

BASIC IDEA AND MATERIAL: AN INTEGRATED APPROACH, FROM THE KNOWLEDGE TO THE CONSERVATION

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ABSTRACT:

To preserve a cultural asset, the main goal to achieve is represented by the conservation, which can be carried on, at first, through a preliminary scientific program of knowledge “of the object, and the context it is referred to. In this critical moment, the most influent aspects are the interdisciplinary instruments and methods coming from heterogeneous available sources that have continuously been updated.

The rich cultural heritage related to the architectural asset, at things stand, create serious problems of documentation: by using a pragmatic attitude, it is necessary to supply to include in the ordinary cultural work, methods and techniques, that on the basis of wide margins in the metric plotting, can be able to guarantee the memory as in the essential form as in the characteristics of a building.

Obviously, the manufactured product’s objective importance and complexity will inform about the opportunity or the impossibility to adopt simplified or sophisticated techniques, but if either economic sources, nor temporal ones would be enough, it seems to be appropriate to safeguard, first of all, the artistic heritage’s memory, converting the artistic work, at least, into the photographic documentation.

Fortunately, the photographic picture [by using a few shrewdness] can be considered, even if a modest metric precision’s “measuring instrument” a very fruitful work’s tool.

The photograph doesn’t provide an analytic study, but it is useful in order to define the manufactured product’s consistence.

The first step is to establish the building’s shape and realize a basic communicable image (qualitative judgment); only afterwards, and after a precise global rating, the accurate analysis could be considered as a possibility (quantitative judgment) and in the end it will be decided the opportunity to operate or not.

1. INTRODUCTION

Today, the necessity to get an outcome, that constitute the scientific support underlines the importance of interdisciplinary context for an enormous range project, as the knowledge for the cultural historical heritage’s conservation.

Besides, the “operative priority” problem is still open: Which operations do we have to execute first?

Are there some operations which could be executed simultaneously? Is there the possibility to change the established protocol without any injury to the job?

Summarizing the previous lines, the first step to do is to define the building’s shape. But the deep understanding of a shape (architectural shape, but not only) which cannot belong to the concurrence of the cultural range of that on to the researcher’s one, must consider the object into its symbolic, functional, material, evocative, contextual values.

The primary goal is to offer friendly technology to the operators of the human sciences field, including the subjects that are interesting in the protection, the improvement and the preservation of the cultural heritage. Although, the times have been changed, within the most authoritative intellectuals, real deputies of the culture’s defence, there’s a strong and at the same time unjustified aversion for the technology. Instead, it is very important to spread the new technologies, with a common sense, free of prejudices, technologies made friendly thanks to the designer’s job, which had the merit to make them known and “popular” by the most of people.

It is necessary to carry out the process acceleration, fortunately already in progress, of the conversions from old procedures, outmoded techniques and unnecessary resistances to new and modern methods and techniques.

It is interesting to cite the example of a group of archaeologists of the classical age, that without losing their own specificity concerning the philology and the archaeological excavation, they manage all the sphere of the metrical survey through the computerized control of the topographic operations and simplified photogrammetry.

It is important to underline how today the conservation’s project, into its development, requires the rationalization of a process identified by the application of a planning method and by the adjustment and the standardization of the vocabulary of the statute’s restoration. It comes from that, the opportunity to create a representation through whose the information objectivity can make easier the reading, also the critic one; besides the representation should highlight in a direct manner the successions and the comparisons of the operations expected. Nowadays, the topographic techniques and the photographic representation haven’t just the function to document in objective way a *status quo*, but, through repeated applications, they can also afford a reading “on going” of the consistence: the creation of an incontrovertible data base able to provide the good’s monitoring as time goes by and its scientific contextualization in a extended and integrated system.

Besides, the representation of the conservation's process constitute a complex and central problem. The need to transpose in graphic - and in synthesis- the information derived from the numerous analysis carried out on the historical building together with the decisions taken with regard to the project, involves, at first, the design, because a survey as coherent as possible with the dimensional and proportional relations with the material consistence of the building itself, it will provide a graphic support as similar to the reality as possible, to be used to add the critic information and the information concerning the project. The new technologies offer unlimited levels of investigation for the survey and the plotting of an investigated object, but it is necessary to establish the more convenient refinement's level to the specific case.

And now the strict sharing of purpose comes into play that has to established between the disciplines. Also motivating the opportunity that these technologies can be applied always on a larger scale and with higher interchangeability.

