

Execution Manual and Preventive Maintenance in Residential Works

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Abstract— Despite the continuous growth of civil construction, problems such as lack of maintenance have still been a major reason for disasters. And this process is regulated by rule, because it is part of the system in which it is necessary to correct pathologies and in order to maintain conditions of use of the building. Any and all residences must undergo this maintenance process, whatever the type, and preventive maintenance must be followed in order to maintain routine care to guarantee quality, durability and good performance of the facilities and services. Through a form, which was applied to professionals linked to residential construction, in a descriptive way a manual was developed, which through the results obtained was able to generate important tips as to pay attention to some processes in the execution and the attention that must be taken frequently, and when necessary performing routine maintenance. The most important points that were raised in the manual are the cold water and sanitary installations, services on walls and roofs that generate frequent wear and which causes the loss of the performance of the system as a whole. The intention is to raise the importance of paying attention to these repairs that are repeatedly observed and to be more careful when building with the proper techniques and labor and even after delivery, for the user's responsibility to keep a close eye on the expiration dates of each element inserted in the residence.

Keywords— Maintenance, Pathology, Preventive, Manual.

I. INTRODUCTION

Over the years, the lack of maintenance has been mentioned a lot by the disasters that have been occurring, and maintenance actions need to be seen more than just a repair, an activity scheduled and carried out properly and at the right time.

With the technological evolution, the civil construction had to prepare itself adapting, mainly in the reduction of costs due to the reality of the market when we went through a process of fall. So, the civil construction tries to restructure itself looking for favorable conditions to bring quality in the workforce and in the construction processes.

For such reasons, the NBR (Norma Técnica) 15,575 of performance seeks to reconcile the reduction of uncertainties with experts regarding the position of the Consumer Protection Code, in order to discipline this union through parameters. And so, to enable the standard to give conditions to develop a quality of the performance of the construction systems in order to leverage the civil construction with quality (ABNT, 2013).

As a form of action in view of the repair needs that emerged from Maintenance Engineering, a way of creating and providing conditions to perform the services properly. One example is the possibility of carrying out an action plan, seeking to reduce the extinction of setbacks and ensure durability and quality of the services then performed. This is how the concept of maintenance management was created.

But we still need to overcome some barriers in the face of evolution. Kardec and Nascif (2009) explains the three maintenance paradigms briefly as:

The paradigm of the past was when the maintenance man was satisfied with the performance of a good renovation service. The paradigm of the present is for men to feel good about preventing the occurrence of failure and thus work. And finally, the paradigm of the future is when man is actually able to avoid unplanned repair work.

Thus, in the search for the leap of companies regarding the paradigm of the future, it will bring greater and better results within the civil construction sector and can carry out reform activities in a planned way in order to solve recurring problems.

The use, operation and maintenance manual governed by one of the standards, NBR 14037, has the function of demonstrating that care is needed in the execution, conscious use, that is, in the continuous attention with the residence after the moment of delivery, especially because each service and installation, for example, has a pre-established useful life mainly due to the fact that each material used in any construction stage has a performance and durability, and when it loses workability it must be changed. Not to mention when services are performed in the wrong way, it will possibly highlight the need for repair well ahead of schedule (ABNT, 2011).

The usefulness of the manual is not only to establish deadlines for carrying out services and repairs, but to safeguard each responsibility for the usefulness of the product, which in our case is residence. Both the engineer / builder and the user need to be aware of their obligations.

The objective was to identify and analyze the observation of residential construction professionals, which are the recurrent pathologies, and then the creation of the manual with some instructions for care with execution and preventive maintenance. That through it describe the appropriate processes for the application and correct performance of services and due repairs. Finally, guarantee durability and quality in your home and avoid any problems that may generate discomfort and danger.

II. METHODOLOGY

This article used the means of applying a questionnaire (via google forms) with residential construction professionals from all over Brazil, which obtained qualitative results. The main focus was to understand how professionals point out which pathologies bring major problems to the building, mainly about their contact with preventive maintenance, maintenance management and manual.

The article was carried out in a descriptive way, using bibliographic research methodology, standard articles, laws and books of renowned literature already published, as well as: periodicals, dissertations and magazines.

The survey data was obtained through a form, with objective questions for any professionals who have contact with specifically residential construction.

