CREBA

CENTRE DE RESSOURCES
POUR LA RÉHABILITATION RESPONSABLE
DU BÂTI ANCIEN

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Charter for the responsible retrofit of historic buildings

rehabilitation-bati-ancien.fr

SUMMARY

1 > INTRODUCTION

This charter was drawn up by the executive board of CREBA, the French centre for responsible retrofit of historic buildings.
As a definition, historic buildings are all buildings built before World War II with traditional materials (bricks, stones, cob, etc.) and techniques, while more recent buildings were built with industrialised ones.

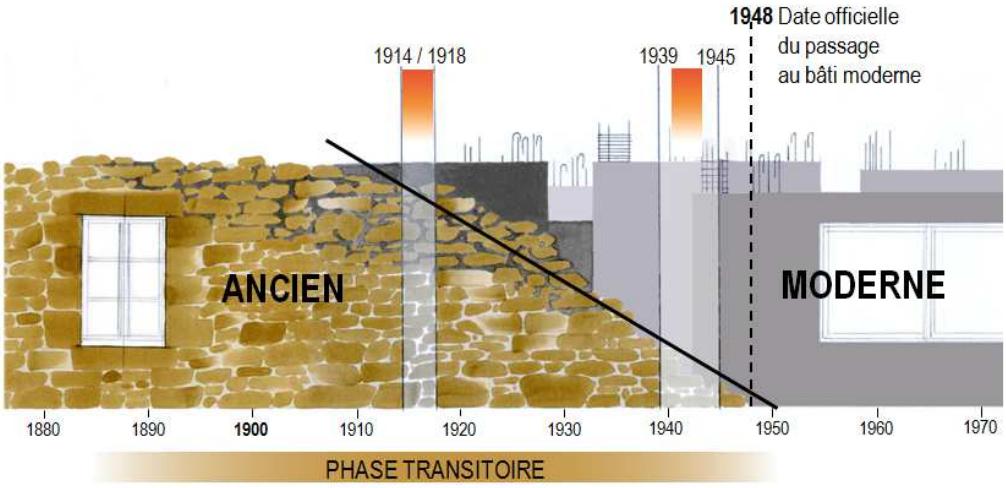


Figure 1 : Evolution of construction methods in France during the 20th century (source: MPF)

Retrofitting historic buildings deals with several specific challenges:

- **Environmental :**

  Because of their average energy consumption level and their number (approximately 33% of the existing stock), historic buildings represent a huge opportunity to reduce energy consumption and to cut greenhouse gas emissions.

- **Cultural :**

  A major part of heritage buildings were built before World War II. Most of them are not protected by law and their retrofitting could endanger their heritage value. However, their retrofit leads to a problem of conservation and enhancement.

Figure 2: Illustration of the cultural issues associated with loss of architectural value after energy retrofit (photographs before and after retrofitting - source: DRAC Grand Est)

- **Technical :**

  Historic buildings have a specific hygrothermal behaviour, very different from modern buildings. Retrofitting historic buildings without taking it into account can cause damages, going from mould growth to collapsing floors.

Figure 3 : Illustration of the technical stakes associated with the risks of pathology after energy retrofit (source: STBA)

Through these different issues, it appears that the retrofit of heritage buildings requires a global approach, integrating many other issues than thermal performance alone.

The present charter thus aims to propose an approach and criteria to be respected for a so-called "responsible" retrofit of a historic building.

This charter defines an approach to rehabilitation that the members of the CREBA resource centre seek to promote and enhance, in particular through case studies and other tools available on the www.rehabilitation-bati-ancien.fr website.

This document is composed of two main parts:

- **General requirements** that retrofit project must comply with as a whole;
- **Specific recommendations**, theme by theme, to be followed for each project according to their context.

2 > GENERAL REQUIREMENTS

A "responsible" retrofit project of a historic building has integrated the heritage, energy and technical dimensions of the building and has been the subject of a study justifying the choices made and the expected results.
Such a retrofit project does not, a priori, respond to any "standard" retrofit measures.
It must be able to justify a **global and contextualised approach** to the project, from the **diagnosis phase** to the **choice of energy efficiency measures** and their implementation.

