Consolidation and repurposing of cornices.

IS IT:

- [ ] *Product*
- [X] *Technology*
- [ ] *Equipment*

APPLICABLE FOR:

- [X] *Restoration*
- [X] *Rehabilitation*
- [ ] *New Construction*

APPLICABLE ON:

- [ ] *1. Foundations and underground structures*
- [ ] *2. Vertical structures*
- [ ] *3. Horizontal structures and vertical connections*
- [ ] *4. Roof and terraces*
- [X] *5. Façade and building envelope*
- [X] *6. Finishes and completion elements*
- [ ] *7. Integrated services*
- [ ] *8. General strategies for building recovery*

Related companies: *No companies; university research; structural study.*

DESCRIPTION

The operations of reinforcement and repositioning of cornices, frames, and moldings, using suitable mortars and specific techniques, are necessary when phenomena such as gaps, lacks and detachments are evident.

The causes could be anthropogenic (accidental damage, pollution) and natural (biological aggressions, infiltrations, meteorological factors).

These could cause various forms of degradation such as superficial saline efflorescence, exfoliation of the finishing or more serious forms such as breakages, collapses and consequent gaps.

WHY TO USE

The intervention aims to:

1) preserve the integrity of the elements and maintain the decoration and morphological structure of the façade;
2) avoid further detachment, with consequent fall of elements.

However, these elements have a significant task of protecting the façade since they guarantee a continuous and regular removal of the rains that would otherwise cause damage.

HOW TO USE AND APPLY

For the integration or reconstruction of moldings, cornices or particular friezes, that are not made of natural stone or brick, it is suggested to use a moldable, fiber-reinforced mortar.

For the cornices, the same hydraulic lime-based mortars, commonly used for the external plaster, can be applied. In both cases, the mortar of the finishing layer must use very fine aggregates such as marble dust.

If the internal structure of the cornice, in brick or rough stone, is compromised, it is necessary to restore or glue it to the masonry before proceeding with the works on the finishes.

In the case of non-cohesive finishing, its total detachment is carried out by staking out. Then brushing and hydro-cleaning are applied to eliminate the possible dust from the surfaces of the support. If there are damaged parts, they can be restored with a modeling mortar based on hydraulic lime and coarse sand.

After cleaning, on the wet surface, a smooth plastering layer is applied (Fig. 1). In some cases, a net is put in place to ensure adhesion to the plaster.

In the cornices, the mortar application is made for significant parts by contours that allow to propose again the original shape (Fig. 5). Finally, the final painting is done, possibly with silicate or lime-based dyes.

In some cases, for the reconstitution of a cornice missing parts, a wooden and metal support is installed (Fig. 2)

In the case of reinforced concrete, the degraded and detaching parts are removed until a solid and resistant substrate is reached, proceeding with an energetic brushing of the reinforcing metal or steel bars, also using abrasive discs, until eliminating any trace of rust on the surface.

The metal or steel bars are then treated with a rust converter which can be removed by brushing or covered with a corrosion inhibitor. That is done to avoid a direct contact with the cementitious mortar. Where necessary, the reinforcement is integrated through welding with other bars or steel elements, then intervening with the application of a corrosion inhibitor (Fig. 3).

Afterwards, after a few hours and before applying the restoration mortar, it is necessary to remove the remaining dust, wash and soak the surface to facilitate the perfect adhesion of the new mortar to the support. In some cases, it is possible to use a primer to improve its adhesion.

The concrete shapes are then restored using a single-component, thixotropic, rheoplastic and anti-shrinkage cementitious mortar specific for concrete recovery interventions (Fig. 4).

That should be characterized by high mechanical resistance. The thixotropic component allows the mortar to take on a gelatinous appearance at the moment of laying which gives stability to the mortar itself. Sometimes for the reconstruction of the shapes it is possible to use formworks for the casting of non-thixotropic and, in any case, rheoplastic and with compensated shrinkage mortars. The use of a primer can facilitate adhesion to the

original concrete. All the surfaces are subsequently grouted and smoothed.

If the original shape shows moldings with complex designs, firstly they must be detected by casting from the intact parts (Fig. 5) and possibly defined in their complex parts with manual tools (Fig. 6).

The intervention ends by applying a final paint, possibly with a silicate or lime-based product.

In the event of instability of cornices or masonry moldings, it is advisable to clamp the structure of the overhang to the wall with threaded stainless-steel rods or fiberglass rods. This expedient can also be used to clamp the reconstructed parts with the original ones.

In the case of complete reconstruction, or of considerable integration, different systems can be used with reconstruction of light shapes in ribbed, nets or hollow fiberglass shapes to be connected to the masonry. The latter can be purposely made from a cast obtained from the intact parts.

TECHNICAL CHARACTERISTICS

The mortars used for restoration should not show a too liquid consistency since they must keep their shape immediately after their application.

Their micro-granulometry must be carefully selected in order to obtain a homogeneous and compact application. If the mortars are used to reconstitute shapes, they must present a mix of coarse aggregates in order to have greater consistency and resistance.

