



3.1 FROM SINGULAR, ACCIDENTAL BUILDING PROBLEMS TO EARLY DEFECTS OF A CONGENITAL NATURE

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3.1.1 INTRODUCTION

Buildings constructed in the second half of the twentieth century will most likely be characterized by the fact that they were mass produced as just any other consumer good. These recent buildings have been produced by specialized companies, which have put them on the market for sale or rent. However, at the time of their production, it was not known who would how they would be lived in (Figure 15).

The experts, who defined the building programme and specified the building techniques, as well as the workers and products involved in the construction, originate from places which are physically and culturally distant from the area in which the building is located. As a result of these differences, the technical discipline of building pathology is now in another context that is notably different from the traditional scenario.

3.1.2 SINGULAR AND ACCIDENTAL PROBLEMS

For centuries, building pathology has been a discipline aimed at studying problems those accidentally affect individual buildings of a certain age, leading to obvious damage that is a cause of social alarm. The work of experts is needed to assess this damage and even propose interventions for repairs.

When carrying out this expert task, there is usually a lack of prior information on the building, given that with the passing of time, contact with agents who worked on the building is lost and the original written information is dispersed.



Figure 15 – View photo of a set of newly constructed residential buildings in urban peripheries



In addition, building pathologists are always handicapped by the fact that they have to adequately interpret the construction techniques that have been used successively in the damaged building, due to its constant evolution and restructuring. Only important monuments have records of all the work that has been carried out.

In this context, the work of the building pathologist is markedly archaeological for the following reasons: the cause of the defect is the passage of time; the reconstruction of information is always partial and limited due to the availability of documents; and the final conclusions are often attained in collaboration with other experts. The social responsibility of the building pathologist generally only comes into play when the damage is so great that the building is on the fine line between repairable and ruin. In this case, experts have to decide whether the affected element is worth repairing or should simply be replaced.

3.1.3 GENERIC DEFECTS OF A CONGENITAL NATURE

In contrast, mass-produced modern buildings (such as industrial premises, schools, offices and dwellings) often have construction defects that appear early in the first few years into the building's life. In this context, the building pathologist's work is clearly different from that carried out in the traditional scenario described above. In this case:

The owners of the defective building are its users who feel personally affected. As a result, they express their indignation as citizens and consumers. This condition of being both citizen and consumer means that the government guarantees the users' rights through the relevant legislation. This guarantee in response to the adversity that a defect represents is essentially financial, through a system of compulsory insurance policies.

The rights of a building's owners are guaranteed for a limited period of time, whose length depends on the defect (if it is in the cladding, in the functional elements that provide services or in the supporting elements). Therefore, the building pathologist must act at a very early stage, spurred on by the guarantee's expiration terms.

The reported defect is usually of low severity, but appears quickly and progressively with use and the passing of time. The problem that initially causes alarm and leads a citizen to make a claim is not always based on a technically sound argument. However, the complaint reflects an imbalance

between the consumer's expectations and the real behavior of the building.

The building pathologist has fast, easy access to large amounts of technical information, as neither the documents nor the agents who worked on the building have yet been lost with the passing of time. The availability of information means that research into the cause of the defect can begin using the documents. This work method is based on the industrial quality control criterion of traceability, which enables us to trace any process back uninterruptedly until we find the link in the chain in which the error or omission that led to the defect occurred. The criterion that enables us to determine whether each and every one of the activities that took place in the course of the building work was correct or not is based on the prior existence of standard public protocols or regulations, which establish the specific requirements that apply, as well as acceptable and unacceptable.

In this context, the authority of the building pathologist is called upon to specify various interrelated aspects:

a. He/she must define whether the reported defects are "acceptable" or whether they can really be classified as damages. In this case, the different levels of severity are specified;

b. He/she has to establish rigorously and clearly the scientific and technical causal connection between these damages and the defects that provoked them;

c. He/she has to determine whether the cause of the damage lies in a defect of the building or incorrect use by the citizen-consumer;

d. He/she has to attribute responsibility for the damage to specific agents who participated in the construction of the building, in order to claim compensation from the irrefutably or to ask them to do the repair;

e. He/she has to assess the direct (repair work) and indirect (safety measures, protection of the rest of the building, rehousing, management, etc.) costs of the work required to repair the damage.