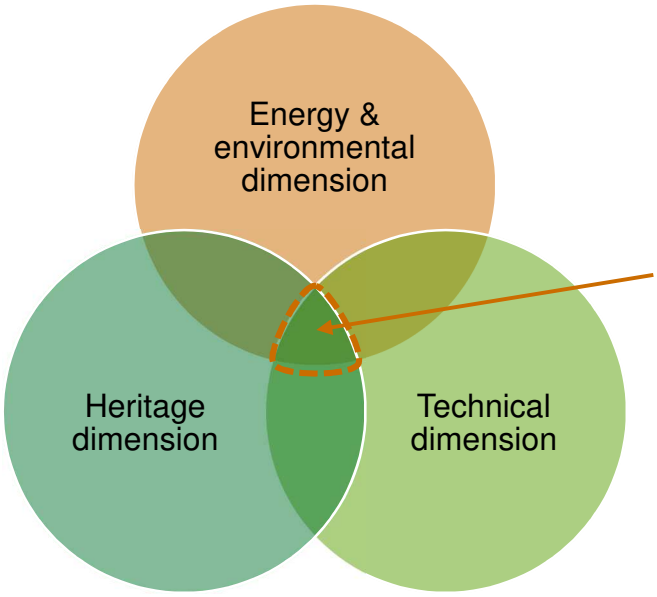
This global approach is defined by the European standard *EN 16883 "Conservation of cultural heritage - Guidelines for improving the energy performance of historic buildings".*

2.1 > A necessarily global approach

Retrofitting a heritage building cannot be limited to the objective of reducing energy consumption. On the contrary, it must follow a global approach based on:

1) A **complete diagnosis** of a given existing condition,

2) A **choice of measures justified by a multi-criteria assessment**, according to three particular dimensions, beyond the economic and social stakes inherent to any retrofit project:
    - Energy and environmental dimension (reducing energy consumption and the environmental impact of the building, increasing indoor comfort)
    - Heritage dimension (preserving the architectural and heritage values of the building)
    - Technical dimension (durability of the components and sanitary quality of the building)



Responsible retrofit approach:
From the diagnosis phase to the choice of measures and their implementation

Figure 4: Dimensions of a "responsible" retrofit approach

By following this global approach, the retrofit project must be carried out by a multidisciplinary team with the required architectural, technical and energy efficiency skills, in close collaboration with the project owner and the users of the building.
Where appropriate, particularly for buildings of outstanding value or located in protected areas, the responsible authorities should also be involved.
The project team should be sized to suit the complexity of the project.

2.1 > An overall assessment of the existing buildings

It is necessary to carry out a comprehensive diagnosis of the existing building, enabling informed decisions to be made on possible measures to improve energy performance.

This initial assessment includes:

- General information about the building (general description of the building and its context, current and future use, ...).
- A description of the heritage significance and conservation opportunities and requirements (2.2.1).
- An assessment of the technical condition of the building, its components, and associated environmental factors (2.2.2).
- An assessment of the initial energy and environmental performance (2.2.3).

2.1.1 > Heritage diagnosis

The heritage diagnosis should collect the following information:

- The history and evolution of the building and its elements.
- Details of the building and technical systems. This includes the original layout, the development of the exterior and interior form and the evolution of the use or function of the building.
- A description of the heritage significance of the building, as well as its character-defining elements and their vulnerability to change.
- Conservation and retrofit priorities or requirements.
- The opportunity or potential to re-install or reveal lost or hidden features (e.g. re-installation of the original window type) or to increase their heritage value.

2.1.2 > Technical diagnosis

The diagnosis of the technical condition of the building should collect the following elements:

- An overall description of the construction type.
- An assessment of the condition of the building envelope components, accompanied by brief descriptions (constituent materials, finishes and hygrothermal properties, previous interventions).
- An assessment of the condition of the building's technical systems, accompanied by brief descriptions.
- Information about the local environment, the climatic and topographical conditions of the plot, the physical interactions with the surrounding buildings.

2.1.3 > Energy and environmental diagnosis

The diagnosis of the energy status of the building should collect the following elements:

- The actual energy consumption of the existing building and the associated CO2 emissions,
- The overall heat losses of the building, as well as their distribution by components (walls, windows, floors, ...).
- The performance of energy systems.
- The conditions of management and use of the building.
- The level of indoor comfort, according to the seasons.

2.2 > A global approach for the choice of retrofit measures

The global diagnosis described above feeds the project owner's programme and allows to determine the priorities, opportunities and requirements of the retrofit project.

Different retrofit measures can then be considered.

The choice of the measures ultimately selected must be made according to a multi-criteria approach, based on energy performance objectives, but also on how these measures influence the physical behaviour of the building and their impact on its heritage significance.

This assessment can be applied to components of the building as well as to the building as a whole.

