

INTRODUCING MATERIALS FROM THE CIRCULAR ECONOMY INTO THE CONSTRUCTION INDUSTRY

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With 40 million metric tons of waste (75% inert, 23% non-hazardous and 2% hazardous), the construction industry is one of France's largest scale producers of waste¹ and has been identified by policymakers as one of the major challenges for the circular economy. It is an issue being addressed at the national level via the February 10, 2020 law on the circular economy and combatting waste, which created an Extended Producer Responsibility system for the construction industry, and at the local level with, for example, the Paris region making construction one of the priorities for its 2020-2030 circular economy strategy.² At the same time, work on the 2024 Paris Olympics and the Grand Paris project has greatly increased the number of construction sites and quantity of construction waste in the Paris region. It is thought that work on the Grand Paris Express will generate around 43 million metric tons of spoil (50% from tunneling, 50% from creating stations and ancillary structures) at 267 separate sites.³

In an effort to address this issue, and with encouragement from national policymakers, new actors are trying to develop practices centering on eco-design, reuse and recycling in the construction industry. However, although certainly on the increase, the place of materials from the circular economy in the construction industry remains peripheral. The industry started by focusing its efforts on recycling concrete from demolitions as a source of subgrade backfill for roads or as aggregate for making more concrete. However, faced with the limitations of recycled concrete that loses some of its physical-chemical properties, such as its compression strength, the industry is increasingly looking into new solutions such as biomaterials (timber constructions, hempcrete and bio-sourced insulation), and recovering and reusing second-life materials, including concrete, plaster, glass, wood and metal. Although at the time of writing these solutions remain marginal in terms of the overall construction industry, they do offer hope for the future.

Business models in the construction industry have changed in recent years, leading to new construction and demolition practices. The Paris region has a profusion of initiatives, projects and experiments

designed to set in place new regional ecosystems that will create loops for materials to circulate between various work sites across the region. One of the best examples is Plaine Commune, an authority comprising several municipalities from Seine-Saint-Denis, north-east of Paris.

In 2014, Plaine Commune launched an "urban metabolism" project designed to kick-start mechanisms for reusing construction materials across its territory, based on five pillars: developing synergies between work sites; providing locations where materials reuse platforms could be set up; structuring local recovery and reuse schemes (identification, listing and supporting actors involved in reuse); developing an IT tool to raise the profile of sources of materials and put them in contact with construction and renovation sites, and, finally, supporting businesses to learn more about the problems associated with reuse (types of materials, legal framework, etc.) via individual and collective training sessions.

Taking account of factors such as the volume of available sources and their potential outlets, Plaine Commune opted to focus on several types of materials: bricks and terracotta tiles; concrete; doors and windows in PVC, aluminum or wood; wooden construction components, and metals and metal elements. The local authority has also begun to develop a platform to aid reuse of terracotta, metal components, metalwork, PVC, aluminum and wood, and plans to recover demolition concrete to be transformed into recycled aggregate for subsequent use in the production of structural concrete components.

It is also worth mentioning the Cycle Terre project,⁴ which has led to the creation of a plant at Sevran, east of Paris, that makes unfired clay bricks on a 6,000-square-meter site adjacent to a source of excavated earth. The plant has circularity designed in and can be moved to wherever the sources are. The idea behind the project is to use unpolluted earth excavated from city construction sites to manufacture unfired clay bricks that can then be used in the construction of new districts for the Grand Paris project. At present, the project aims to process

¹ Ademe (2018) - *Déchets du Bâtiment, Optimiser les matières premières, renforcer le tri, le réemploi et la valorisation des déchets du bâtiment (Construction waste, optimizing raw materials, strengthening reuse and recovering building waste)*: <https://www.ademe.fr/dechets-batiment-0>

² Région Ile de France (2020) - *Stratégie Régionale en Faveur de l'Economie Circulaire (Regional Strategy to Promote the Circular Economy)*: https://www.iledefrance.fr/sites/default/files/medias/2020/11/strategie_economie_circulaire_2030.pdf

³ ORDIF (2016) - Paris region waste figures: <https://www.ordif.com/publication/tableau-de-bord-des-dechets-franciliens-2016>

⁴ Projet Cycle Terre: <https://www.cycle-terre.eu/>



Timber-framed house with solar power, Bouray-sur-Juine, 91 - ©AREC

25,000 metric tons of earth a year, a modest goal when you remember the 43 million metric tons that will be produced by work on the Grand Paris Express, and the 400 million metric tons that work on the entire Grand Paris project will produce by 2030.

In reality, companies that want to use recycled or reused materials face numerous difficulties. To start with, processes for designing and transforming materials are usually cross-functional within organizations and also impact the countless contractors that construction professionals rely on to deliver their site works. This means that a change in materials involves changes to an entire ecosystem, which can be very complex to put in place. The widespread adoption of building information modeling (BIM), which makes it possible to fully digitalize the building design process, may offer the beginnings of a response to this problem.

Companies also face issues surrounding the quality, quantity and durability of sources of reused materials. The logistical arrangements between the removal, reconditioning (where needed) and reinstallation of components or materials have to be totally fluid, and operator training is needed. The companies also need access to storage depots in the event that an operation or site is delayed, and remain hampered by legal restrictions and uncertainties relating to the status of the waste, approval from insurers and obtaining environmental impact records.

Countless local synergies are possible to overcome these hurdles, but this also involves setting up new industrial ecosystems where some companies can use local waste or resources generated by other companies as inputs for their production process. Inter-organization cooperation of this type requires building relationships of interdependency between companies, in turn requiring the collective establishment of a system of rules and conditions for cooperation in order to access shared infrastructure and resources. A whole host of clusters already exist in France, like Matériaupôle, with the capacity to bring actors together from across a region (businesses, researchers, authorities, etc.) to organize the pooling and sharing of the tools, technical installations and infrastructure that can support the setting up of these new ecosystems. Matériaupôle is a multi-actor cluster operating as a registered nonprofit and located in Vitry-Sur-Seine. It was co-founded by the Val-de-Marne department and the Grand Orly Seine Bièvre inter-municipal authority. Its goal is to bring together companies (small businesses, startups and large corporates), research and teaching centers (laboratories, universities and schools), local authorities and creatives (designers, artists and makers). Since it was established in 2009, Matériaupôle has helped breathe new life into the materials and processes sectors in the Paris region.