

Thermal rehabilitation: assignment of balconies into conservatories; the 'Libellules' case study

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ABSTRACT: In the context of the process of thermal rehabilitation of apartment buildings set up during the 50ies, 60ies and 70ies, a common intervention consists in improvement of the building envelope by addition of perimeter insulation and transformation of open balconies into glazed verandas or conservatories. The most commonly proposed arguments are acoustic insulation and repair of constructional defects associated with the gain of a potential living area.

However, in the majority of cases that have been monitored over the past years, this kind of intervention proves problematic in regards to hygrothermic aspects as well as from a practical point of view concerning the use made by the inhabitants of these intermediate spaces.

The origin of these failures may be due to the lack of a clear assignment of these spaces.

This paper will discuss a recent case study of a big building complex called the 'Libellules' in a suburban region of Geneva.

Keywords: rehabilitation, comfort, space reassignment

1. INTRODUCTION

A frequent practice when mass housing blocks with balconies are rehabilitated is to close these partially or entirely converting them into loggias. In many cases analysed this kind of intervention which obviously is considered an improvement turns out to be the creator of new problems both on a constructive level, on the comfort level and of the quality of housing.

These new defects are generally caused by a too summary evaluation of the changes that this type of intervention is to result in. One question, above all, which never comes up is a very basic one: the nature of the function of the space which is to be created, often ignored in favour of other aspects such as the problems of its construction and its acoustic and thermal qualities. This problem is amplified if the space to be treated is of considerable dimensions. Are we looking at a future winter garden, at a space to be left open the whole year round, and with which other rooms does the newly created space connect ?

The parameters which usually govern our studies, strictly limited to the physics and energy requirements have been at the origin of all of the evaluations we have been contracted for. Nevertheless we have found that entering the parameters of the historical, constructive and social dimension would give us a better appreciation of the consequences of closing off balconies and to give a clearer definition of options to those who take the decisions in a search for optimal and durable solutions.

We are not here talking about a cut and dried absolutely rules which can be applied in any situation, but rather of a methodology which can aid decision making in the treatment of this kind of situation.

2. THE "LIBELLULES" CASE STUDIES

2.1 General context.

The "Libellules" block is an important 10 story high housing block built in the years around 1968 and situated in the outskirts of Geneva. It has a total of 540 apartments ranging in size from 1 to 4 rooms. Its floor area excluding common spaces is 39'900m².



Figure 1 : The "Libellules" block in its actual state (sight of the southern wing).

Initially the building was of a prefabricated modular construction on the system « Balancy » and its walls were composed (from inside to outside) as follows: 1 cm rough-coat or tiling, 5 cm of concrete, 4 cm of cork, 12 cm of concrete, which gave a pretty weak thermal performance which was nevertheless acceptable at the time. The IDE was 610MJ/m².K (final heating energy)

From 1989 to 1996 important readapting work to improve the cladding's thermal performance was undertaken.

The facade had 10 cm of glass wool isolation added to it in a ventilated construction system glazed on the exterior by fibrolite plates.

In addition all of the balconies were simply closed with the placing of windows of a good thermal performance for the time ($U=2,7 \text{ W/m}^2\text{.K}$). The old balcony walls in 10 cm ferro-concrete were naturally also refacaded with the same system as the rest of the building.

The new windows were equipped with outside solar protection in the form of canvas roller blinds.

Figure 1 shows the building in its actual state. The old balconies, now closed are easily recognisable by a colour coding on the level of the facade, as they are painted white.

The firm that was in charge of the renovation went bankrupt during this period, and most of its subcontractors have been difficult to contact and such technical information as there is dispersed. Another firm finished the renovation work.

It has nevertheless been possible to discern the main reasons for the initial intervention :

- The balconies were badly designed, with problems of drainage (hanging drop) and water evacuation,
- The building was unhygienic and its envelope was subject to infiltration of water at many points,
- The block was situated in a rather noisy zone (large peripheral route, airport) and the closing of the balconies would have considerably reduced the acoustic nuisances from the immediate environment.

2.2 The present situation

The trust which owns the building has two major preoccupations :

- Many of the tenants complain about the lack of "comfort" in the loggias and of the presence of moisture.
- Many of the canvas blinds are torn and unusable, the more so as the guide rails tend to come loose.

2.3 A Diagnostic

To deal with the comfort problem, we have undertaken a campaign of hygrothermal measures in situ [1] using small sensors of the HOBOTM type so as to be able to register and correlate temperature and humidity changes in the spaces in relation to changing climatic conditions outside.

At the same time we have also had a detailed look at the thermal quality of the construction around the loggia space, with numerical analysis as well as with measures with the infrared camera [2].