Therefore, after analyzing the data, it allowed us to build a manual with some guidelines for execution, such as preventive maintenance, the main emphasis of which is on the discussion of the most recurrent pathologies. The objective is to give a general notion to the builders, in important points that we must pay attention to, either

during construction or in preventive care, in order to avoid wear, total loss of performance, guarantee greater durability and useful life of the residence.

NBR 5674 explains the importance of the maintenance process for the building, it portrays the responsibilities of both the owner as a service provider, the maintenance system as the attributes of the building universe, guidelines and considerations, as well as explains the importance of basic documentation, budget forecasting, that is, all the essential process that must be observed and that explains how valuable it is to carry out the necessary maintenance (ABNT, 2012).

The creation of the manual and the discussion of results used the basis of some standards such as: NBR-5462 - reliability and maintainability, which contributed to the understanding and application of concepts, especially defects. NBR 5674 - Building maintenance in 2012 that helped with the procedure for the provision of building maintenance in matters such as data collection, required basic documentation, design and budgets for the services performed, among others. NBR 14037 - Guidelines for preparing manuals for the use, operation and maintenance of buildings - Requirements for the preparation and presentation of the 2004 contents, which added guidelines for the preparation and presentation of the manual with language issues, minimum content, structure, and among other relevant and considered points, as well as other standards and authors mentioned (ABNT, 1994; ABNT, 2012; ABNT, 2014).

III. RESULTS AND DISCUSSIONS

From a form elaborated with 11 questions, we initially identified about the professions of the interviewees as shown in figure 1, considering that we will have a greater opinion of civil engineers, which leads us to say that we will have a point of view more technical experience of the graduates.

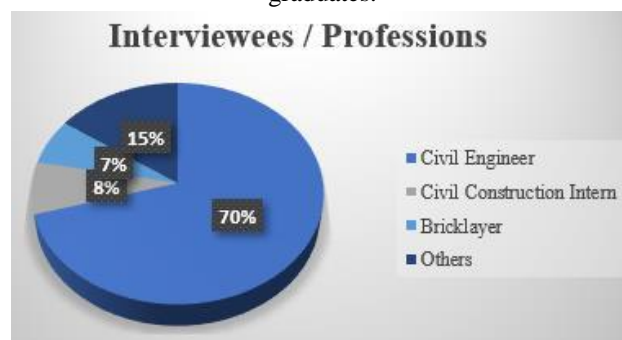


Fig.1: List of respondents.

Source - Author of research.

In the following figures taken from the questions in the form, the interviewee was free to check more than one option and pass on his experience which facilities are the protagonists as well as causing future repairs. Which led to the main two being: cold water and sanitary facilities.

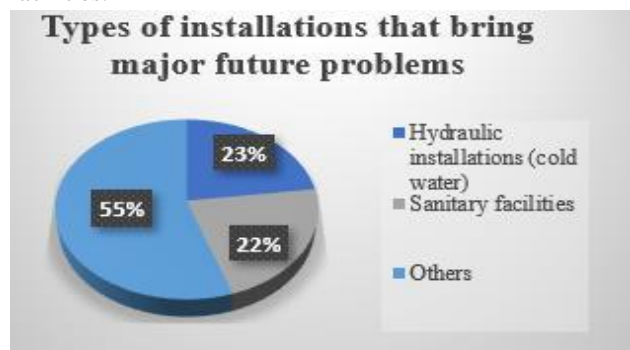


Fig.2: Installations leading to pathologies.

Source - Author of research.

According to NBR 5626, “component: Any product that makes up the building installation for cold water and that individually fulfills a restricted function. Examples: tubes, connections, valves, reservoirs, etc.” In order to understand the depth in which exactly part of the installations these problems occur, there was another question and it was identified that in the pipes, according to the professionals, the connections inside the installation and accessories such as the parts of use, bring greater problems and demands of repairs. Check in figure 3 (ABNT,1998).



Fig.3: Problem part of the installations.

Source - Author of research.

The installation of cold water is still a service that brings many problems regarding pathologies, which results in maintenance. In preventive maintenance, the intention is to maintain care to avoid total degradation. In order for this not to happen, attention must be paid to the proper execution of services and continuous preventive care.

