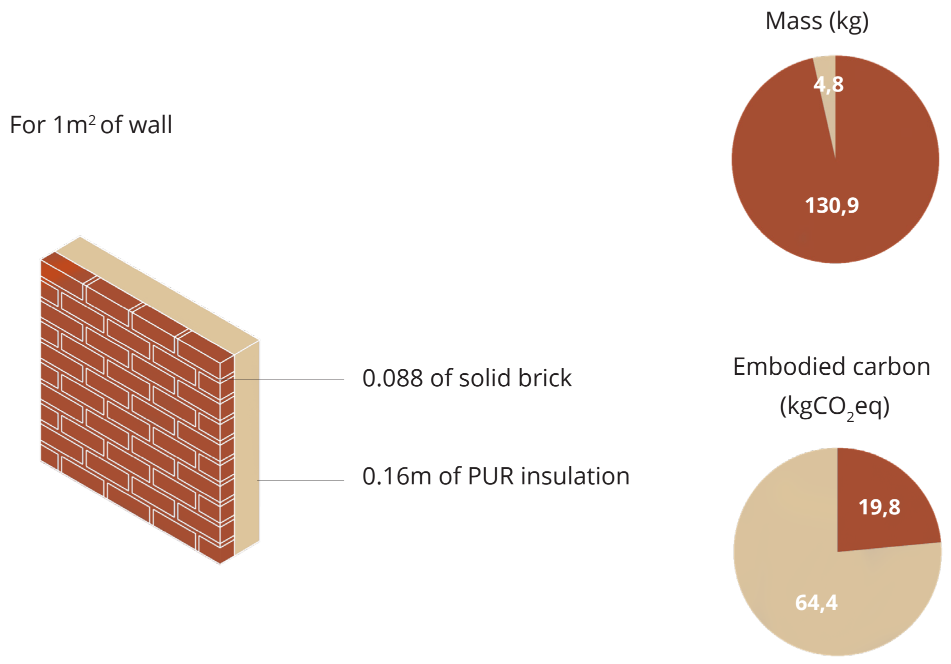
It is also a metric that can induce some uncertainty depending on what is being measured. Is it the volume of material delivered to the construction site? Is it the volume of the material actually installed? Should an expansion factor be factored in?

Volume is also a variable: certain materials can expand or shrink depending on temperature and humidity levels.

Finally, as with mass, volume can lead to a bias in favour of bulkier items at the expense of more compact ones.

Financial volume

Setting a target in economic value is an effective and relatively simple way of ensuring results in terms of integrating reused



Source of data : TOTEM

materials. It means committing a proportion of the budget to this objective. This has several advantages, including:

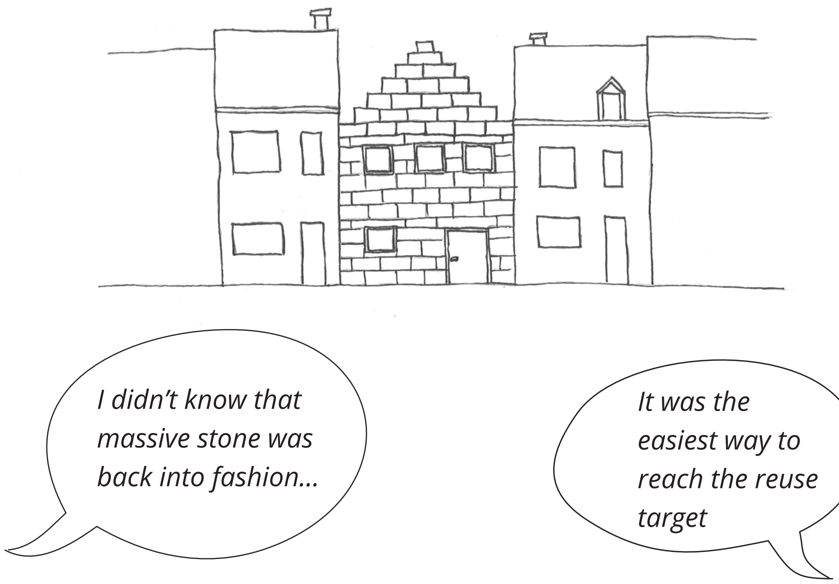
- Securing a budget for reuse operations. This ensures that the operations take place, while giving the project leaders some leeway on how to allocate the budget.

- The cost of the work necessarily appears in the offers and price lists. This makes monitoring very simple. There is no need to make conversions as when using mass.

Limits of the financial volume

However, this unit also has some disadvantages:

- Some types of reclaimed materials can be very expensive. Architectural antiques or unique pieces, for example. It would therefore be quite easy to fulfil an economic value target through the purchase of a few one-off items of this type, at the risk of becoming anecdotal or to the detriment of a more diversified approach.



