100% reused pavers for the Esplanade Agnès Varda in Villeurbanne

by Loïc HOUCHERINGER / 2023-06-05 00:00:00 / France / 541 / FR

Year of commitment: 2022
Address 1 - street: Esplanade Agnès Varda 69100 VILLEURBANNE, France
Diameter: 1200
CO2 Impact: 4,366 kilos of CO2 avoided

Builder
Company JEAN LEFEBVRE

Manager / Dealer
Metropolis of Lyon and City of Villeurbanne

GENERAL INFORMATION

The Gratte-Ciel Centre-Ville district project in Villeurbanne (69100) consists of extending the city center of the town over 8 hectares, including 2.7 hectares of public, pedestrian or peaceful and heavily vegetated spaces. In this context, a Reuse Master Plan was drawn up in 2020, in order to experiment with concrete actions in terms of integrating reused materials in new constructions, temporary occupations and public spaces.

For this last part, it was decided to implement a coating of 100% reused granite cobblestones for the development of the 1,200 m² of the first phase of the Agnès Varda esplanade, located between the new P. Brossolette high school and a 66-unit building (delivery: November 2021).
Sustainable Development

Attractiveness:
All those involved in creating this public space had to get involved.

EODD and Bellastock (project management assistance - reuse) first analyzed the supply chain for reused pavers in the territory of the Auvergne Rhône Alpes region. As the sector seemed to be sufficiently structured, it was decided that the proposal for reused materials would be made directly by the companies applying for the works tender.

The developer (SERL group) then adapted its consultation of companies, in particular the criteria for selecting offers and the use of negotiation, in order to achieve the expected objectives in terms of reuse. A negotiation phase was organized with the companies in order to specify the means, methodology and mechanisms mobilized to guarantee the use of reusable paving stones.

The project management team (InSitu+Arelia) then reworked the project design in order to incorporate the requirements of 100% reusable paving (layout according to the materials proposed by the selected company rather than adaptation materials to a layout).

During the work, the company had to carry out cutting work on the recovered slabs and monitor the supplies available in the territory, in order to supplement their own resources. The layout also had to be adapted gradually on site, in order to mix the different types of granite, to avoid large areas of different colors.

Finally, throughout the duration of the operation, decisions were shared and exchanged with the future public space management services of the Métropole de Lyon, more particularly the ROADS LABORATORY of the Métropole de Lyon (specific service relating to changes of practices for the development of public spaces).

Once the work was finalized, the developer had two REX documents produced (feedback): A technical file allowing a complete evaluation and guidelines for the rest of the work; and a pedagogical synthesis intended for an oral presentation. These two documents are attached to this application.

TECHNICAL REVIEW:

REX ORAL PRESENTATION:

Well Being:

Construction site: Acquisition of specific tools by the company to facilitate the recutting of the cobblestones and thus reduce the hardship for the workers.

Accessibility and comfort of use: Accessibility commissions were held before and after the works in order to check the compatibility of the reused materials for the future uses of the esplanade, and the practicability of the surfaces by people with reduced mobility. The accessibility commission after works proposed principles for improving the system, in particular by requiring less spacing between the paving stones (joints).

Visual quality and acceptability: it was hoped that for aesthetic and acceptability reasons, the reused pavers would not be identifiable as such after their installation, and that they would not diminish the quality of the public space. The project management assistance Concertation of the joint development zone carried out interviews of users on site after the delivery, to record their feelings. The outcome of these interviews is very positive and the users have encouraged the continuation of the experimentation in future public spaces (see attached file).


Social Cohesion:
100% reusable paving does not in itself create social cohesion. On the other hand, the creation of a qualitative, inclusive, shaded and pleasant public space for users allows a meeting and relaxation space for users of the district (residents, high school and college students).

In addition to the paving, the operation was able to accommodate 100% reused furniture (seats) which was imagined, designed and then produced by high school students in the plastic arts option, and duplicated by an integration company. This operation was carried out during 6 workshops of 3h30.


Preservation / Environmental Improvement:

The operation resulted in the following savings (according to the impact calculation tool offered by the Circular Buildings Trophies):

- 4,366 kilos of CO2 avoided;
- 9.55 m³ of water saved (i.e. 1 Olympic swimming pool);
- 55,323 tonnes of waste avoided.

