REMCO – Overview of reuse practices in the construction industry in French speaking Switzerland

Lionel Rinquet[1*], Benoît Séraphin[1], Almir Delfieu[1], Mija Frossard[2], Stéphane Citherlet[2],

[1] University of Applied Sciences Western Switzerland (HES SO) , HEPIA, inPACT, 1202 Geneva
2 University of Applied Sciences Western Switzerland (HES SO) , HEIG-VD, Energies institute, 1400 Yverdon-Les-Bains

* Corresponding author lionel.rinquet@hesge.ch

Abstract. REMCO (reuse of construction materials) conducted by HEPIA and HEIG-VD of the University of Applied Sciences Western Switzerland (HES SO) provides an overview of the reuse of construction materials in Western Switzerland over the past five years. It has identified around twenty construction sites where reused materials has been significantly implemented and has analysed in detail five case studies from a multi-criteria perspective of implementation, logistics, cost and environmental impact. The outcome of REMCO shows that reuse is still in its infancy in this area, and that despite its very interesting environmental benefits, it is only being implemented on a very limited scale. It also highlights that if cost may not be the main problem for the development of this practice, warranty issues still need to be addressed, and a common language has yet to be implemented to link offer and demand.

1. Introduction

The construction sector exerts significant environmental pressures: depletion of mineral and metal resources (88% of materials consumed worldwide)[1], production, and management of deconstruction waste (5 million tonnes per year not recycled in Switzerland)[2], or greenhouse gas emissions (13% for construction materials alone) among other environmental effects[3].

Reuse (disassembly, reconditioning, and reassembly of a construction component) can change practices towards greater circularity and environmental sustainability. But reuse is still in its infancy in Switzerland, as in the vast majority of developed countries. Many reasons explain this situation: habits and established material distribution channels, lack of knowledge and actors involved in construction materials' circularity, apprehensions regarding financial and time losses to set up a reuse compared to new materials or uncertainty about material quality. The REMCO research project, funded by the HES SO, establishes an inventory of reuse practices in Western Switzerland through a multi-criteria analysis of case studies carried out over the last five years. The main questions it seeks to answer are:

- What is the extent of reuse practices in Western Switzerland?
- What solutions are implemented for the dismantling, logistics and reassembly of reused materials?
- What are the cost and environmental impacts of reuse, compared to new products?

To answer these questions, two teams from the HES-SO joined forces; HEPIA carried out the market analysis, researched the detailed case studies, conducted interviews, and gathered information on implementation and costs. HEIG-VD analysed the environmental performances of reuse, carrying out an environmental life-cycle assessment of the case studies and comparing the results with identical solution using new materials.

2. Methodology

Feedback have been established through a literature review, semi-directed interviews with field stakeholders, and a detailed analysis of five case studies (collective housing, public facilities, community center, training center and eco-neighborhood)[4], carried out through a multi-criteria grid including implementation, logistics, costs and environmental impacts of logistics of the reused component. The case studies are taken from a survey carried out at the start of the project, based on publications in the specialized press, calls for testimonials and by discovering new projects as the interviews progressed.

The environmental assessment of reused material is still often simplified. For example, the newly released Swiss standard SIA 390/1:2025 considers the impact of a reused product as 20% of the impact of a new product of the same material composition (production and disposal), whatever the indicator and the materials is. By comparison, in France, products derived from reuse have zero impact in the regulatory calculation of the RE 2020. The REMCO project, which started before the release of the SIA 390/1, aims to perform a complete life cycle assessment (LCA) to have a detailed assessment of the environmental performances for the reused materials of the five case studies. It applies the state-of-the-art methods used in Switzerland [5,6] to calculate the global warming potential linked to greenhouse gas (GHG) emissions.

The REMCO study covers the reuse supply chain (from collection on the source site to implementation on the recipient site), and the end-of-life disposal of reused products. To perform this analysis, the KBOB database and its UVEK background database were used. Field information was collected to model reuse-related activities in terms of energy and material consumption, transport, or waste generated (e.g. cutting waste). In case of missing information, assumptions were chosen from case studies in literature and other projects (e.g., energy consumption for slab sawing, crane lifting).

The definition of new variants is straightforward if they have been studied and costed by the client, but much more complex and even debatable if they have never been considered. In these circumstances, functional, material and aesthetic equivalence has been considered for the new solution.