From the most exhaustive knowledge of the historical building, it will spring the operation of conservation/ restoration, that today, more than even, represents a main act in the diachrony of the building itself formulating of compatible choices and integrated functions.

1.1 Cases Study

In the general outline of the architectural, archaeological and environmental heritage's preservation, for a long time now it has been decided to adopt usual procedures based on strictness, cheapness and consequent possibility of a massive use, renouncing unrealistic application's programs of highly sophisticated methodology and techniques, therefore excessively specialized. For example, in archaeology, the totals low cost stations together with non-sophisticated topographic methodologies, managed in large part by adequate computer supports, have replaced the use of the "quadrillage" as metric reference table, always by keeping the purposes of territorial identification and by using the table as network for the camera orientation and the model orientation for an external positioning in photogrammetric operations.

The following examples assume the shape of this description.

The first one concerns the lucky movement of the traditional topographic methodology in archeological fields, performed by the archaeologists themselves, in the area of Occhiola near Catania, in Sicily (Figure 1).



Figure 1 Occhiola's network in the archaeological area

It is a typical example of survey to put in spatial relation tests carried out in different directions, but not so far from each other in fairly uneven grounds; at first an eight corners network has been set up, the measurement operations have been realized with a Total Station at 20cc, by using the trilateration only, both to make the job less heavy and because of the tool's mechanical features which become always more critical at the local execution temperatures, without assuring the good quality of the azimuthal measurement. A small excess of measurement has permitted an internal check of the reliability of the work, that, however, has been tested through a more precise Total Station. Table 1 shows the average results of the compensation executed with a commercial software (Starnet, Starplus).

σ_x	σ_y	σ_z
0.007 m	0.009 m	0.015 m

Table 1 RMS of the net

In conclusion, it has been possible to affirm that with only one Total station at 20cc, instrumentation distinguished by less rectification's problems because of its sensitivity's threshold relatively reduced, the Total Station works with usefulness in the detail's survey, with a distance in the order of a few tens of meters and so with a reduced risk to meet with unacceptable mistakes in case of problems related to the reading of the azimuthal circle; It could become a good instrument for the networks with maximum 200-250 meters per sides and with gaps which do not make the azimuthally corner exceed of $\pm 20-25g$ as regards to the horizontal. This kind of measurements can also be done by semiskilled staff in the measure's field but qualified in their own sector and trained in a simple and practical way.

The following example regards the archaeological area of Albintimilium that is Ventimiglia and the most significant surveys; this example has similar purposes and it is also brought up by the same operating philosophy of the previous one.

In this case some "crude" material have been used and bought by Regione Liguria and by Provincia di Imperia, which are the aerea-photograms used to reproduce technical cartography on a scale of 1:2000, to produce a map on a scale 1:500.

The claim to get cartography on a scale 1:500 from frames planned for the realization of technical maps is normally denied by the cartographers and by the photogrammetrics, which is why it's necessary to make some preliminary statements:

1. We're not dealing with the cartography, but we're speaking about the drawing of the Roman area map of Ventimiglia with metric soundness suited to the archaeologist's needs;
2. The topographic support is carried out in a stronger way and it is restricted to the area involved;
3. It is used to employ digital reproducers and even reproducer's programs on Personal Computer;
4. The final result is "adapted" to collect the local surveys executed with the traditional archaeological method or with surveys and integrations carried out with total station;
5. The product appears in the form of a drawing subsequently worked out and built in accordance with the Archaeologist requirements (Figure 2);

Otherwise, always remaining in the view of the widely held use of simplified methodologies made "popular" it is interesting to say that some appropriates photographic shootings have been executed by non-metrics cameras, both digitals and non-digitals. The result, although not very precise, has the typical characteristics of the photogrammetric product, firstly the

uniform allocation of the mistake. Besides, because of its simple use, this is not a time-consuming learning and it doesn't require too specific knowledge of Photogrammetry (Figure 3).

