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*Modern Heritage in Concrete*

*Icomos - Unesco*

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## THE TOUR PERRET OF GRENOBLE Foundational construction / foundational restoration

### **ABSTRACT:**

*The tower of the 1925 International Exhibition of Hydropower and Tourism was to be a mere attraction for the city of Grenoble. But the Perret brothers were granted full creative freedom by authorities and the Modern milieu of Grenoble and Paris, of which Marie Dormoy, literary woman and journalist, was the linchpin.*

*For the city of Grenoble, the goal was to allow an experienced team to demonstrate the potential of a new technique before the implementation of local construction projects to meet the needs of the post-war period.*

*For the Perret brothers, the idea was to establish reinforced concrete as the material representative of the 20th century. The tower of Grenoble was the first of its kind, intended as a manifesto built as part of the "Concrete Order" dear to Auguste Perret.*

*Reinforced concrete became the most used material of the 20th century and reinforced concrete construction has raised technical and ethical issues in the area of restoration for the past 30 years.*

*The tower of Grenoble, also unique for the fact that it was left in its original state and without maintenance for one hundred years, requires extensive restoration. It has all the assets to, once again, serve as an architectural manifesto, through a pilot conservation project.*

### **TEXT:**

The commission of the tower for the International Exhibition of Grenoble is a turning point in Perret's journey, in the lightening of reinforced concretes and in the recognition of the monolithism inherent to this new material. Notwithstanding the works carried out by François Hennebique, the behaviour of reinforced concrete was yet to be theoretically mastered.

It is through the energy of engineers and builders such as Robert Maillart, Eugène Freyssinet or Pier-Luigi Nervi that it became possible to break free from the old model.

The Perret brothers also formulated a technical approach. In 1903, they called on Coignet for the construction of their Franklin street's building on Paris, and its reinforced concrete frame became the core of the project. Soon thereafter, they would plan to build buildings standing at a height of over 70 metres and theorise the construction of a project composed of 250-metre skyscrapers, named "the City of Towers".

The design of Freyssinet is based on the idea of structural lightening and that of Nervi explores resistant systems through shapes where the envelope and the structure meet.

The Perret brothers unify elements composing the project. Structure, space and light form a whole<sup>1</sup>.

Around 1910, Auguste Perret is recognised as builder but not as an architect and is unable to bid on public construction contracts for the implementation of reinforced concrete projects. He begins to give interviews to promote concrete as a "French" material among French architects and companies stuck in the exercise of historical pastiche.

Indeed, engineer Louis Vicat from Grenoble invented modern cements in 1817. France is a major producer of cement and concrete. But Germany, the enemy country in 1870 and 1914, had developed

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<sup>1</sup> Joseph ABRAM, « Auguste Perret », *Restaurer les bétons : la masse et l'épiderme*, Colloque Icomos during « 200 ans de Béton, Grenoble 2017 », 24 novembre 2018.

a particularly efficient industrial design, with engineers as Gustav-Adolf Wayss or Koenen and companies such as Wayss & Freytag or Dickehoff & Widmann were winning important public contracts.

Concrete remains a misunderstood material, lacking exposure. Cyrille Simonnet speaks of a "deficit in iconicity", that concrete fights through the exploitation of an image of modernity, allowed by another medium, photography, that is equally modern and chemical. This is best exemplified by Max Berg's Centennial Hall (Jahrhunderthalle) in Breslau / Wrocław (Poland), built in 1912<sup>2</sup>.

It was not until after the war, in 1922, through a private procurement contract, that the church of Raincy, known as "Our Lady of Reinforced Concrete" could be implemented, providing the Perret brothers with an opportunity to make a revolutionary proposal stemming from their industrial experience of 15 years.

The Perret brothers turn an economical construction project into an architectural venture, through the expression of the materiality of rough concrete and the application of an unprecedented technique involving load-bearing cast-in-place systems and prefabricated wall elements<sup>3</sup>.

### **The tower**

The 1925 International Exhibition of Hydropower and Tourism in Grenoble was intended to promote the merits of the regional industry, "bring back the gold lost in war, and it aims at showcasing reinforced concrete, making it attractive to entities in charge of the implementation of construction projects. All of the structures in the Exhibition will therefore be made of reinforced concrete.

Indeed, in Grenoble, a city with a thriving cement industry for over 100 years at the time, everything is made of concrete : bridges, dam, factories, town halls, schools, churches in particular, a hospital, thermal complexes, houses, buildings, all of it, most often in moulded concrete said artificial stone made of so-called "natural cement" (roman cement).

Marie Dormoy informed Auguste Perret of the competition launched for the Exhibition of Grenoble in 1923. He was close to a number of artist groups, some avant-garde. He is a friend of sculptor Antoine Bourdelle, who introduced him to the young Marie Dormoy, a free and independent art and literature critic. She writes articles about him and pushes him to become an active theorist. This is a time when Henry Van de Velde steps down from the Deutscher Werkbund to leave Walter Gropius at the Bauhaus, where Le Corbusier writes *Toward an Architecture*, where art magazines publish architectural manifestos.