SINDUSCON-SP, proves that about 75% of the pathologies in civil construction are the result of problems in the hydraulic installation, and that some factors favor

this high index, such as: running the installations without a project, using quality materials and inferior performance with an interest in decrease costs in the work, unskilled labor, and because the facilities are not visible and are in most cases buried. This confirms the analysis of the professionals regarding the attention and the importance of highlighting the hydraulic and sanitary installations in our manual.

In order to describe the conditions of recurrent pathologies in an analysis, we will have a better performance in buildings, ensuring prevention and avoiding the future appearance of new problems like this. And this discussion can result in a significantly positive way in the realization of projects, executions and also favor the user in terms of information and in the administration of both proper use and maintenance (NEVES and MACEDO, 2013).

And talking about maintenance proved to be important because even though the first question showed in their answers that 91.5% know the concept of maintenance, later that 65.1% have worked or work with maintenance practices, question three still showed an index below 59.4% of respondents have already worked or work with maintenance management, which is important in controlling the durability of the system as a whole.

During the research, he was also asked among the elements of the residence, which represent the greatest number of problems over time. And walls and roofs stood out as the first. And to have a better investigation, it was asked what exactly these pathologies are appearing, being highlighted the cracks, cracks and cracks in the walls, as well as leaks, infiltrations and molds that arise due to problems with the roof. The figure below shows how the professionals scored the pathologies according to each element of the construction.

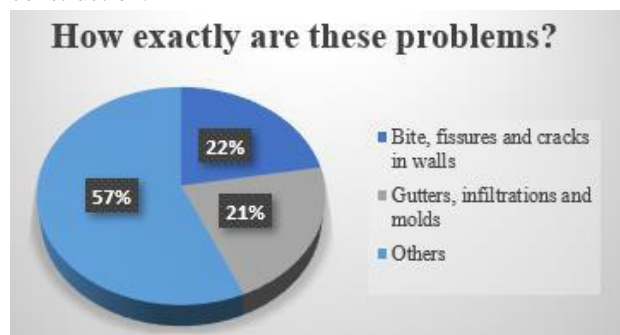


Fig.4: Pathologies in construction elements.

Source - Author of research.

Holanda Jr. (2008) explains that the appearance of cracks is often due to imperfections in the performance of

masonry, which also occur in concrete structures. This pathology occurs when the requesting forces are greater than the material's resistant capacities, as a result of which the opening is caused by the release of tensions. And this type of opening can lead to a failure in aesthetics even in the durability of the building's structural performance.

The pathologies of cracks and fissures are more common, while the structures are moving. Pereira (2005) brings the study of anomalies in non-structural masonry walls and mentions that cracks and cracks occur frequently if the execution does not comply with the requirements that the standard requires, but that there are several reasons for the appearance of cracks and cracks. Nascimento (1993) also brings a study of cracks, but in soil-cement brick walls and explains that mainly when the construction techniques are flawed, this type of problem occurs, and the main intention was the study in order to minimize these pathologies.

Table 1 - Leak in the roof rain network. Source - Adapted from KLEIN, 1999

Leak locations	Errors of	Causes	Manifestations
Gutters	Project	<ul style="list-style-type: none"> • Insufficient cross section for flow in gutters and 	<ul style="list-style-type: none"> • Stains on ceilings and walls • Gutters • Runoff from the walls
	Execution	<ul style="list-style-type: none"> • Incomplete or broken welds • Little drop for draining water • Rails without support • Inadequate connections in the fall pipes • Insufficient goodwill in downspouts, flashings, etc • Insufficient fixation of downspouts on walls 	
	Maintenance	<ul style="list-style-type: none"> materials used (oxidation of gutters) • Holes in gutters and conductors • Clogging by debris (sheets, paper, etc.) • Kneading gutters 	<ul style="list-style-type: none"> • Mold
Drop tubes (conductors)		<ul style="list-style-type: none"> • Prevention of vegetation in the gutters 	
	Materials	<ul style="list-style-type: none"> • Low quality 	

Costella, et al (2015) also brings a study of the appearance of cracks in sealing masonry focusing on the rupture stress of the materials used in the restoration of the element that was compromised. Abreu (2019) brings an analysis of the recurrent pathologies of cracks in molded walls on the site. Anyway, there are several studies focused on the use of various types of materials and constructions

that involve pathologies of cracks and cracks, which leads us to realize the importance of this study.