3. Results

3.1. Census of projects in French-speaking Switzerland

Without claiming to be exhaustive, the survey lists 21 projects carried out between 2019 and 2023 where reuse reached a significant scale, based on three criteria: i. Involvement of construction professionals (craftsmen, contractors), ii. Components permanently integrated into the building, iii. Investment in time and reflection relatively significant for the client, professional team and building contractors.

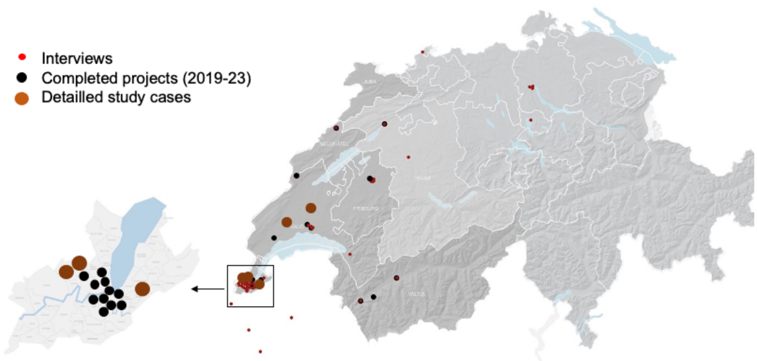

Figure 1. Map of listed projects, interviews and detailed study cases.

Significant reuse currently concerns only a tiny fraction of buildings relative to all the construction activity in the territory and period concerned (24,682 building permit applications submitted in the canton of Vaud alone between 2019 and 2023, source: Vaud statistics, 2025). Since there are no GHG emission requirements in force in Switzerland, apart from certain sustainable construction labels (Minergie-Eco, SNBS), it is generally the architects who have been the promoters of reusing materials with their clients. Their motivations are linked to a desire to reduce the environmental impacts which is consistent with the finding in litterature[7]. The possible economic interest of reuse was not a motivational factor in any of the cases analyzed.

3.2. Implemented solutions for reuse

The study of the identified projects highlighted four types of reuses, which are compared below in terms of impact and complexity with the traditional process (demolition + recycling or landfill and construction with new materials, with no direct link between them).

Type 1 – Internal in situ reuse: The construction site, which is both source and target, is supplied by the components deconstructed in situ, with no need for transport, intermediate off-site storage and ownership's transfer. The planning process is equivalent in complexity to the traditional method, with the need to produce an inventory offset by simplified tendering and choice of materials. Implementation requires more careful dismantling than conventional demolition. Logistics are simplified (components are present on site) and contractual aspects are facilitated by the absence of transfer of ownership and risk.

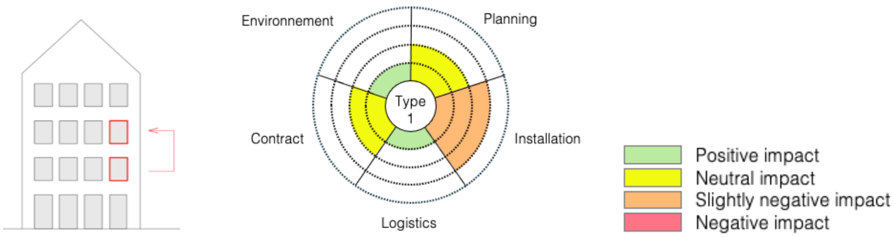

Figure 2. Characteristics of type 1 internal in situ reuse

Type 2 – Internal ex-situ reuse without intermediate external storage: The target site is supplied with components from deconstruction sites, both buildings having the same owner (internal reuse), without intermediate storage. Reuse is simplified by knowing in advance the availability and quality of reusable materials and by the absence of transfer of ownership (same owner for both buildings). The management of flows between the source and the target requires a rather simple planning effort.

Figure 3. Characteristics of type 2 internal ex situ reuse without intermediate external storage

Type 3 – External ex-situ reuse without intermediate storage: The target site is supplied from another owner's deconstruction site (external reuse), without intermediate storage. The availability of components in the required quantities and the timing are critical for the target site's site management. This type of project requires very detailed planning of material flows, which depends on synchronization between source and target sites, managed by representatives serving different clients. The product's warranties linked to the transfer of ownership is also a centra issuel. This type offers the greatest challenges compared to the other types of reuses and to traditional processes.