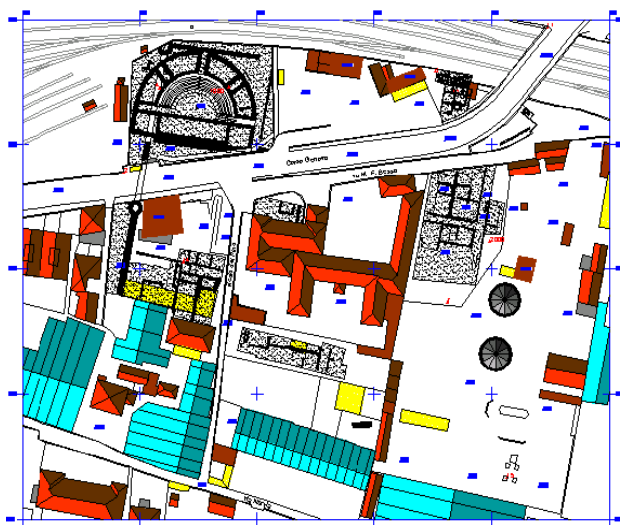


Figure 2 CAD reproduction (original scale 1:500)

It is particularly important to focus the attention on the Simplified Digital Photogrammetry's front, the "close range" in order to provide techniques and methods for the documentation and the survey of a big heap of minor cultural heritage, which is important as evident product stratified in the history.

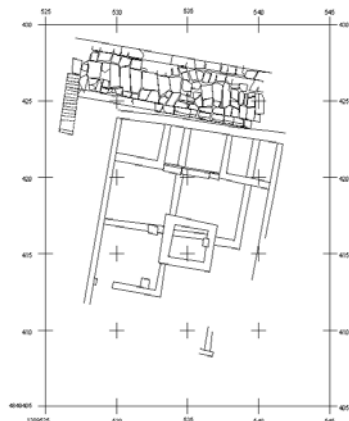


Figure 3 Photogrammetric plotting (original scale 1:50)

The following examples are referred to different realities or because of scale or because of study's aim

The Commercial software of Photogrammetry and "Modeling", if they are supported by simple preliminary topographic operations, offer good chances to store the Cultural Heritage at risk; often, they are enough for the preliminary operations at a detail's survey and they are able to provide results more than adequate and valuations about the different possibilities and typologies of restoration. This is the case of the Parrocchiale Church in Sale San Giovanni, in the province of Cuneo (Figure 4).

The combination of this software, also with non-professional means capable of execute aerial frames, make the survey operations of small areas cheap, with a moderate precision. This is the case of the "bricco" of sale San Giovanni (Figure 5).



Figure 4 Orthophotos of Parrocchiale Church in Sale San Giovanni



Figure 5 "Bricco" of sale San Giovanni

So, the problem of the cultural heritage conservation is precisely cultural and not always strictly technological. The safeguard of the building tradition doesn't pass only by some photographic operations or by high technical contents and high metric precision, but from the opportunity to offer to the specialists, and to all that are interested in Cultural Heritage, adequate means, which without dissuading them from their main interests, afford them to come to the creation of a picture expressed by the drawing, that could keep the memory of an asset and if necessary let it to be restored.

In the architectures study, the initial action is represented by the shape's understanding, which is normally represented by the identification of the geometries that are used as support to the understanding, itself: the most common example in view of the obvious consideration that a simple votive chapel appears as a parallelepiped overcome by a triangular section prism. The fact that the measurements deny the orthogonality of the figure's faces doesn't challenge the obviousness that in the builder's intention it had to be a parallelepiped surmounted by a triangular section prism!

Obviously, the big structures are more exacting, but going back to the De Architectura of M.Vitruvio Pollione or to Giorgio Martini's works or other treatises, or Guarino Guarini's ones and other architects, it is possible to justify the existence of Formal Geometries, which define the essentiality of a architectural shape; an essentiality not disrupted by the problems related to the material substance, that are essential for the construction.

The following figure 6 shows the reconstructions of the Hellenistic and Roman periods of the Theatre of Sagesta (Sicily)

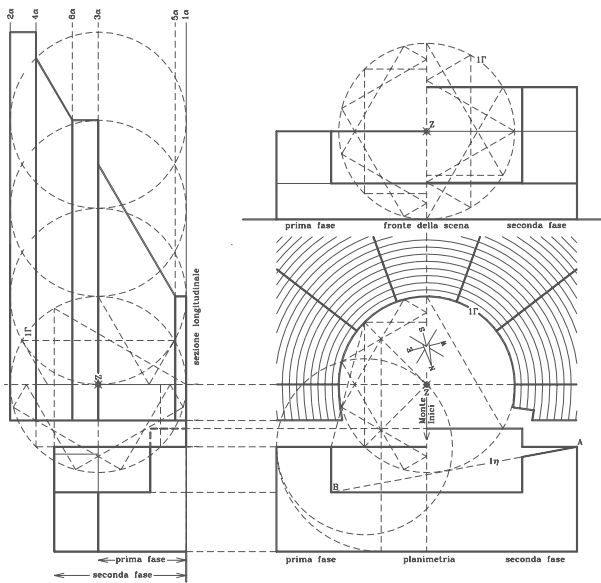


Figure 6 Geometric studies of Segesta Theatre

The hypothesis of a previous period of the same theatre (Figure 7).