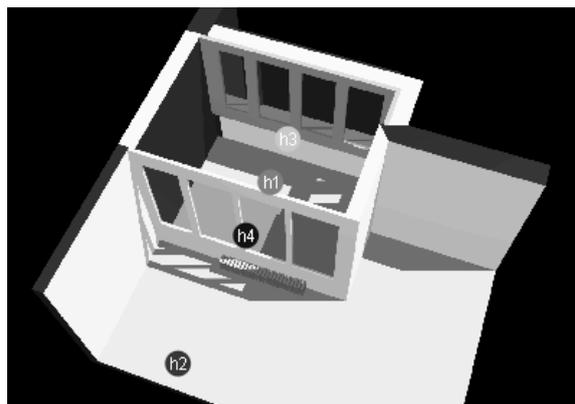


Figure 2: Measurements locations in "balconies-loggias".

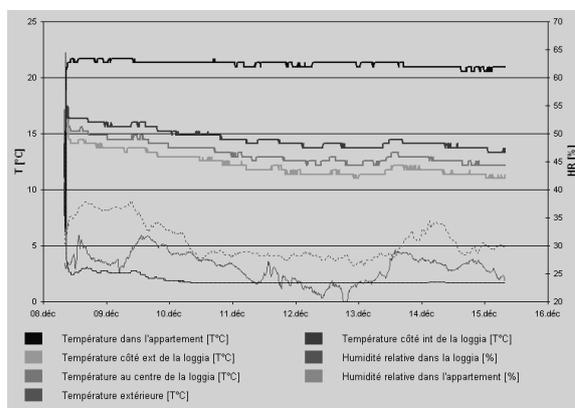


Figure 3: Hygrothermal data profile in different measurements points.

In winter conditions with a weak sunshine factor measures consistently showed a loggia temperature 8 or 9 °C below that in the interior of the apartment. Predictably both measurements and careful calculations using a modelisation of the construction elements frequently show interior surface temperatures below dew point. These observations, related to the manner in which the space is used suffice amply to explain the presence of surface condensation at the interior of the loggias.

In summer, on the other hand, and this applies particularly to the loggias with the maximum exposure to the sun, interior temperatures can peak well above 38 °C, above all in view of the defective solar protection blinds.

We can therefore conclude that this "hybrid" space created by the suppression of the balconies is not suitable as a living space, and that any attempt to make the interior space of the apartment reasonably comfortable, the thermal buffer effect must be used diligently as seasons change. This means that thermal flux between the interior and the exterior space would have to be controlled by a modulation of the passage through the loggia.

The functional reality of the space is actually quite different; a closer analysis of the habits of a good cross section of tenants has demonstrated that the bigger loggias are often used as an additional room.

In the case of smaller loggias these become an extension of the living room notwithstanding the presence of the old window separating the apartment from the balcony as it once was (see fig. 2).

So we can see a considerable ambiguity of function and use concerning this loggias. Depending on the size of these spaces and on the free interpretation that the users make of their function the one recurring motif is an expression of their dissatisfaction expressed in various ways.

It seems obvious that the rehabilitation would have been different if this phenomenon could have been anticipated, and it might even had been considered worthwhile to question the wisdom of closing the balconies in the first place.

The Libellules are not a unique case. This kind of problem has been encountered even in new buildings. A detailed analysis reveals that in most cases it was a question of situations in which the use of balconies was modified during the construction, in order to win a few square metres of "living" space, often against the rules and regulations that govern normal building practice.

For this reasons the closure of balconies is often realized in a summary way, with the owner or architect making abstraction of the fact that a perfectly adequate old balcony will become an integral part of the living surface. Window frames and panes of inferior quality and an absence of ventilation systems, coupled with an inappropriate use of the space will quickly reveal it to be unsatisfactory to the tenants.



Figure 4 : Recently built housing block. The balconies were closed at the time of building. After 3 years of normal use, the first damage to the interior of the loggia due to condensation have appeared.

As far as the canvas awnings for solar protection are concerned a wind study has shown that the two principal facades of the building are in an orientation which exposes them to the strongest prevalent winds.

The tearing is all the more accentuated as the distance between the surface and the glass pane is rather large and there is no lateral protection so that the wind easily gets between the layers.



Figure 5 : Detail of a transformed balcony in a bow-windows and sight of solar protections in fabric torn.

2.4 The proposed solution.

Starting from our diagnostic a number of variants of intervention were proposed, based on the parameters of building, of comfort and of space.

In our opinion, only one of these offers a valid solution to all of the problems outlined as much for the future life of the building as for the quality of life for those who live in it.

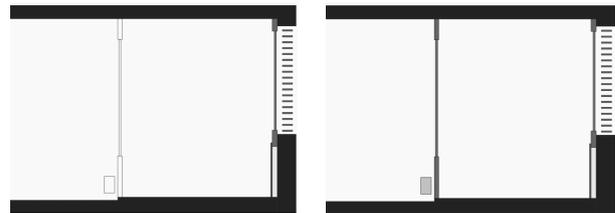


Figure 6 : suggested solution with unambiguous position concerning intermediate space.

alternative solution without ambiguous position from the intermediate space and not solving with certainty comfort in space.