Figure 4. Characteristics of type 3 external ex situ reuse without intermediate storage

Type 4 – External ex-situ reuse with intermediate storage: After a careful dismantling, reconditioning and intermediate storage, the components are reused with transfer of ownership (potentially multiple with the involvement of third parties for storage and reconditioning, e.g. recycling center). Phase shifting has the advantage of providing visibility on the type and availability of reusable components during the planning phase of the target project and facilitates the management of flows between the source and target sites. Warranties can be provided by the third party who repackages and stores the material between the two sites. Logistic is similar to the traditional process.

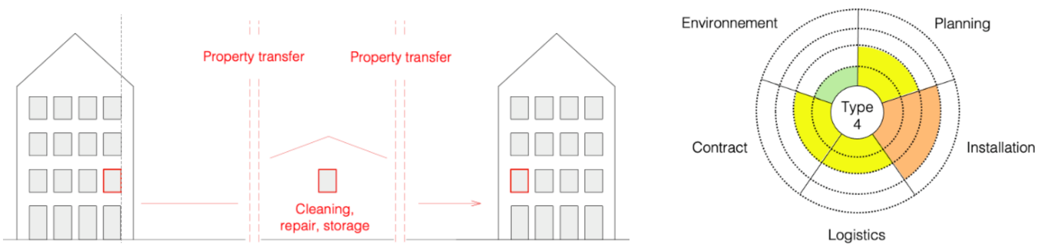

Figure 5. Characteristics of type 4 external ex situ without intermediate storage

A fifth potential reuse type (internal ex-situ with intermediate storage) has been considered but does not appear in the projects identified. It is therefore not described here.

Out of the 21 projects in the survey, 9 (43%) implemented type n°1, 3 (14%) type n°2, 8 (38%) type n°3 and 7 (33%) type n°4. Some projects implemented two types of reuses and one project three types.

The diversity and possible combinations of reuse types illustrate the complexity of the process. In the absence of organized channels, know-how and proven processes, each reviewed project was experimental. In all cases, the warranty risk was assumed by the owner of the target site. In each analyzed project, the ambition to reduce the environmental impacts of the project made reuse a reality. However, this decision was taken based on "gut feeling" as no LCA calculations were performed prior to the works.

3.3. Study cases detailed analyses

The issues of cost and environmental impacts were central to the five detailled case-studies. Reuse generally suffers from a negative preconception regarding the costs involved and a positive one regarding the environmental aspects. Table 1 shows the cost and LCA results of these 5 case studies.

Table 1. Cost and environmental impacts

	Type of works	Type of reuse	Reuse variant (CHF)	New variant (CHF)	Δ (%) reuse-new	% of total cost	Reuse variant (kgCO2-eq./unit)	New variant (kgCO2-eq./unit)	Δ (%) reuse-new
Case #1	Reinforced concrete paving	Type 3	29 460.00	27 540.00	7%	1.6%	25	104	-76%
Case #2	Prefabricated concrete wall elements	Type 1	131 000.00	101 600.00	29%		4	50	-92%
	Glued laminated timber beams	Type 1	34 000.00	35 000.00	-3%		27	164	-84%
	Metal sheet roofing	Type 1	53 000.00	52 000.00	2%		0.2	22	-99%
	Overall		218 000.00	188 600.00	16%	1.3%			
Case #3	Massif slabs out of timber joists	Type 3	7 440.00	19 200.00	-61%		32	98	-67%
	Sanitary appliances (supply only)	Type 4	1 960.00	6 450.00	-70%		14	102	-86%
	Overall		9 400.00	25 650.00	-63%	0.6%			
Case #4	Reinforced concrete paving	Type 2	141 759.00	259 759.00	-45%	1.5%	35	104	-66%

NB: Case study n°5 does not provide a credible comparison between the reuse and new variants.

Although five case studies do not provide a sufficient basis to draw definitive conclusions, this portfolio shows that:

- The spread of costs, from -70% (supply only of sanitary appliances) to +29% (reuse of prefabricated concrete walls elements) between the reuse solutions and the new variants is significant and does not show any clear trend. When reuse is cheaper than new materials it will be favored by the customer without any restrictions. On the other hand, when reuse is more expensive, the customer may be prepared to pay more, but within reasonable limits (a reuse variant that exceeded the cost of new by too much would not be implemented). This probably explains the limit to extra cost at +29% (already very high, but on a small part of the project total), when there is nothing to limit the savings reuse can offer.
- The percentage of reuse in relation to the total cost of the project is systematically anecdotal. This indicates that even when the project owner and its professional team are willing to implement it, the rate of reuse of materials remains marginal compares the use of new materials in the target building.
- In several cases, the economic circuit does not correspond to an ordinary market, since the material was offered by the owner of the source site, generally to avoid landfill costs. Our study does not allow us to conclude that the same would be true in a more structured market, where supply and demand would be balanced.
- The LCA results show a reduction in GHG emissions between 70% and 99% compared with a new product. Logically, it's those components that combine a high impact on production with a low need for reconditioning before reuse (roofing sheet metal, for example) that show the greatest reduction.