More recently, it has become common for users to attribute responsibility to the agents involved in the construction of a building. As a result, this kind of conflicts has been institutionalized either through the creation of expert technical services by the after-sales departments of construction and insurance companies, or the establishment of arbitration councils that are also comprised of building pathologists.

The creation of such services, departments or councils with the involvement of numerous building pathologists, limits, as far as possible, the time and money that may be spent as a result of consumer

claims. Therefore, a new characteristic is the confrontation and debate that usually arises between different pathologists, who may defend conflicting technical contents, but always have the financial consequences of the confrontation in mind.

3.1.4 AN UPDATE EXPERT METHOD

In recently constructed, mass-produced buildings, the reported defects are usually not severe but are widespread. In this case, a preliminary report on the defects is of key importance as it becomes a systematic descriptive record, which is markedly

different from the subsequent interpretation of the results before the diagnosis. This record could be:

- Synchronous: all of the defects are recorded in a short period of time, with their most relevant descriptive parameters (photographs, dimensions and description) as well as their position (x,y,z) in the geometry of the building (Figures 16, 17 and 18);
- Diachronic: all the defects must be recorded at different stages to assess their evolution over time. They may get worse (increase in the size or severity of the problem) or stay the same. In some cases, a diachronic record should be used to assess whether or not a repair has been successful (Figures 19 and 20).

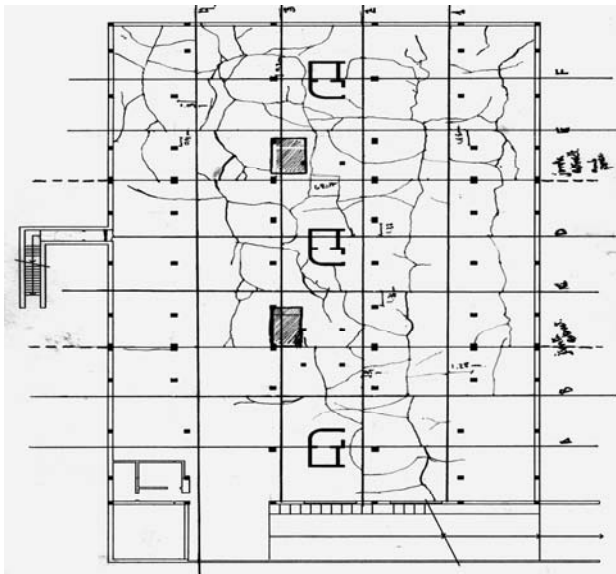
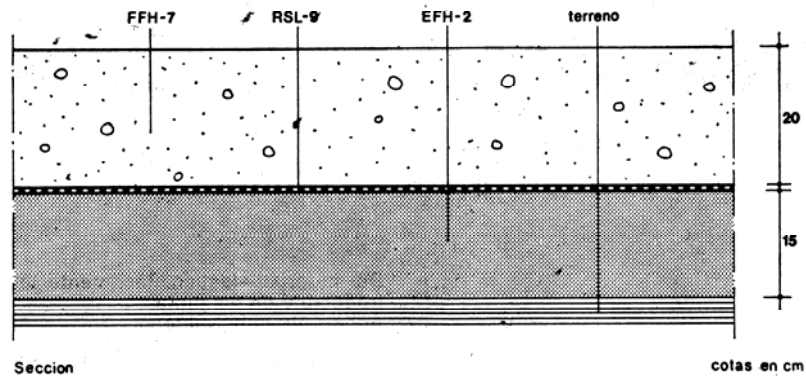


Figure 16 – Planimetry of a large crack in the floor of underground parking of vehicles in an apartment building



Figure 17 – General view photo of underground parking of vehicles in an apartment building

RSS-6 Solera pesada



EFH-2

Sand, with maximum grain size 0.5 cm forming a layer 15 cm thick, spread over ground mechanically compacted to achieve a value of 90% of Standard Proctor. It will end the process before making up the sand compacted in two layers.