This would entail the isolation of the walls on the interior and the suppression of the old windows, now inside the building, the replacement of the canvas blinds with a metallic Venetian blind system which is closer to the exterior surface of the windows with the addition of lateral elements of protection against the dominant wind. This solution had the additional advantage of suppressing the ambiguity of the intermediate space in making it clearly part of the sitting room.

As previously outlined the principal aim of this article is to demonstrate that a different approach is possible from the usual rehabilitation programme uniquely based on the constructive and energetic basis of making balconies into loggias.

We are not going to go into the usual details here of the thermal and economic calculations of the different variants we have considered. It is obvious that the variant we have come up with is by a short margin the most costly, however for a really complete comparison the "social" and "economic" value of this new space would also have to be considered.

Computational tools like HEAT2 [3], RADIANCE [4] were employed to calculate the variants.

3. "SPACES AND FUNCTIONS"

3.1 Historical signs in balconies and loggias evolution.

The unexpected theme that this study revealed to us finally incited us to take a look at the evolution of balconies and loggias in classical urban housing during the last century.

The primordial function of balconies is to allow the occupants of a house to get a better view of what is happening outside, or simply to take a breath of air.

In buildings of a certain rank the balcony can be absorbed in the apartment still allowing for the same functions with a better protection; such space would be called a "loggia".



Figure 7 : Geneva detail of a loggia in a XXth century building.

Bow windows (oriels) have a similar function to closed balconies.

In Nordic countries this architectural solution allows, aside from a view onto the exterior, a larger luminous surface, with a protection against the often harsh climatic conditions.

In some southern countries oriels are equipped with special devices of visual protection allowing the inhabitants to look out without being seen. These shutters and screens also serve as generators of shade and as ventilation slats.



Figure 8 : Tunis, the Médina. Traditional Oriel.

In many Mediterranean countries balconies on buildings exposed to the wind are often protected by structures not unlike bow windows. The depth of the space created is reduced to 60 or 80 cm.



Figure 9 : Bilbao wind protection screens over balconies.

Among the different interventions we have met in our study, here are two interesting case studies which fit well into the subject of the transformation of spaces originally built as balconies.

The first case, illustrated in fig 10 was found in a building of the XXth century and represents a « hybrid » intervention in which only a part of the original balcony has been closed off. In this case, taking into account the privileged viewpoint the balconies offer, the space created, even in its reduced dimensions has become a genuine prolongation of the living room, both in summer and in winter.



Figure 10 : Geneva. Detail of a sheltered and partially enclosed balcony in a XXth century building.

Figure 11 shows an intervention on a building of 1960. It comprises the placing of sliding glass plates which can be easily moved and stocked at one end of the balcony space. This type of intervention was imposed by acoustic as well as thermal criteria; the facade of the building is next to an important traffic route, and exposed to strong winds from the lake just across the street.

Aesthetically and functionally this is a particularly interesting intervention. The glass plates give the façade a certain lightness and leave the initial aspect of the building intact. Not a single structural element is apparent in front of the balconies, the glass plates are suspended from an overhead rail. A fine adjustment of the glass panes and their relative movement allows for a weatherproof and soundproof facade when all of the elements are closed.



Figure 11 : Bellevue, Geneva, Sliding glass panels over balconies on a mid XXth century building.

The glass facade is very easily adjusted which allows the inhabitants to interact with their environment on a virtually daily basis making the space sometimes a balcony and sometimes a bow window.

With such an approach the architects have certainly avoided the problems which would have been inevitable in the case of a fixed enclosure of the balconies such as on the Libellules estate.

This space modulation notwithstanding, the fact that the facade is movable and not fixed and sealed and the fact of having preserved the transparency of the primordial building allows the balconies to conserve their original function.

4. EPILOGUE

To conclude we note that the different traditional solutions are responses to well defined and established usages, leaving us in no doubt as to their spatial function or of the constructional characteristic of the generated intermediate spaces. This clarity is invariably diffused or lost in most modern interventions or rehabilitations.

We must also point out the disturbing fact that this badly solved situation and defined situation is often visible in recent buildings.

In the specific case of the Libellule block we suppose that the original intention of the modifying architects was to «repackage» the building in thermal insulation, and thus to allow it to conform to the norms in force at that moment. This was obviously also the case of the balconies, in the hope that a relooking would make the loggia spaces comfortable. This has obviously not proved to be the case.

No matter what degree of precision the computational and measuring tools at our disposition might have, allowing very fine measures of the physical aspects of a building, it seems very clear to us that before any intervention a clear idea of the future function and needs of spaces to be transformed is indispensable. The function must direct us to the intervention we need, and not the contrary.

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