It is specified that we had carried out a calculation made by the project management assistance - reuse of the joint development zone Gratte-Ciel, the EODD / Bellastock group, on the basis of a cross analysis between a zero impact of reuse (convention adopted in the RE2020) and an impact avoided only in the production phase of the material (which corresponds to the extraction and transformation phase at the level of the stone quarry). Input data from an FDES sheet "Roads and natural stone exterior coverings" from the INIES database.

These calculations are much higher than those resulting from the impact calculation tool offered by the Circular Buildings Trophies.

Environmental report:

Photo of grass paving and plantations:

Resilience:

Stormwater management has been designed so that all precipitation is infiltrated into the ground to recharge the water table. For this, several experimental techniques have been adopted: working the soil complexes over several meters in order to improve its permeability; implementation of draining joints and grass joints for all paved surfaces; construction of infiltration trenches to prevent runoff and store surpluses in the event of heavy rains, making it possible to supply water to the tree pits.

Responsible use of resources:

By using 100% reused paving, resources have largely been preserved since this has avoided extracting raw materials from the quarry.

This experiment revealed that the local reuse paving industry was not structured, or even non-existent. If the experiment was possible, it is mainly because a specific resource was available in sufficient quantity: almost new slabs deposited the previous summer on a Lyon site, stored by the company with a view to being crushed.

This feedback was presented at the end of the project to the elected representatives of the local authorities concerned. Discussions are currently underway so that the Métropole de Lyon can set up a service dedicated to the recovery of cobblestones from the demolition of roads on its territory, as it already does for road edges.

Testimony / Feedback

Governance

Groupe SERL

Holder Type: Mixed Economy Company
Company JEAN LEFEVRE

Builder Type: Construction Industry
Metropolis of Lyon and City of Villeurbanne

Manager / Dealer Type: Public

The development operation of the esplanade mobilized many actors throughout the project and its realization:

- Local authorities: Metropolis of Lyon, City of Villeurbanne
- Developer MOA: SERL
- Project management: In situ + Arretlia
- project management assistance reuse: EODD + Bellastock
- Supply and implementation: Defilipis
- Assessment: Metropolis road lab, PMR associations, project management assistance consultation (Urban identification)

The changes compared to a classic organization are:

- Supply of materials: the company holding the supply and installation contract must obtain supplies differently. This involves researching materials, consulting stakeholders in the sector, taking into account stocks available internally. The developer and the Metropolis of Lyon also contributed to the search for materials, in particular by mobilizing the management subdivision of a stock of curbs.
- Methods for evaluating these materials and the structure being reused: although close to a development using new materials, it was necessary to adapt the framework for validating the suitability for use of the materials, with in situ tests.
- Research on site for technical solutions: the project management assistance and the project manager must be very strongly involved throughout the site to achieve balanced compromises between architectural requirements and supply of materials.

Business Model:

The development of the Varda esplanade with 100% reused cobblestones is an experiment, which it was decided to carry out during the project. Indeed, this public space was originally planned in the classic way with new paving (stones extracted from the quarry).
The financial risk of this change borne by the operation was limited insofar as the paving had to be purchased new in any case and the company selected proposed in its offer an equivalent price (in the offer, cost of reuse = new cost). However, it is not certain that this cost is really equivalent in fine for the company, given the significant cutting and sorting work required.

**Sustainable Solutions**

Implementation of reuse paving on the Esplanade Agnès Varda

**Description :**
In order to limit the use of new materials that are costly in terms of CO2 (international quarry extraction and transport), the solution proposed was to implement 100% of the reused paving stones on the Esplanade Agnès Varda in Villeurbanne.