☞ The « Guidance Wheel » tool is a help to this overall approach.
The assessment method, based on a risk-benefit principle, allows to identify the best measures and eliminate those that are unsuitable

3 > SPECIFIC RECOMMENDATIONS

3.1 > Taking the heritage dimension into account

A retrofit project integrating the heritage dimension is based on the **respect of the authentic elements constituting the building**, while **allowing its adaptation to the current way of life**.
It is a retrofit that generally tends to:

- save the existing elements that constitute the heritage value of the building, giving priority to their repair, restoration and reuse,
- give preference to replacement by identical and compatible elements (materials and shape),
- restore original provisions which have been distorted,
- use contemporary architectural interventions in a reasoned and justified manner, without damaging the original architecture.

According to the applicable rules, it is necessary to obtain planning permission.

☞ Below is a **list of recommendations to be followed** to take into account the heritage dimension, by building component.

☞ The overall diagnosis will help to determine the opportunities and requirements **specific to each building** and to adapt these recommendations to the project's context.

3.1.1 > Interventions on joineries

It is necessary to consider the possibilities of conservation, improvement (over-glazing, improvement of airtightness...) of existing windows or the installation of double windows.

If these actions prove to be irrelevant, then preference should be given to interventions that respect the shapes, proportions and materials of the original joinery, whether in terms of:

- Dimensioning and rhythm of the openings,
- Drawing of the joinery (thickness of the uprights and glazing bars to be preserved),
- Choice of frame materials (wood is the preferred material).

The same applies to interventions on guardrails or shutters.
Thus, existing elements should be retained or restored if they have been deleted, as follows proportions and original materials.

3.1.2 > Interventions on roofs

As far as possible, attics should not be occupied and their floor should be insulated, thus preserving their original function as heat buffer spaces.

Furthermore, preference should be given to interventions that respect the nature and colours of the original roofing materials (tiles, slates, metals) or those traditionally used on this type of building.

When working on the framework, the proportions, shape and method of assembly of the original framework should be followed.

The external Insulation of the roof can be considered, provided that it respects the architecture and volumetry of the building.

3.1.3 > **Interventions on walls**

Several measures can be implemented, starting with so-called "thermal correction" measures.

For walls giving to the outside or to an unheated volume and in cases where heat losses are high, insulation measures can be put in place.

The external insulation of walls without decoration and without particular heritage value (mainly gable wall, rear facade, ...) is conceivable, provided that it does not require the destruction of authentic elements, that it respects the proportions of the facade and that the connections with the other maintained elements of the construction are dealt with (window frames, eaves or cornices, etc.).

Interior insulation of walls presenting decoration elements (of plaster, of wood, etc.) is possible, provided that it does not require the destruction of authentic elements and that it restores the decorative elements.

As regards the treatment of external coatings: in terms of composition and colour, the original coatings or those traditionally used on this type of building must be respected.

3.1.4 > **Interventions on systems**

Duct exits (heating, ventilation) on the main facade(s) should be avoided, as well as roof exits or caps treated with non-traditional shapes and materials.

As far as flue gas ducts are concerned, preference should be given to existing ducts. If a new flue is installed, it should be a roof outlet.

Similarly, outdoor units of heat pumps should be avoided on the main facade(s), or should be integrated into the building.

The possible installation of renewable energy devices (such as solar panels, wind turbines, etc.) must be the subject of a siting study in order to respect the architecture of the building.

If a single-flow system is installed, the air inlet on the living room windows should be as unobtrusive as possible, both inside and outside.

3.1.5 > **Extensions**

Extensions, including those treated in a contemporary manner, are conceivable, provided they are justified by architectural considerations.

3.1 > Taking the energy and environmental dimensions into account

Retrofit that integrates the energy and environmental dimensions must aim at an overall objective of the **French low-energy consumption buildings label** by 2050, in accordance with the provisions of the French law for energy transition and green growth.
This requirement must be assessed after reception of the building, by monitoring the performance of the building.

This objective can be modulated **according to the technical and architectural particularity of the building**, revealed by the diagnosis, and specific to each case.

This objective can also be **achieved by step** (partial retrofit, on only a few components), provided that a more global retrofit is considered at the end.
The order in which the components are retrofitted must be justified and the retrofitting of the other components but be anticipated.
So, ideally:

- The insulation of the envelope is to be preferred before installing new equipment;
- The performance of the retrofitted components should be towards the low –-energy consumption building label;
- A discussion must be carried out on the treatment of interfaces and interactions between components. Here again, the use of the "Guidance Wheel" tool allows to identify these interfaces and interactions (e.g. installation of a ventilation system when changing joinery).
- The environmental impact of the materials, products and equipment installed must be integrated into the reflection.