Dormoy knows Grenoble well and knows contemporary art collectors like architect Alfred Rome, painters and lovers Jules Flandrin and Jacqueline Marval, friends of Henri Matisse. Marval has already collaborated with Perret.

Marie Dormoy also knows Andry-Farcy, curator at the museum of Grenoble, known throughout Europe: it is the first museum to feature Matisse and to have been gifted a free Picasso.

The organising committee of the exhibition is composed by all these Moderns to whom Marie Dormoy presents Perret. He gives his first "Conference on reinforced concrete" during the summer of 1923, in Grenoble.

The Perret brothers are unique in the way they handle their business. Auguste and Gustave run the architecture firm on the one hand. Auguste, Gustave and Claude manage the construction company on the other hand. The agency "A. and G. Perret, architects" is granted full support by the City's administration and the Exhibition's organisers to build the tower, and so the City prepares a consultation file perfectly adapted to the "Perret brothers builders" company.

Nines firms specialised in reinforced concrete firms answered the public call for tenders of April 17, 1924. They all decline the offer made by the mayor of Grenoble. May 17, 1924, Auguste Perret returns to give a conference in Grenoble and is announced as the winner of the contract to build the tower. On May 20, 1924, he submits detailed implementation plans : 3 days to produce more than 150 drawings...

In fact, Perret had already drawn everything, and he now had 11 months and not 7 to handle the construction phase. On May 4, 1925, the tower is completed.

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<sup>2</sup> Cyrille SIMONNET, *Le béton histoire d'un matériau*, Marseille, Parenthèse, 2005.

<sup>3</sup> Joseph ABRAM, *Idem*.

The official supplier of cement for the buildings of the Exhibition, namely the colonial society of limes and Portland cements of Marseille.

This is illogical from the point of view of construction, but allows to avoid rivalries among the 30 local cement companies, among which 6 are major firms.

For political-industrial reasons, Paul Mistral's new socialist municipality dismisses Grenoble's cement manufacturers, including Nestor Cornier, director of Ciments Vicat, who also happens to be the mayor overthrown by Paul Mistral in the municipal elections of 1919.

"Super Flambeau" is the type of artificial cement chosen for the construction of the tower for its slow-setting, extra rapid hardening and high-strength properties.

This is the cement that Perret praised in his lectures and that will allow him to build during the winter.

The tower's section is a 9 m diameter octagon, 85 m tall. The structure stands 90 m in height from bottom to top, over a 15 m deep foundation composed of 72 vertical reinforced concrete stakes. A frame made of 8 columns is joined by ring beams placed every 22 m. An orientation table is located on the balcony at 60 m. The top of the structure can be reached through stairs, visible on the top open level, which is narrower.

The construction expresses classicism and rationalism à la Perret:

- Through rational structural calculations

- In the fine and straight lines, without ornament, featuring cuts and profiles specific to reinforced concrete building.

- Through an implementation of the building at the lowest possible cost, perfectly suited to the art of formwork.

Half of the cost of concrete construction is linked to formwork and its implementation. Perret, as an entrepreneur, is perfectly aware of this fact, and wishes to demonstrate it. Everything is designed so that the construction process is inexpensive and fast. To make reinforced concrete is to use the formwork module as a building module and not to achieve a low-priced imitation of stone.

Here, Perret perfectly masters the subject and finally demonstrates it. The tower is an open book, his own architectural manifesto.

Perret defines every detail: wood grain on boards, the placement of nails, the placement of planed and varnished wood surfaces to facilitate the unmoulding process, as well as the placement of clamps.

Thus, the formwork composed of small wood sections may be quickly dismantled and re-used quickly, allowing to pour layer upon layer of concrete almost without delay.

In this context, the chosen Super Flambeau cement proves useful, as its slow setting (workability), makes it possible to supply the construction site and pour the concrete without haste, but its rapid hardening (strength development) makes it possible to quickly release the moulds, simplifying the building process during winter time.

Rationalism is also present in the prefabricated elements composing the "secondary framework":

1,440 concrete openwork panels for the shaft of the tower. These are the panels of Notre-Dame du Raincy: 60 cm side, 0.26 m<sup>3</sup> and weighing 57 kg on average. These elements are made near the construction site or around Grenoble. It is possible that Perret requested the assistance of local mould manufacturers. His correspondent in Grenoble, architect Alfred Rome, knows the best local professionals.

The concrete used for these elements is fatter and probably made with natural cement.

A so-called "fish scale" pattern composed of pointing-down triangles is designed for the tower of Grenoble. This motive will be widely reproduced afterward. It allows to let the light in and leave rainwater out, without the need for windows.

The pattern forms a screen wall, which, in addition, mitigates the impact of winds.

Two Otis-Pifre elevators are rented but kept thanks to the success of the tower as a visitor attraction. All French ministers come by, as well as the elected President, in the summer. The maximum attendance record of 2,000 visitors is reached on September 6.