- It should be clarified what exactly is included in the reuse budget. Only the supply of materials? Also their installation? Also the preliminary studies that may be necessary, including characterisation tests?

The scope of the objective should therefore be very clearly defined and, if necessary, targeted objectives should be set according to layers or phases of the work (see section 5.1).

Combined units

An effective way to avoid the bias associated with the use of an exclusive unit is to express a goal that combines several of them.

For example, combine mass and economical value. This combination balances two possible tendencies of bidders: (1) to opt only for very heavy elements at the expense of comparatively lighter elements and (2) to opt only for a few very expensive elements at the expense of a more diversified approach.

☞ If the aim of the contracting authority is to ensure a certain diversity in the reuse strategies, it is also possible to set different targets for

THEY DID IT :

A reuse rate of 1% by economical value (Live test in Paris)

In the Paris region, the Plaine Commune regional authority (a group of 9 towns to the north of Paris) has decided to move up a gear in terms of promoting circularity in construction. Since 2020, all property developments in the area have had to achieve a minimum target of 1% reuse, expressed as a percentage of the budget.
Bellastock had the opportunity to help a specific project, in La Courneuve, achieve this target. In this case, it was a question of reversing the approach and asking what means could be activated within an architectural project to meet this general requirement.
Among the various findings, it quickly became apparent that the impact on the budget varied enormously depending on the constructive layers involved. Achieving 1% reuse with finishes alone does not represent the same effort as reaching this value by working on the structure, for example. With this in mind, Bellastock developed a small modelling tool to simulate reuse in different areas and obtain an estimate of their contribution to the overall objective.

This operation gave rise to a FCRBE live test. To go further, see *Live tests. Report on 4 operations using reuse targets.*

different layers (see section 5.1) or to require that a certain number of batches are subject to reuse operations.

It is worth remembering that reuse cannot be reduced to a question of quantity. There are many good reasons for reuse (preserving elements that are part of our material heritage, supporting a promising economy, lowering environmental impact, etc.) and these cannot necessarily be grasped through a purely quantitative approach. It is important to remember that the measurement of quantity is only ever a potentially simplifying *proxy* for all these richer and more complex facets.

Measuring environmental benefits

Reusing building materials is of great interest for reducing the environmental impact of construction. It is therefore tempting to use this criterion to express quantitative performances for reuse.

In practice, construction and renovation projects can operate under two main situations today:

1. Project owners are committed to calculating (and reducing) their overall environmental impact using assessment tools based on life cycle analyses (LCA).

2. Project owners are not committed to calculating their overall environmental impact, or at least not using a holistic approach based on LCAs.

The first case may be voluntary (when projects seek to obtain a green label entailing applying this type of approach, for instance) or arise from binding frameworks (when public authorities enact obligations in this matter, for instance). In both cases, architects and their consultants will have to use tools that enable them to assess the environmental impact of the project (hereinafter referred to as EIA tools). These are based on data derived from the LCA of various materials.[1]

1- For a more detailed overview of these tools, their operating principles and their relevance to reuse, see FCRBE, *Reuse in Environmental Impact Assessment tools. A prospective report.* November 2021. Available online: https://www.nweurope.eu/media/15802/reuse_in_environmental_impact_assessment_tools_2021.pdf

EIA tools make it possible to model a project's construction choices – in particular the choice of materials – and to deduce their environmental impact. Depending on the tools used, these impacts are either aggregated into a formulation of the overall impact or detailed for several impact indicators.[1]

EIA tools are designed to help architects choose construction solutions that have less impact on the environment. In practice, these models highlight the most impactful elements of a project and encourage developers to explore more environmentally friendly alternatives (which can then be modelled, assessed and eventually substituted for even better solutions, as part of a continuous improvement process).

Some EIA tools can be used to model reuse scenarios. Unfortunately, this is not the case for all of them.[2] Those that do generally apply the following logic: they consider that reusing a material saves the impacts associated with the production of a new element that would otherwise have been used. In practice, to model a reuse scenario, these tools use the LCA data available for new materials but do not take into account the impacts associated with the production phase of the element in question. The other phases of its life cycle (use, end of life) are factored into the overall impact[3]. For the majority of materials, it is precisely their production that contributes most to their overall impact. According to this approach, opting for reuse generally makes it possible to significantly reduce the impact of the project.