☞ Below is a **list of recommendations to be followed** to take the energy and environmental dimension into account, with regard to the performance of the envelope, equipment, airtightness and environmental impact.

☞ The overall diagnosis allows to determine the opportunities and requirements **specific to each building** and to adapt these recommendations to the context of the project.

3.1.1 > Envelope performance

Interventions on the building envelope must aim at meeting the performance criteria of the French low-energy consumption buildings label.
Any other performance may be considered, provided that it is justified by architectural and energy considerations and/or relating to the indoor comfort of the users.

3.1.2 > Equipment performance

Interventions on equipment must aim at meeting the performance criteria of the French low-energy consumption buildings label.
Any other performance may be considered, provided that it is justified by architectural and energy considerations and/or relating to the indoor comfort of the users.

3.1.3 > **Airtightness**

The airtightness of the retrofitted building must be taken care of. It can represent a significant gain in consumption.
An airtightness objective can be set after diagnosis of the initial envelope.
An airtightness test carried out at the reception of the building will make it possible to verify that this objective has been achieved and to correct any unintended air leakage.
The search for this airtightness must necessarily be accompanied by a reflection on the building's air renewal systems (passive or active).

3.1.4 > **Environmental impact**

The choice of materials, products and equipment installed must be justified according to their environmental impact (use of environmental product declarations, or even a global calculation based on a life cycle analysis of the retrofit project).
In line with this, reused, local and biobased sectors are to be favoured.

The choice of energy used to operate the building after retrofit must also be considered according to its environmental impact.

3.2 > Taking the technical dimension into account

Taking the technical dimension into account in the retrofit project means using materials, systems and implementation processes that:

- Respect the rules of the Art;
- Are compatible with the physical functioning and constitutive elements of the original building;
- Avoid any possible damage and thus guarantee the durability of the building.

☞ Below is a **list of recommendations to be followed** for taking into account the technical dimension, by building component.

☞ The overall diagnosis allows to determine the opportunities and requirements **specific to each building** and to adapt these recommendations to the context of the project.

3.2.1 > Interventions on walls

Before insulating (wall, floor), it is recommended to fix structural disorders and to limit possible sources of humidity by:

- Stopping water infiltration;
- Managing the indoor humidity;
- Limiting capillary rise;
- Restoring elements that may have been altered or contaminated by mould.

In case of insulation, it is recommended to choose materials and techniques that are not likely to create hygrothermal damages.
In particular, it is necessary to:

- Select insulation, airtightness membranes and coatings that maintain the balance of vapour and capillary transfers within the original wall;
- Take care of the airtightness of the envelope and avoid any puncture of the membrane: this is to limit any vapour infiltration and any possible condensation point inside the wall;
- Ensure sufficient indoor air renewal to limit humidity.

In fine, the use of a project manager is recommended to allow a justified choice of the type of insulation, on the basis of the global diagnosis and by integrating the particular hygrothermal behaviour of the old walls.

3.2.2 > Ventilation and aeration

Any intervention on the envelope must be accompanied by a reflection on indoor air renewal and the efficiency of the ventilation system.
It is advisable to respect the air renewal rates prescribed by the French 24 March 1982 decree relating to the ventilation of dwellings, or by the French labour code and the French departmental health regulations in the case of tertiary buildings.

3.2.3 > Other

It is recommended to design notebook for users to keep records of the implemented interventions and to explain the conditions of management and maintenance of the retrofitted building.
Such a notebook should include in particular:

- Conditions for subsequent measures (risk of possible airtightness membrane puncture, ...);
- Conditions of management and maintenance of the heating and ventilation system (changing filters, cleaning of the air inlets, ...);
- Good operating practices (ventilation, temperature settings, ...).

4 > APPLICATION OF THE CHARTER

This charter, co-written by the members of the CREBA resource centre, is a framework document to define and promote a "responsible" approach of the retrofit of a heritage building.

It is intended to be shared and relayed by any actor (institutional, professional, etc.) involved in the field of heritage and energy retrofit of buildings.

A given project may be valued in the light of this charter, on the website www.rehabilitation-bati-ancien.fr, under the heading "case study", after examination by the steering committee of the CREBA resource centre.

Members of the CREBA resource centre :

A project supported by the PACTE programme :

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