And so, in 1925, the tower of Grenoble is considered a technical success and a reference in cement-based architecture. It is the centerpiece that allows Perret to develop his "City of Towers" theory. The Tower has never been reproduced but it stands as an *exemplum*. Perret proposes here a "Concrete Order" advocating a sober, radical and efficient architecture, with straight lines and surface textures resulting from the logical assembly of timber formwork elements. Reinforced concrete will be the material of the Modern Movement in architecture. Probably not its instigating factor, but the very expression of its geometrical language.

Perret is now considered one among the great architects, and must submit to architecture and design competition protocols, which he abhors.

He was supported in Grenoble, but was rejected in the first round in the competition for the construction of the Basilica of Saint-Jeanne-d'Arc in Paris in 1926. His 250 m tower church project is perceived as frightening, and his mixed architect and entrepreneur status raises ethical concerns.

### **Issues related to concrete restoration**

It was never restored. Hence the idea, in the city of cements, endowed with unique cement-focused laboratories, a university specialised in nanolimes and earthquake-resistant calculation, a laboratory in the school of architecture specialising in ancient concretes, to honour its flagship building with a pilot and exemplary project.

For decades, the restoration of 20<sup>th</sup> century concrete has been the subject of debate. Already in 1996, in Le Havre, Icomos organised a symposium on this issue.

Reinforced concrete is a composite material involving concrete and metal. This is already an issue in itself in terms of mechanics as the strength analysis of old concrete structures, composed of corroded steels, porous and "tired" concrete, and the uneven bonding between concrete and reinforcement, require complex calculation methods. Also, the restoration of old concrete structures would require the intervention of design and technical consultants capable of developing interventions without the addition of reinforcement elements. Which would require work on structural standards.

Over the past 30 years concrete manufacturing has evolved considerably, with the emergence of high-performance concretes, concrete admixtures and the awareness of future non-renewable resource problems. Cements are regular, standardised and contain additives but made to serve the needs of civil engineering and suit the economies of new construction projects.

-Enormous progress has been made to regard the analysis concrete pathologies in parallel with modern cement analysis methods (see the RoCem and RoCARE programmes focused on the restoration of heritage concrete structures). But the RoCARE project failed to manufacture Roman cements in Germany. This means that the question of the manufacture of restoration cements remains open.

-Regarding the analysis of the porosity and elastic modulus of concrete to design viable concrete materials and restoration mortars, from a technical and an aesthetic point of view.

Which is one of the main issues: the small-volume production of restoration cements makes niche products for industrials at best.

-Concerning the analysis and identification of implemented concretes, the same way stone materials are recognised: cements, aggregates, sands, formwork and pouring types are extremely varied and often connected to local traditional and even entrepreneurial know-how, is another challenge. Today, the cements or limes used in building restoration are quite often coated with a coloured patina that conceals the repairs. This is not satisfactory in the long term because the aging of concrete is irregular. In addition, we often see grey or uniform applications while old concretes are rarely grey - they tend to turn ochre due to the fact that they were not cooked at the same temperature as they are today.

Lastly, masons learn to build but not enough to restore.

Heritage architects learn restoration with stonecutters, but not with masons. Learning collaborations must be developed.

Then, there is an ethical question that may not be supported by the conventions established so far. I am not referring to the reversibility of operations for example, but to the restoration's appearance. Concrete is not stone: Concrete architecture is young. It has not sustained the modifications and alterations of old stone architectures, where scars and gaps become visible, to which the eye has grown accustomed. Can a concrete building, whole, monolithic, bear visible intervention marks similar to those present in old stone buildings?

The restoration of 20<sup>th</sup> century concrete is a challenge for the 21<sup>st</sup> century.

I invest much hope in the restoration of the Tour Perret of Grenoble as a well-thought event. Historically, it is the first concrete tower, a feat in and of itself, which can become a reference in conservation. The tower has all the assets required to be the heart of technical and ethical debates. The tower was designed and built by an architect whose thought process and intentions are known, which helps in making well-principled decisions. In addition, the initial project is particularly well documented, up to the composition of concretes, element by element. The structure is located in a public space, a park, and is thus visible and identifiable. The tower is also accessible and, in addition, not occupied. It is in its original state and built only in concrete with no finishing. It shows damage over 360° and 100 metres: different pathologies are found on the same concrete over different spots, which is of interest scientists.

The restoration project is being launched as a "pilot" project, as it will be the subject of specific studies and "exemplary" building works and the decision-making process itself will be documented in a series of publications. This is a delicate point, as all these activities will interfere with the work of the architect/project manager responsible for the restoration of the structure.

I hope that this conservation project encourage the pursuit and conclusion of the debate on the restoration of concrete structures.

When we visited the tower in 2017, international architect Rudy Ricciotti, who is in love with concrete, described it as "a masterpiece" and added that "the restoration process will be intricate, and the Perret laboratory will live on". I am counting on it.

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