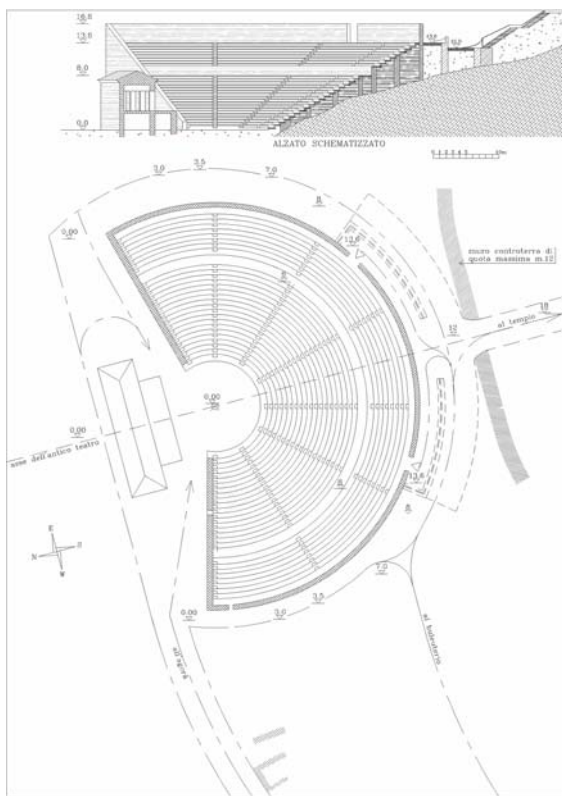


Figure 7 Hypothesis of Segesta theatre

In the example of the theatre of Segesta it has been executed a traditional architectural relief (the low cost photogrammetric methodologies didn't exist yet), while in Hierapolis, many measurements have been acquired by simplified photogrammetric techniques.

Also the communication of the hypothesized antique monuments reconstructions has changed, but in this case, it's

about coopting staff able to manage the new computer technologies especially from the point of view of the modelling 3D and the immersive animation.

The Benevagienna Theatre (Augusta Bagenorum) reconstruction hypothesis (Figure 8) has leaned against a metrical survey by using a topographic traditional methodology with a system of networks of collocation and survey on the celerimetric way, apart from the usual investigations of philological and architectural nature.

Afterwards, it has been set out the most probable geometrical diagram where it is possible to lean the real reconstruction. The product's impact, even if it appears rather superficial from the architectural point of view, use to produce an emotion with difficulty achievable by the most traditional and rigorous drawing.

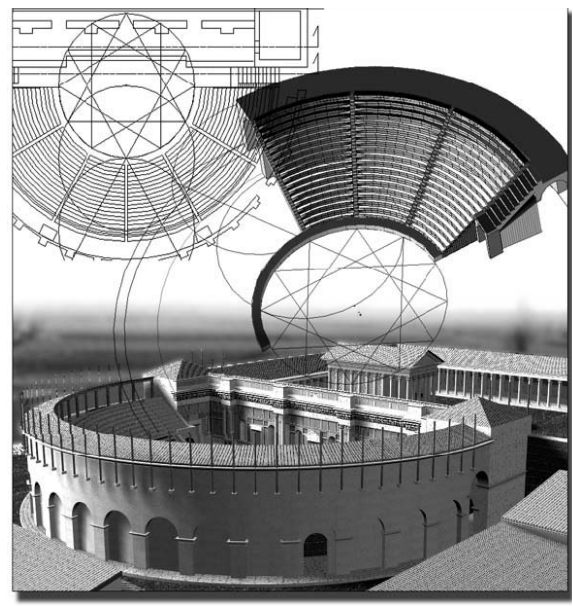


Figure 8 3D modeling on the basis of the geometrical reconstruction and the metrical investigation

In conclusion it is important to stress that the possibilities offered by the modern technologies, when they are managed by people skilled from the cultural heritage point of view, people able to escape from the illusory charm of an impossible precision and objectivity, they can be the real source for do not lose the memory of a past which is at the origin of our future.