When it comes to pathologies on the roofs, Klein (1999) also highlights the leaks that arise over time, where he indicates the locations, what type of error was identified, the manifestations and their causes (as shown in table 1) which leads us to our figure 5 of the research that he identified in view of the observation of the professionals where exactly it was the errors that generate the changes in the residential construction.

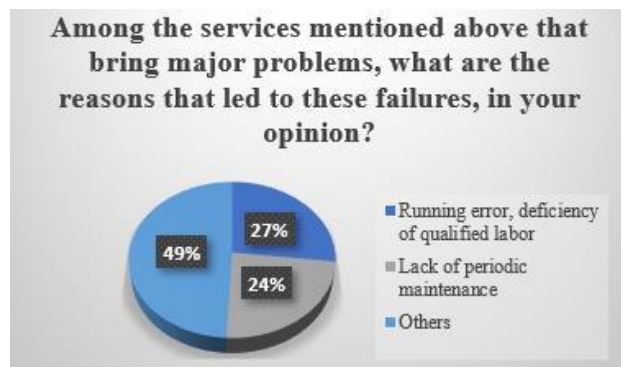


Fig.5: Causes of pathologies.

Source - Author of research.

This result brings us a concern with the execution mainly in the deficiency of the specialized labor and in the preventive maintenance practices, confirming even more the importance of the Use, Operation and Maintenance Manual that must be delivered to the owner right after the delivery of the house. Taking the construction company and the user the responsibilities and care of both parties, valuing the performance and durability achieved as mandated by NBR 15.575, which says that the residence must have a minimum of 50 years of useful life with quality (ABNT, 2013).

In another question on the form, the person responsible for these failures was asked whether it would be a lack of care by the owner, mainly performing routine maintenance or by the construction company that performed the services in the wrong way, figure 6 shows how the professionals scored. Which leads us to question other points, such as in cases where the owner fails to build without projects, buys material of inferior quality than it should, hires unskilled labor, which in both cases can be done by the construction companies, generating pathologies and the lack of

responsibility and commitment to the residence.



Fig.6: Main responsible for such pathologies.

Source - Author of research.

Still in terms of awareness regarding maintenance, NBR 5674 concerns the responsibility of the building owner to carry out proper repair care with the techniques established by the standard and in the manual, if any. But the construction company is of the opinion that it should keep this manual ready for the user and declare the importance of periodic care (ABNT, 2012).

In an analysis of the research, it was identified that 59% of the interviewees have already worked or work with maintenance management, which is a positive index, but which needs to increase, since NBR 5674 itself concerns the organization of a whole system that provides material, financial and human resources in order to respond to the necessary maintenance, whether routine, planned (or preventive) and unplanned, but making it possible to reduce unplanned repairs. And finally, guarantee a better development of the building system (ABNT, 2012).

Another debatable fact is that in question two of the form, it was asked whether the professionals work or have worked with any type of manual, unfortunately 60.6% answered that they did not. In agreement with the importance of the manual in civil construction, we have that in question number 11, where the great majority, 97.2% believe that the use, operation and maintenance manual facilitates not only the life of those who will execute it, but also of those who will repair and even the user who can follow this whole process with knowledge of the techniques and pay attention to deadlines. Because it was necessary, the form brought the indispensability of creating a manual with some instructions focused on the recurrent pathologies that can be seen in Appendix 1.

IV. CONCLUSION

The survey obtained a positive result regarding the indication that the interviewees in the majority know the concept of preventive maintenance, have already worked

or performed practices of this maintenance and that they know or work with preventive maintenance management, but unfortunately about 61.2% of the interviewees do not work or have never worked with manuals, which may indicate that in most cases repairs are carried out without the technical instruction of the construction companies, or that perhaps these homes are built without projects and technical support.

Also according to the survey data, it made us conclude that the facilities and services mentioned in the manual are deserving more attention in the correct execution of the services, such as maintaining attention in the performance supervision, paying attention to deadlines and performing preventive maintenance, to guarantee performance as well as to achieve the useful life of the entire building processes.