**CO2 Impact :** 4 366,00

- Urban project governance
- Citizen participation
- Waste management

**Photo credit**
@Groupe SERL / @Christophe Lecardronnel / @PetiteEsquisse.com

**CIRCULAR ECONOMY**

**Circular economy strategy**

- Phase in which reuse has been integrated : Final design studies
- Type of circular economy strategy implemented :
  - Maximization of quantities on targeted products
  - Maximization of the mass of waste avoided

**Validation protocol for reused materials :** Yes

The business consultation file explicitly incorporated the objective of providing reusable pavers for all surfaces. One of the bid analysis criteria, weighted at 35%, corresponded to the supply of materials and the justification of their origin (in particular via the transmission of product sheets). The responsibility for supplying reusable paving stones has thus been given to companies. A suitable open procedure with the possibility of negotiation has been put in place, making it possible to carry out essential exchanges in order to achieve the set reuse objectives. A verification of the materials proposed by the selected company was then carried out by the project management, in order to verify their compatibility with the specifications: homogeneous thickness, dimensions allowing the lengths to be varied, homogeneous colors, recent materials and adapted to road use. Finally, accessibility commissions were held before and after the works in order to check the compatibility of the reused materials for the future uses of the esplanade, their future maintenance and the practicability of the surfaces by people with reduced mobility. These commissions brought together representatives of local authority road services, as well as user associations.

**Deposit validation form :** Yes

**Reuse : same function or different function**

- Batches concerned by reuse :
  - Landscaping

**For each batch :** Reused Materials / Products / Equipments :
1200 m² of paving stones reused

**Reused materials rate :**

**Materials :** reused granite pavers

**Origin :**
- 75% of the cobblestones come from a public road deconstruction site in the city of Lyon, using granite slabs. These have been completely resized to correspond to the layout expected on the Esplanade Agnès Varda;
- 17% comes from residual pavers from other company sites (“pallet bottoms”);
- 8% were purchased from suppliers offering reused materials.

In addition, reused curbs were used for the grass paving areas.

All of these materials were recut before installation to match the desired layout and to guarantee continuity with future public spaces.
Supply and traceability: The use of reused granite pavers for this experiment was possible because the company selected had a large stock of slabs from the dismantling of a Lyon site. As the stock proved to be insufficient, a search for additional deposits had to be carried out.

Costs: the supply included the costs of preparing and re-cutting the pavers in stock (plus the cost of immobilization carried by the company).

Eco-design: The use of materials from re-use implies a change in practice by inviting the MOE to design the project from the available resources and their characteristics, rather than adapting the resources to their project.

Organization of local authorities: The VTPF subdivision of Lyon Metropolis has a stock of curbs from removal sites. There is a technical clause in public works contracts requiring companies to deliver all curbs deposited to this depot. It is interesting to rely on this existing approach to pursue reuse objectives in public spaces.

Stone sector in the AURA region: This experiment has made it possible to mobilize the players in the stone sector on the structuring of the reuse offer: the Rhonapi association has in fact initiated a working group bringing together quarry workers from the region, specifiers and principals to discuss this issue of reusing stone.

A “supply of reused materials” lot?

Given the extent of the development of public spaces to be carried out in the coming years and in view of the difficulty of access to materials from reuse, the establishment by the developer of a supply market is a relevant option. (although a palliative solution to a structured sector). This lot would be in charge of supplying future construction sites for public spaces in the ZAC. This presupposes work on sourcing companies upstream and dealing with the question of the ownership of materials.

Standard clauses for public contracts in the territory?

Furthermore, it is necessary to anticipate the search for materials and facilitate access to the resource. For this, the Metropolis of Lyon can rely on the technical clause imposing the restitution of the curbs and the paving stones deposited on public worksites (obligation in the road regulations of the Metropolis). This clause can be strengthened and increased by taking into account other materials. A follow-up of the practices would make it possible to optimize the supply and to sensitize the actors of the building site.

Standard technical clauses could also be drawn up for all public contracts.

Rehabilitation and reconditioning operations (if project concerned by a cleaning/demolition stage) : Yes

Please specify the stakeholder that carried out these operations :
DE FILIPPIS Company

Storage of materials for reuse in situ (if project concerned by a cleaning/demolition stage) :
- On an external platform, in combination with reconditioning operations

Storage of materials from external supply :
- No problem of storage, supply correlated to the progress of the works

Opinion of the road laboratory of the Metropolis of Lyon: for paving of this thickness and this size, even if the origin of the stone cannot be guaranteed, the granite stone is sufficiently solid so that the problem of the resistance of the paving does not arise.