1.2 Survey and conservation

To preserve a cultural asset, the main goal to achieve is represented by the conservation, which can be carried on, at first, through a preliminary "scientific program of knowledge" of the object, and the context it is referred to. In this critical moment, the most influent aspects are the interdisciplinary instruments and methods coming from heterogeneous available sources that have continuously been updated.

The survey is a fundamental step in the preservation and restoration's operations, especially in absence of precise documentation regarding the architectural asset's stratifications. Together with the material analysis and the building particulars, the survey allow to outline the situation, which will be afterwards completed by the investigation of the stratum of alteration, deterioration, deformation and the possible meltdown.

For the conservation of the discipline, the direct survey is considered the main instrument. In fact, it allows, at the same time, the punctual observation of the manufactured goods and the immediate check of the data acquired. The survey for the conservation deal with entering in the specific of any particular signs, so much to let to process a "history" of the building, through the perception of the different phases of aggregation and transformation.

Otherwise, thanks to the laser instrumentation the action's preparation become punctual and precise. That's the moment to define further necessary parameters for the project: the determination, for example, of the possible slope of the building texture, which can suggest the presence of subsidence, of settlements, also of little importance, where fessurative phenomena don't appear in evident manner. The same happens for rotation's phenomena when it is not clear yet the structure's stability.

So, after having highlighted some applicative opportunities, it is still important to underline a few aspects that cannot be ignored for a correct integration between the survey's disciplines, the representation and the conservation.

First of all it is important that the "actors" that carry out the measurement and rendering operations are specifically trained in the restoration field: pointing out a fracture, for example, it will be necessary to own a precise sensitivity and information about the physiological behavior of the building, to be precise, by finding the areas and the deterioration's products, it will be important to know the causes and the different expression's forms.

So, underling the importance of the different competences and disciplines that come into play in the conservation project, it is basic to confirm once more as the survey doesn't appear as analysis *tout-court* , but finalized to the purpose of the knowledge and the evaluation of the intervention on the factory (Figure 9-10-11).

That requires the rationalization of a process identified by the application of a planning method and by the adjustment and the standardization of the vocabulary of the statute's restoration. It comes from that, the opportunity to create a representation through whom the information objectivity can make easier the reading and besides the representation should highlight in a direct manner the successions and the comparisons of the operations expected.

Nowadays, the topographic and the representation techniques haven't just the function to document in objective way a status quo, but, through repeated applications, they can also afford an "on going" reading of the consistence: the creation of an incontrovertible data base able to provide the good's monitoring as time goes by and its scientific contextualization in a extended and integrated system.

From the most exhaustive knowledge of the historical building, it will spring the operation of conservation/ restoration, that today, more than even, represents a main act in the diachrony of the building itself formulating of compatible choices and integrated functions.

2. REFERENCES

M.L. De Bernardi, (The shape and its picture) *La Forma e la sua imagine*, ETS, Pisa, 1997

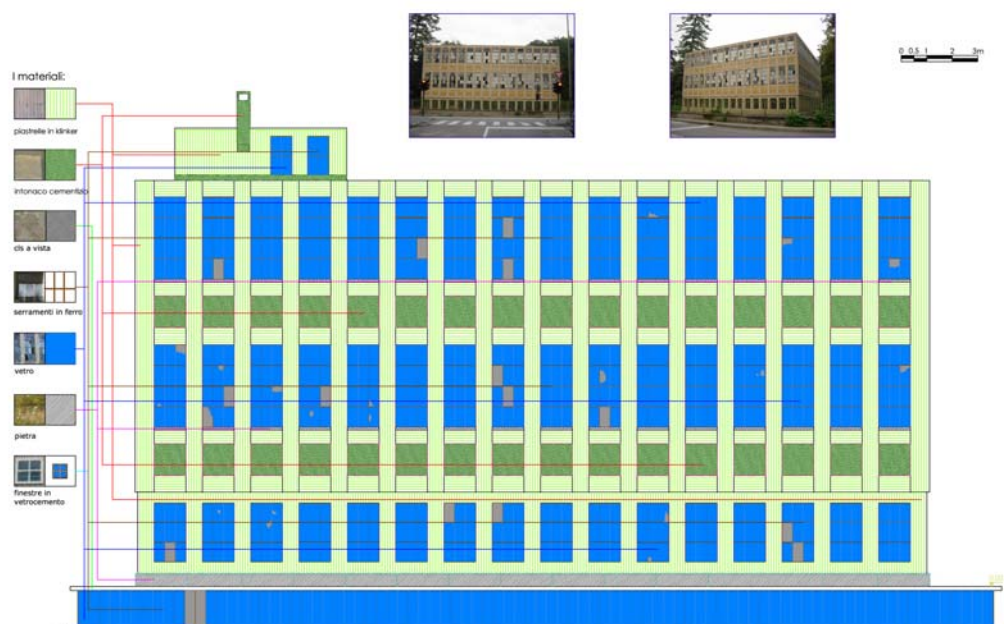
Ientile R., 2001. *Per un consolidamento consapevole dei beni architettonici*, Celid, Torino.