For lack of time, it has not been possible to determine the extent to which the reuse of components has had an impact on the global GHG emissions generated by the project. However, given the low proportion of reused components in relation to the total cost of the works, it is safe to say that the overall reduction in emissions linked to reuse on these projects remains marginal. At this stage, we are unable to tell if this reflects a limitation of reuse itself, or rather the limited implementation in the cases studied. Such impact at global level has been analyzed in the Reuse LCA project by HEIG VD, which final report will be released later this year.

4. Conclusion and discussion

The still embryonic reuse initiatives of construction materials that have been analyzed in detailed and the interviews conducted with players in the sector show that the widespread adoption of reuse in the building industry faces many challenges: fear of the unknown and lack of shared know-how and processes, difficulties in integrating reuse into procedures for granting planning permission, uncertainties about the reuse materials' availability of and their costs, lack of a common language to match supply and demand chain, absence of organized channels to ensure logistics between source and target sites, mismatches between source's and target's building schedules in simultaneous reuse, risk aversion linked to the difficulty of guaranteeing components from deconstruction, resistance from new materials producers, etc.

Various interviews with reuse pioneers in France and Belgium showed that these challenges are not specific to Western Switzerland. However, a clear difference emerges when comparing the situation in Switzerland with these other countries: the labor intensity of reuse is high here, as elsewhere, due to the careful disassembly, cleaning and additional handling involved, but labor costs in Switzerland are significantly higher. As a result, reuse will often be less competitive in Switzerland than in those countries where it benefits from lower labor costs. This could explain why Switzerland is generally lagging behind when it comes to reuse. It's also likely that the Swiss taste for "cleanliness" and meticulous finishes where nothing "sticking out" doesn't help...

Having said that, this study has shown that reuse offers interesting solutions to reduce the environmental impacts in the construction sector, and that the costs issue cost may not be an insurmountable obstacle (reuse is not systematically mor expensive). The widespread and improvement of the efficiency in the reuse of materials in the future can only go in the direction of reducing costs, through productivity gains linked to improved dismantling and re-installation techniques and the arrival of new entrants, which will stimulate competition. We can therefore hope a lifting of some currents barriers and envisage a future for the reuse of construction materials, particularly in connection with the widespread awareness of the need to significantly reduce the environmental impacts of this industry.

In conclusion, although reuse has received a great deal of media coverage, there is still a long way to go before it becomes a widespread practice, and since the volume of dismantling is much lower than that of new construction (in Geneva, for example, according to the canton's statistics office, the rate of housing demolition is 5 times lower than that of new construction,). Even if selective dismantling were practiced on an industrial scale, reuse would not be sufficient to meet the demand for materials at the current rate of construction. Reuse is therefore one solution among others for reducing the environmental impact of the construction industry, which must be combined first and foremost with the integration by project owners, architects and engineers of sobriety and impact reduction at the basis of the design process, from the setting of project objectives and manufacturers to proposing materials with increasingly low environmental impact.

Acknowledgments

The authors would like to thank all those who agreed to be interviewed and who provided information for this study and the HES SO for its financial support.

References

1 M. Gauch, C. Matasci, I. Hincapié, R. Hörler, et H. Böni, « Projekt MatCH - Bau: Material- und Energieressourcen sowie Umweltauswirkungen der baulichen Infrastruktur der Schweiz », 2016.

2 OFEV, « Déchets et matières premières : En bref »

3 IEA (2023), Global CO2 emissions from buildings, including embodied emissions from new construction, 2022, IEA, Paris

4 https://www.hesge.ch/hepia/recherche-developpement/projets-recherche/remco

5 SN EN 15978, Sustainability of construction works - Assessment of environmental performance of buildings, 2011

6 SN EN 15804+A2: Contribution des ouvrages de construction au développement durable – Déclarations environnementales sur les produits, 2019

7 Salza, Materiuum – Construire le réemploi (2020)