Insurance broker on the project : No
Consultation of the broker : No
Consultation insurer : No

Environmental assessment

Impacts avoided : water, waste, CO2 :
The operation resulted in the following savings (according to the impact calculation tool offered by the Circular Buildings Trophies):
- 4,366 kilos of CO2 avoided;
- 9.55 m³ of water saved (i.e. 1 Olympic swimming pool);
- 55,323 tonnes of waste avoided.

The reuse operation saved the equivalent of 34,934 kilometers traveled by a small car, or 40 Paris-Nice journeys, 64 rectangular bathtubs filled with water and 111 years of household waste for a Frenchman.

More details on the avoided impacts :
It should be noted that we had made a calculation by the assistance to project leaders Reuse of the joint development zone Gratte-Ciel, the EODD / Bellastock group, with much better results. For your information, you will find the details of this alternative calculation below.
To quantify the environmental impact avoided by this reuse, we rely on the default environmental data sheet available on the INIES database “Roads and exterior cladding in natural stone”. It is to date the only validated sheet, drawn up from old FDES representative of the impact of the material (Breton granite cobblestone, Tarn granite cobblestone, Comblanchien stone, etc.).

The functional unit of the sheet is as follows: “Ensure the coating of 1m² and 15 cm thickness of roads or public spaces in natural stone for a reference life of 150 years”

The main impacts, by functional unit, of this material are as follows:

<table>
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<tr>
<th></th>
<th>Production</th>
<th>Construction</th>
<th>Use</th>
<th>End of life</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Global warming (kg CO₂ eq.)</td>
<td>45</td>
<td>13.1</td>
<td>0</td>
<td>4.39</td>
<td>66.4</td>
</tr>
<tr>
<td>Net use of fresh water (m³)</td>
<td></td>
<td></td>
<td></td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>Non-hazardous waste eliminated (kg)</td>
<td></td>
<td></td>
<td></td>
<td>Total 5830</td>
<td></td>
</tr>
</tbody>
</table>

Two main simplified approaches can be followed to quantify the environmental impact avoided by the use of reused materials:

- The total impact is considered to be nil, a convention adopted in RE2020, aimed at promoting the emergence of these practices.
- We only consider the avoided impact of the material production phase (module A1 to A3) which corresponds to the extraction and transformation phase at the level of the stone quarry.

In the first case, the avoided impact values are as follows:

- Greenhouse gases avoided: 78 TCO₂
- Water consumed avoided: 3422 m³
- Production of waste avoided: 6879 T

In the second case, the avoided impact values are as follows:

- Greenhouse gases avoided: 53 TCO₂
- Water consumed avoided: 2738 m³
- Production of waste avoided: 5504 T

Here, the assumption made is that 80% of the water consumed and the waste generated are during production (quarry).

By crossing the 2 approaches and making an approximate average, we can consider that the use of nearly 1200 m² of reused paving stones on the school forecourt makes it possible to avoid the following impacts:

- 65 tonnes of CO₂ avoided (i.e. 13.5 laps of the earth by car);
- 3,000 m³ of water saved (i.e. 1 Olympic swimming pool);
- 6,200 tonnes of waste saved (approx. equivalent to the waste produced in 1 year by 4 families of 4 people).

By way of comparison, the additional stone supplied by the supplier Noblema and coming from quarry offcuts in Portugal, generated a CO₂ emission (transport+cutting) of around 3.5 tonnes of CO₂.

**Economic assessment**

- Total cost of reuse: 220 000
- Reuse quantified in the companies’ offers?: Yes
- Purchasing process for reused materials:
  - Others

Purchasing process for reused materials:

Materials proposed by the companies consulted.

More details on the economic balance:

The financial analysis carried out upstream by the project manager makes the assumption of savings between a reused paving stone (which “only” requires storage and possibly cutting) compared to a new paving stone (which requires extraction, transformation, transportation). However, the equation is more complex than that, since it depends for the reuse block on its storage time, transport, and the necessary recutting.