In this sense, in a context that would make consistent use of such EIA tools (in particular if these are coupled with specified ☞ performance objectives), one can imagine that it would theoretically no longer be necessary to set specific reuse objectives. Such objectives would become somewhat redundant in the light of a more holistic approach to assessing the overall environmental impact of a project. In a project geared towards this objective (and

1- For example, the impact on the alteration of atmospheric radiative forcing (linked to the emission of various greenhouse gases), on energy consumption, on emissions of polluting substances, on land use, and so on.
2- Cf. FCRBE, *Reuse in Environmental Impact Assessment tools, Op. Cit.*
3- Some tools also make it possible to model the distinction between on-site reuse and reuse of off-site elements. In the former case, the impact of transport from the "factory" to the site is also ignored - in the latter, it is included in the overall impact.

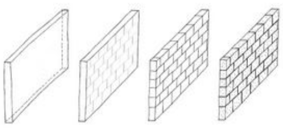
properly equipped to model such choices), the reuse of materials would be an obvious choice.

☞ However, even in this case, it would still be worthwhile for project commissioners to continue to draw the attention of the tenderers to their desire to see reuse strategies implemented. However, this could take the form of qualitative targets or lighter incentives, since the environmental benefits of reuse would ultimately be included in the overall impact calculation. The more materials a project will reuse, the lower its environmental impact will be.

In practice, however, many project developers continue to operate in contexts that fall more into the second category, i.e. situations that do not involve modelling the environmental impact of a project using a holistic approach based on life-cycle analyses.[1] In these cases, setting a target for mass reuse is a useful and relevant *proxy*.

☞ It certainly doesn't have the same degree of accuracy as a full environmental impact assessment. On the other hand, it also requires measuring equipment that is much lighter and easier to handle than most EIA tools. Until such time as holistic environmental impact calculations become the norm, the expression of mass reuse objectives remains a very interesting interim solution. Even if it fails to measure all the environmental impacts, it at least gives an accurate picture of the efforts being made to use primary resources sparingly – and an indirect indication of the other environmental benefits derived from it.

5.3 Specify the desired level of detail



When measuring a reuse effort, the level of detail required should be made clear. This refers to the level of precision with which material flows are measured.

This is particularly the case in the context where different offers are put out to tender. In order to be able to compare them, each submission must have applied the same level of accuracy in the way it accounts for material flows (see also section 3.4).

1- Or that do so, but with poorly calibrated tools for modelling reuse scenarios…

It is possible to rely on the level of detail of a project's development. In a context where project modelling is based on BIM models, it is possible to rely on the conventions in force for determining the level of detail:

Project phases	*Level of detail (BIM)*
Inception phase	Concept
Preliminary design	Approximate geometry
Detailed design	Precise Geometry
Execution file	Fabrication
Report	As built

☞ In general, the level of detail required should maintain a balance between accuracy and workability of data. There is no point in asking for accuracy to the nearest kilogram at the stage of a first sketch. Conversely, a report of operations with ± 10 tonne estimates is likely to be too imprecise (unless the project is of a very unprecedented scale...). A good way to do this is to rely on the levels of detail usually required at different stages of project development – and to update the monitoring table at each of these stages.

5.4 Set the target

The final step is to set the quantity for the target.

☞ To do so, it is useful to draw on specific and contextual studies: knowledge of the reuse market, prior experience of service providers, studies of possible supply channels, recourse to an inventory of reusable materials (for same-site reuse), pre-studies regarding the targeted applications, etc.

If these factors are too uncertain, it is advisable to work with relatively low minimum targets and to ask bidders to try to exceed these. If necessary, these starting targets may even not be set at all - leaving a lot of leeway for bidders.

It is also possible to draw on the results achieved by similar projects. See complementary documents:

- *Ex-post analysis of 32 construction and renovation works. Results and discussions.*

- *32 detailed project sheets. Projects info, reused rates and reused elements.*

6° CONCLUSIONS

Setting preservation, reclamation and reuse rates can be a useful approach in certain contexts. However, it presupposes that a series of frameworks, procedures and basic data are clearly established. This can be detailed at a project level. It is also conceivable that the public authorities will gradually take up the issue and establish a common framework.

The setting of the rates to be achieved is obviously a crucial issue. We discuss it in detail in the other documents that follow this one. To summarise, the best way to establish these rates is to carry out contextual studies that provide a clear understanding of the specific features of each project. This work is best carried out in conjunction with the stakeholders concerned. This may involve market research, negotiation (if procurement procedures allow), or even more extensive involvement of stakeholders (where appropriate, by choosing procurement procedures that value these approaches).

Independently of their incentive use at the start of the project, these rates can also be established *a posteriori*, in a project assessment phase. Producing this data can be an interesting way of summarising some of the efforts made. Taken together more broadly, these data can also help to establish an overall vision of the results that can be achieved in a given area. This approach deserves to be widely encouraged by the public authorities.