RECOMMENDATIONS AND OTHER INFORMATION

In the reinforcement treatment phase, if the bars show a high degree of degradation, and no longer perform their function, they can be replaced.

To obtain a good adhesion, it is advisable to work fresh on fresh.

The surface must be moistened before modeling the decoration.

EXAMPLES

RESTORATION AND REHABILITATION OF THE FAÇADES AND ROOF OF THE PALAZZO BARBIERI-PIOVENE-CICOGNA, VICENZA, LATE 17TH CENTURY.

ACTUAL STATE OF THE WORK

All the external *marmorino* coatings (consisting of a rough-coat in *cocciopesto* and a very thin curl, very smooth and ivory-white *marmorino*) were in a very bad state of conservation. In particular, in the main façade facing the street many damages were added over time due to the action of erosion and degradation caused by the atmospheric pollution.

There were also numerous detachments, lacks and cementitious patches from various periods.

Fig.1: Wall underneath the seventeenth-century finish and dating back to the late medieval period.

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The façade showed panels made by bricks arranged in a flat position and anchored to the masonry with lime mortar and wrought iron nails.

The nails oxidated during time with the consequent volume increase and, therefore, the formation of cracking in the bricks where they were fixed, contributing to aggravate the detachment and fall of the plaster.

Fig.2: Parts of panels in relief made with nailed bricks and marmorino plaster.

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Even the stone materials put on the façade were in bad condition, both due to the characteristics of the material itself (yellow limestone in soft stone, quarried in the Berici Hills), and to the spread of various degrading pathologies: presence of coherent and incoherent deposits, cracks and micro-cracks, flaking and fragmentation, presence of biodeteriogenic agents and black crusts.

The lack of adequate maintenance also led to the fall of a statue, placed on the eaves line, which ruined the underlying cornice, which at the time was simply secured by means of some "L" brackets fixed in the wall and cables. steel.

Fig.3: Securing interventions of decorative elements.

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INTERVENTION

The intervention on the plastered surfaces began with the removal of all the cement patches applied over time: it was a controlled manual demolition in order to avoid damage and excessive vibrations to the surrounding areas of the original plaster.

Then, the colonies of microorganisms were removed by applying a biocide product and subsequent removal of weeds using brushes, spatulas and washing. The cleaning phase of all the surfaces was carried out with nebulized water to remove encrustations. That is a highly effective method whereas carbonaceous sediments and dirt are not very adherent to the surfaces. In many areas the substances to be removed were particularly tough. Consequently, it was necessary to complete the cleaning cycle with ammonium carbonate.

For the plasters‘ reinstatement, as they were incomplete or irretrievably detached, a marmorino analogous to the original one was prepared by imitating color, thickness (number of layers), composition, transpiration and surface finish. Consequently, it was compatible with the support also with regard to the coefficients of thermal expansion and mechanical resistance. Thus, the same behavior under different stress loads (rain, steam, humidity) was guaranteed. The stones resulting particularly exfoliated, eroded, or disintegrated were pre-consolidated by impregnation with brushes, syringes, pipettes, based on acrylic resin in solution.

This intervention avoided the fall of further material during the work, allowing the subsequent phases of grouting of the micro-cracks and gaps, made with lime mortar (natural hydraulic lime with a very low salt content), prepared directly in the construction site, and added with hand-ground stone, in order to have a grain size similar to the original material.

The cornice damaged by the fall of the statue has been restored giving continuity to the frame, eliminating the old and unsightly metal devices, and realigning the elements, which have been fixed to each other and to the masonry with reinforced bars.

Fig.4: Realignment of the elements of the cornice.

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Particularly interesting is the constructive expedient of some decorative elements of the cornice.

They were as wide as the entire thickness of the masonry and hollowed out in a "tub" manner, served as a drainage gutter for rainwater, which flowed through the sculpted zoomorphic masks, acting from gargoyles towards the street.

This ingenious system has naturally been maintained, albeit with the addition of a prudent layer of waterproofing sheaths, and with the channeling of the water inside two downspouts.

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WEBSITE OF THE COMPANY

N/A

IMAGES AND CAPTIONS

Fig.5-6: Example of reconstruction of the overhanging structure in reed mat and subsequent re-plastering (fig.5). Reconstruction of the cornice with wood and wire mesh (fig.6). © *http://www.giancarlomariani.it/wp-2/project/palazzo-saladini-pilastri/ ; http://www.giancarlomariani.it/wp-2/project/palazzo-saladini-pilastri/*

Fig.7-8: Cleaning of the steel reinforcing bars (fig.7). Restoration of the cornices with suitable mortar (fig.8). © *http://www.giancarlomariani.it/wp-2/project/palazzo-saladini-pilastri/ ; http://www.giancarlomariani.it/wp-2/project/palazzo-saladini-pilastri/*

Fig.9-10: Modeling of the original molding by means of a template (fig.9). Sculpture of the cornice (fig.10).
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