Price of classic paving estimated by the MOE: €180.00 excl. VAT / m² (supply and installation + cutting by sawing)

Price of the reuse paving proposed in the market: €182.14 excl. VAT / m² (supply and installation + cutting by sawing initially planned while cleavage carried out)

The estimated additional cost of using and preparing the reused paving stone is ultimately around €3,500 excl. VAT for the surface area of 1,200 m².
In reality, this approach is a little biased because the company awarded the contract was able to rely on a stock of cobblestone already available at its depot and therefore “free”. The cost of labor linked to the preparation and transformation of the reused pavers has been integrated into the supply of the material. If the “free” resource had not been available, and taking into account the purchase of reused pavers from an external sector (at the rate of €50 excl. tax/m²), to which would be added the cost of preparation estimated at €99 excl. VAT/m², the additional cost would be higher: around €53 excl. VAT/m² compared to a “classic new solution.” In addition, the immobilization and holding of the stock of the paving stones has not been quantified here.

Finally, in the event that the company did not have in its possession a stock of cobblestones that could be reworked for reuse and if it had to obtain supplies from external channels (in structuring), the overall additional cost linked to the implementation work of reused paving stones versus new paving stones can be estimated between 20 and 30%.

We can also complete this approach by integrating the negative externalities linked to the avoided carbon impact. Considering an equivalent gain in CO2 emissions of 65 T (see chapter below) and monetising the ton of CO2 at €250/T (source Quinet report, 2030 value); the “additional” saving is around €16,250; i.e. less €13.5/m² compared to a new paver.

Communication

Communication on the process : Yes
If so, please specify :

General public: Information panels on site to explain what reuse is and the impact on the space created; communications on social networks (project pages); project home displays.

Professionals: Oral presentations for the technical services of the Métropole de Lyon and project managers of the SERL Group; Interventions in round tables or professional days (re-employment group of VAD, BEpositive 2022 exhibition), press articles (Le Moniteur, progress).


Project visit : Yes

Additional information (PDF documents)

Contest

Reasons for participating in the competition(s)

The concrete proposals of the master plan for the reuse of the joint development zone Gratte-ciel Centre-ville (GCOV) have enabled the project management (SERL Group) and the project management (InSitu / Artelia) to take this dimension into account by PRO phase of the design of the esplanade. This virtuous and experimental achievement had four main objectives:

- Reducing the carbon footprint of the development;
- Developing the development practices of public spaces of all actors (local authorities, developer, MOE, companies) towards more circular economy;
- Evaluating aesthetic acceptability with users, elected officials and technical services;
- Noting the brakes and levers of such an approach to support the sectors and facilitate its replication in the rest of the district and the entire territory of the Metropolis of Lyon.

We noted during the process that experiments around reuse are quite rare in the development of public spaces, or in any case have not allowed replicability and the sharing of experience and therefore the change of scale.

It is, however, a major axis for the integration of reused materials. Indeed, coatings for public spaces today are mostly new materials. The stone, although it is more virtuous than petroleum-based materials, requires costly quarrying for the environment (extraction, cutting and transport in particular), while at the same time, thousands of tons of cobblestones existing ones are deposited each year and transformed into aggregates. Designing developments with what we already have (used and removed cobblestones) rather than with new materials is a concrete circular economy action in public spaces.

The project for 100% reused cobblestones on the Esplanade Agnès Varda, delivered today, is the culmination of meticulous work in preliminary studies, eco-design and works: study of the local sector, adaptation of the structure, adaptation of the layout, adaptation of the consultation of works contracts, adaptations in the pre-works phase, adaptations in the works phase, etc.

Due to its high ambitions in terms of reuse, this project has initiated changes in practices in the stone and VRD sector in Auvergne Rhône-Alpes and should be the starting point for profound and lasting changes. Certain actions in France or abroad can inspire the region, for example that of the historic road materials management platform of the City of Paris, and the development of the promenade of the former Broussais Hospital (project management assistance: City de Paris, project manager: atelier NOUS) on which reused paving stones from this platform were implemented.

Being the winner of the Circular Buildings Trophies 2023 in the Infrastructures and exterior layout category would allow this experiment, which is rich in lessons, to benefit from national display and networking to encourage these practices.