RSL-9

Polyethylene insulation sheet.

EFH-7

Concrete characteristic strength 250 kg/cm² in a layer 20 cm thick, spread over the insulation sheet. The surface will be completed by past master. Curing is effected by irrigation but not producing faded.

Figure 18 – Specification image from official technical regulations

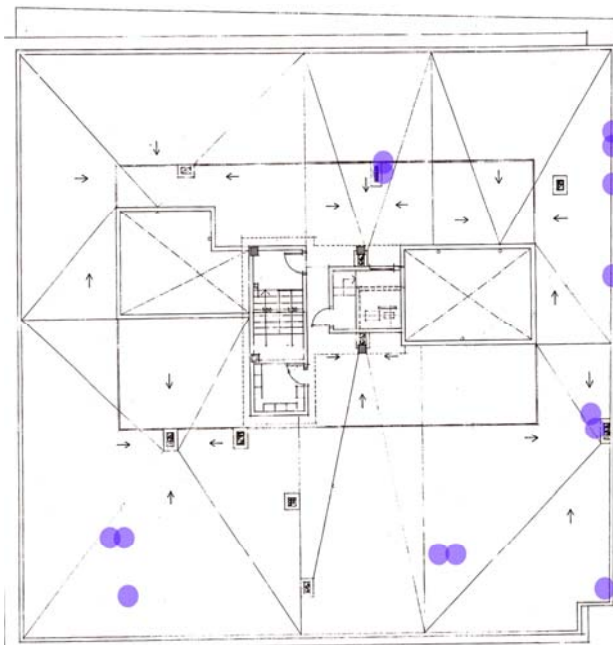


Figure 19 – Planimetry of the points of infiltration of rainwater on the roof of an apartment building



The bathroom has manifested a new infiltration

Aspect of the new infiltration, also visible from the bedroom next door

New moisture infiltration that has appeared in the kitchen

Figure 20 – Thermographic and visible photography points of infiltration of rainwater under the roof of an apartment building



Before the cause of the recorded defects is assessed scientifically and technically, and likely models of deterioration are determined, we must first analyze the records statistically, to differentiate whether each defect is a one-off, and therefore due to an accident, or widespread. If it is widespread, it is probably due to defects that occurred in the mass production processes.

When this information has been gathered, the building pathologist can specify the various interrelated aspects mentioned above:

A.

The damage has to be described on a scale of severity, to facilitate various essential decisions that must be made in the process of attributing responsibilities:

— Does the defect need to be repaired or is it enough to compensate for the reduction in value?

— Before repairs are made, does the entire building need to be vacated or can most of the building use continue as normal, except for the part affected by the defective construction element?

— Should the fault be repaired immediately as an urgent procedure or can an ordinary procedure be used?

Currently, there are no clear or recognized scales of severity for building pathology. Therefore, building pathologists have to check each defect for compliance with the basic requirements established in construction standards, such as those drawn up by the EU. With the experience acquired over the years, building pathologists achieve a balance between caution and alarmism.

However, all arguments must be based on the preliminary records report (Figures 21 and 22).

B.

The scientific and technical relation between the hypothetical defects and the observed damage must be deduced. To achieve this, experts must resort to arguments of authority. There is much appreciation for the efforts made by institutions and research groups to build online databases that can be accessed through the internet. These databases carefully describe defective processes that may arise in buildings and enable pathologists to deduce whether the specific case that they are working on is of the same type as that described in the technical literature (Figures 23, 24 and 25). It is regrettable that in this aspect the insurance companies, the entities that probably have the most statistical information on this subject, are so zealous with their data and do not usually publish it, so as to provide better protection for their policyholders.