Naretto M., 2004. *L'individuazione dello stato di conservazione: ragioni e processi metodologici*, in Romeo E., *Il monumento e la sua conservazione. Note sulla metodologia del progetto di restauro*, Celid, Torino, pp. 165-180.

Ientile R., Astori B., Chiabrando F., Naretto M., 2005. *Geographic Information System for monitoring and conservation of the cultural landscape*, in DEQUAL S., *Proceedings of the XX International Symposium CIPA 2005 "International Cooperation to Save the World's Cultural Heritage"*, Torino 26 settembre-1 ottobre 2005, pp. 855-860.

Ientile R., Naretto M., 2006. *Conservare per il paesaggio*, L'Artistica Editrice, Savigliano

De Bernardi M.L., Goggi F., 2006. *Network Plant with simplified methodology for the investigation in archaeological field: the case of Grammichele*, in M. Barra Bagnasco (edited by), *Da Terravecchia di Grammichele a Occhiola*. Alessandria,



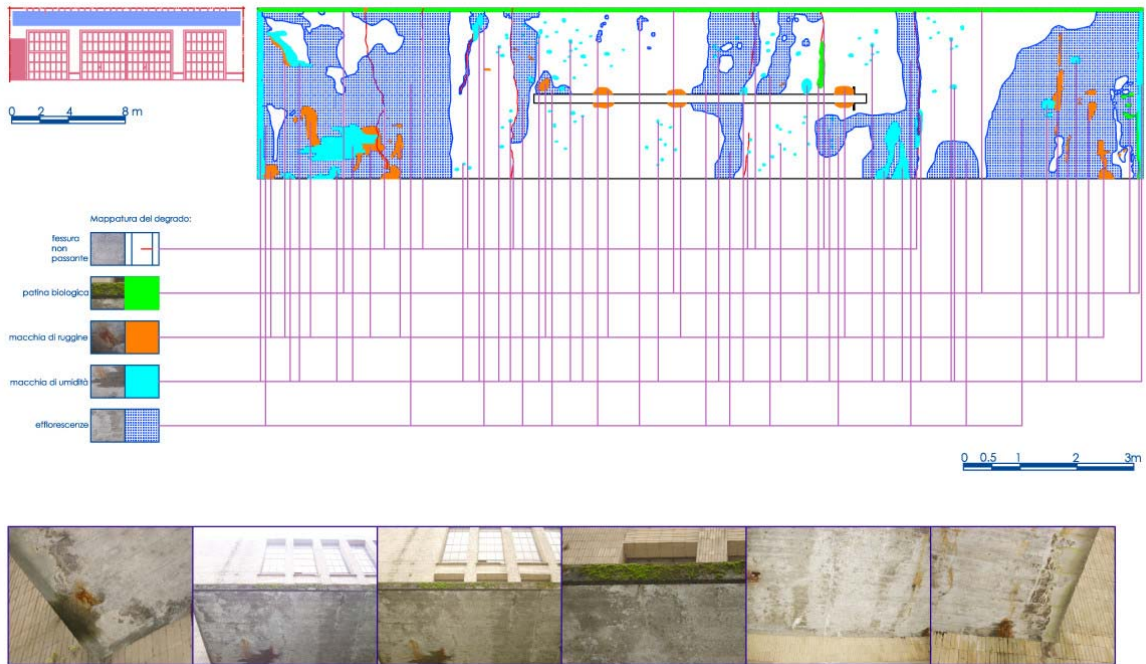


Figure 9 -10 Analysis of the cracking status, materials and deterioration's survey of the building of the "Passanti" factory, in Moncalieri, Turin. (Fig. 9: West prospect with reading of the materials. Fig. 10 Particular, in plant, of the state of conservation of the penthouse).



Figure 11 Representation of the conservation's status and of the restoration's interventions planned for the church of Prealpa in Sparone, Turin.