C.

We have to differentiate whether the cause of the abnormal damage lies in a congenital defect in the construction of a building or inappropriate use or handling of the good by the citizen-consumer. In the case of an early generic defect, this differentiation is of great importance.

The processes of manufacturing and installing construction products have evolved extremely rapidly in recent years, unfortunately, at a greater speed than the professional training of workers and technicians of the companies that use those materials. This imbalance is the cause of many defects in current construction.

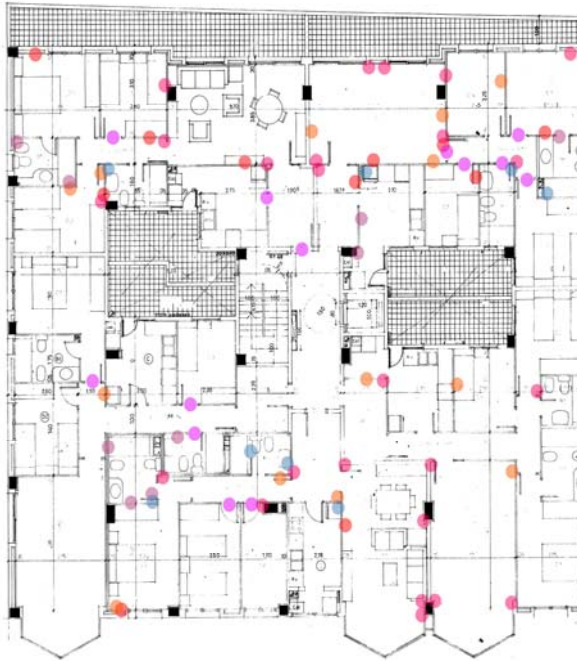


Figure 21 – Planimetry of the points of infiltration of rainwater on the roof of an apartment building

In addition, various adverse circumstances may arise on building sites, some of which have not been studied widely to this date:

1. Some of the interfaces between different, highly developed construction technologies are not specifically considered in the design.
2. During the building work, undocumented changes may be made to the design, which are accepted by the participating agents due to circumstances limiting the available time or money.
3. Situations of congestion may occur (for example, an increase in the number of workers on site at the same time) or there may be pressure to work faster (for example, the timelines are reduced). This leads to the appearance of defects.
4. Signs of technical information loss in the process of transmission from the designer to the worker.

The building pathologist is not always necessarily an expert in processes of implementing construction techniques. Therefore, he/she must compensate for this lack of knowledge by carefully reading the records of the building's construction process, which in some cases have become real "black boxes".

Workers and companies may not have received an up to date training, which may have an impact on the citizens-consumers who use a building. As a result,



Detail view of an area of the crack: the plaster has separated cleanly from the ceramic brick without existing prior grip



Figure 22 – view detail photo of cracking in the walls of masonry of ceramic pieces in an apartment building

users may lack in-depth knowledge of the building's technical characteristics. Therefore, it is essential to carefully read the manual on the use and maintenance of the building, and compare this with the actual way that different people use it.

However, the experience of many pathology experts establishes the existence of defects in buildings that do not necessarily emerge as damages, when this aspect of the building is not used to a sufficient degree.

D.

It is essential to establish unequivocally, on social demand, who is to blame or responsible for the defect that has caused the damage. This is now a difficult task as an increasing number of agents are involved in building work. They are usually not on site continuously and they have highly varied partial responsibilities.

The daily experience of a building pathologist shows that in current construction processes, the rigorousness of quality control and preventive measures is high enough to prevent one defect from being great enough to cause damage. When a problem does arise, it is generally the result of various consecutive and associated errors. Therefore, it is very difficult to attribute the defect to one agent. The tendency in such cases is to implicate the professional



who is immediately above the level at which the error occurred, with the argument that the failure was due to a lack of supervision. This implication usually leads to financial compensation, but does not often result in preventive measures.

E

As a conclusion to their expert reports, building pathologists have to estimate a value for the repair costs. This value must always be provided prior to any repair plan. This is a technically difficult task for building pathologists, as this first evaluation may be

highly imprecise, given that repair works are always uncertain and inefficient. In addition, there are no large enough or verified databases in this field. One solution that is accepted in some cases is to establish cost ranges (with expected maximum and minimum values). However, as the reason for all of this work is usually a claim or legal process, the judge or insurer must establish specific funds to ensure the repair can be carried out in the future. It is up to the building pathologist to decide on this amount.



- 01. NICKS
- 02. EFFLORESCENCES
- 03. SCRATCHES
- 04. BREAKAGES
- 05. STAINS
- 06. REPAIRS
- 07. DISCOLORATIONS
- 08. IMPACTS



Anomaly 01. Nicks		
Description: We talk about the existence of an anomaly nicks when stone plates have notches (loss of material) because of impacts on certain points of its perimeter. This anomaly usually appears at the edges of the plates but is also present in some corners.		
Some graphic examples:		
Valldaura nº22	Valldaura nº 24	Valldaura nº28
J. Coromines nº21	J. Coromines nº17	J. Coromines nº13

Figure 23 – Planimetry based on photographs to facilitate identification, census and classification of anomalies detected in the natural stone façade placated by a group of single houses

Figure 24 – Proposal for classification of the anomalies detected in the natural stone façade placated by a group of single houses

	1	2	3	4	5	6	7	8	
	Escrostonaments	Decoloracions	Rascades	P. Trencades	Contaminacions	Reparacions	Marques	Impactes	
Valldaura 22	17	2	8	4	9	3	1	1	
Valldaura 22 lateral	5	1	1	1	0	3	1	2	
Valldaura 24	9	0	5	0	8	9	0	4	
Valldaura 26	9	3	5	1	10	7	1	2	
Valldaura 26 lateral	4	0	1	0	2	3	3	1	
Valldaura 28	7	2	12	4	17	9	5	3	
Valldaura 28 lateral	8	0	0	0	0	4	2	1	
Valldaura 30	6	0	3	1	14	8	4	4	
Valldaura 32	8	2	1	4	11	12	0	5	
Valldaura 32 lateral	3	0	1	0	3	2	2	0	
Coromines 13	11	1	3	0	9	15	3	2	
Coromines 13 lateral	8	0	0	0	1	4	0	1	
Coromines 15	7	0	1	0	9	13	6	1	
Coromines 17	8	1	2	0	7	22	6	3	
Coromines 17 lateral	7	0	0	0	2	2	1	0	
Coromines 19	9	2	3	0	1	9	4	2	
Coromines 19 lateral	10	0	0	0	0	2	3	2	
Coromines 21	9	1	3	0	4	10	2	0	
Coromines 23	6	2	3	0	5	9	9	0	
Coromines 25	4	2	7	0	7	7	6	2	
Coromines 25 lateral	1	0	0	0	1	3	0	0	
TOTAL CASOS	156	19	59	15	120	156	59	36	620
	25,2%	3,1%	9,5%	2,4%	19,4%	25,2%	9,5%	5,8%	100,0%

Figure 25 – Statistical processing of the anomalies previously detected and classified in the census of placated natural stone facade by a group of single houses

3.1.5 CONCLUSIONS

The professional work of many building pathologists is taking a new direction due to conflicts related to early defects, caused by generic congenital flaws. The new buildings are considered by current societies as goods that should be perfect and impeccable from day one, although it is recognized that they quickly become outdated in technical terms, like any other good. This has led to a quantitative change in the professional activity of building

pathologists who now tend to work in the early phases of a building's life, almost in apparent continuity with the quality control processes of the construction work.

This change in the focus of building pathology activity should be reflected in the objectives and results of research and innovation in this field in the coming years, to take advantage of the experience gained in this discipline and to incorporate methods and knowledge from the consumer goods industry.