Another conclusion that can be made is that even though 61.2% of the professionals in residential construction, answered that they never worked or work with manual, if there was a positive result that, with 97.1% believe that the use of the User Manual, operation and maintenance will facilitate the continuous monitoring of the owner and user who will receive the residence built and accompanied by a technician and that he will be responsible for constructing the manual, as well as facilitating the life of the repairer, instructing with the appropriate techniques. For this reason, the manual that is exposed in Appendix 1 is necessary, it highlights especially the priorities to pay attention to the execution and maintenance in residential construction, pointed out by professionals.

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V. ÂPENDICE

EXECUTION AND PREVENTIVE MAINTENANCE MANUAL

Dear reader:

This manual was developed from a survey of RESIDENTIAL construction professionals. It contains some services that have in fact been identified recurrent pathologies requiring maintenance.

The main focus is to encourage the execution of these services in an appropriate manner, in the frequent and correct practice of preventive maintenance, thus avoiding total wear and tear, mitigating the loss of services and installations.

The suggestion of this Manual is to bring in a summarized way, the processes mentioned above, with some steps of more effective execution, aiming to reduce maintenance expenses, as well as preventive maintenance care. It is worth remembering that the entire basis was removed from the referenced standards cited, as well as research articles on each item.

Cold water installation

In the cold-water installation, according to NBR 5626, various materials are used for the manufacture of parts, such as metals such as galvanized carbon steel, copper, lead, galvanized cast iron, among others. We also have plastics such as rigid PVC, polypropylene and etc., as well as other materials such as: concrete, fiber cement and other materials that, according to the standard, can be adopted in projects, provided that they meet the principles of the

standard and that the use of each material in its manual to then comply with the requirements of the standard and the manufacturer (ABNT, 1998).

It is worth remembering that according to the aforementioned standard, it respects three main premises to assess the conditions of the materials used in the installation of cold water, as well: due to the direct contact of these materials with the water, potability cannot be compromised, as a consequence of the water characteristics, the components that were used cannot have their performance affected mainly by the action of the environment that it will be inserted in and finally, to meet the expected performance in face of the requests that will be submitted during the use.

The cold-water installation is basically designed to supply directly, which results directly from the supply source, that is, from the public network. The indirect system, on the other hand, comes from the use of the reserve, whether it is reservoirs that are lower or higher and part of it is the distribution of the facilities. Mixed media can also be adopted, with the direct and indirect system. The choice of the appropriate form will depend on several factors, be it the choice of the owner, the designer or the conditions of the place, such as the lack of sufficient slope of the lot for proper distribution.

There is a great diversity of components in the cold-water installation, within the system, as a result, it will be described those that were most suggested as protagonists of future problems within the installation, which are:

- Connections
- Use parts and sanitary appliances

The connections are pieces that help in the conduction of water, be they: curves, knees, tees, gloves, among others. There is a great diversity in terms of connections and the intention is not to cover them in detail in this manual, so this information can be found in manufacturers' catalogs. The important thing here is how they should be performed and in terms of maintenance.

The assembly of each connection varies according to each material and which part will be installed, and which must follow the rules on the assembly of galvanized pipes and connections where it explains the necessary procedures. In NBR 11720, it already explains about the specifications of connections for joining copper tubes by welding or capillary brazing, in NBR 6943 it brings the specification of malleable cast iron connection for pipes, etc. (ABNT, 2010; ABNT, 2016).

The part or accessories for use, mentioned by the standard 5626 as: "Component in the downstream position

of the sub-branch which, through its operation (open and close), allows the use of water and, in certain cases, also allows the adjusting your flow.

The general conditions for installing connections and use parts or accessories are:

- In the joints, the execution must take care of the cleaning, in the removal of sticky materials the ends of the tubes to ensure that they are cleaned internally and free of particles that interfere in the adhesion of the parts.
- The care regarding screw joints must comply with NBR NM ISO 7-1: 2000, where there is the use of materials for the sealing in order to guarantee the tightness in the joints, that is, to prevent leaks with care regarding contamination of drinking water.
- Be careful with the water pressure with flow in operation in the places of use, care must be taken with regard to the flow, to ensure the proper purpose of the parts of use and of the toilets following the plan.
- In case of excessive flow or water obstruction in the part of use, where there is cavitation, it can be mitigated by replacing the part, or by decreasing the pressure in the place that feeds the component. In both cases it must also be modified in the project.
- In the case of copper or alloy connections, their faces must be sanded, using a fine steel brush or sandpaper, and the solder paste must be applied, perfectly covering the faces to be joined. The joints must be heated in order to complete the entire space, and then keep the joint immobile in order to ensure fixation and any excess must have removed, following all the manufacturer's recommendations.
- For connections in rigid PVC material, in welded joints the ends of the pipe will be cut to glue the connections. For a surface with a good finish that ensures that it is perpendicular in the cut to the tube axis, it is necessary that the instrument is suitable for use, the inner and outer corners must be sanded with a file or fixed and finally cleaned. Then the two pieces will receive a plastic adhesive for bonding and one piece will be introduced in conjunction with the other and remain stable for 30 s for the handle and the final recommendations is to remove excess adhesive material, and not use it for at least 5 minutes, remembering that the materials used including the cleaner and the glue must follow the manufacturer's recommendations.

- Finally, to guarantee the service, the leakage test must be carried out, in order to observe possible leaks and already carry out the repairs to be released for use. Normally the test is carried out by releasing the pipe with a hydraulic pressure greater than that foreseen in use, this check is made by section in the pipe and 1.5 times the pressure that will be used in circumstances without flow. In the indirect supply pipeline, the pressure in static condition is predicted in the project, in the direct one it depends on the pressure change of the public network and then it must follow a higher value than the one destined by the company.

Maintenance

In the design phase, it must be provided that the installation meets the conditions of use during its useful life and must comply with the guarantee of easy and economical maintenance, provided that it is carried out correctly and at the right time.

Initially, attention should be paid to the accessibility of all piping, its location must be separated from structures, masonry and coverings, mainly due to the movement that will be caused and possible future pathologies in the walls and / or floors. And the inspection points must be ensured in the project, to take advantage of the maintenance already foreseeing that there are no cuts and damages on the surface. "False walls" or shaft are recommended to hide and facilitate maintenance. It is recommended to inspect movement spaces such as water expansion and contraction together with the installation of mainly plastic and copper materials, remembering that the fixing supports in the pipeline must always have good conditions of use.

It is worth remembering that the inspection activity must follow regularly depending on some factors, such as the diversity of the piping, which must already be planned in the project, but which is the sole responsibility of the owner. And the owner or user, as well as said, must have the necessary information regarding maintenance care with clear details identifying the locations with the pipes and the entire system of the cold-water installation with the notion whether it was embedded or coated.

When verifying the appearance of pathologies that compromise any part, appropriate correction must be carried out, such as: adjustment of moving parts, redoing the sealing or replacement of parts for use and / or connection.

In case of changing parts, you must pay attention to the conformity of the existing one and pay attention to the type of modified joint, mainly from the welding thread. Remember, you should always pay attention to carrying

out the appropriate procedure in order to maintain and guarantee the expected performance.

Finally, in any case, the importance of preventive maintenance occurs when compared to repair when the part reaches its degradation and compromise of the system, requiring the transition to a new one, leading the user to understand the frequency and expense when the prevention that must be adopted.

Some precautions must be taken as:

- The supporting elements. Parts of the sink and kitchen countertops must not be removed. And never lean on them which can cause breakage.
- To avoid clogging both the piping and the parts used and toilets, avoid throwing objects in the vases, grease or residues in the sinks, which causes the obstruction.
- In the case of future installations as required by the user, the user must pay attention when the installation is carried out as the other existing ones, in order to guarantee adequate performance without compromising the rest of the pipelines as the existing and expected flows.
- Always pay attention to the manufacturers' requirements, especially in products used in maintenance, such as periodic cleaning.
- Always pay attention to the defined validity periods of each material used as the sealing materials, the internal mechanisms of each set and in the regulation of discharges.
- Always pay attention to the plants in case of changes in the structure of the house, paying attention to the breakage and holes that compromises the installations and even the waterproofing.
- Remember to always check the validity of each service or support element performed, which requires replacement or preventive maintenance such as grouting on walls and floors, silicone and waterproofing and even when changing parts (always taking care when changing parts) or similar in the guarantee of compatibility with that existing in the replacement and in the guarantee of the performance of the part).

Walls

Currently several technologies and materials are used in the construction of walls, either by the method Steel frame, Drywall, or by total in concrete, with ceramic blocks, concrete blocks, with plaster and among other diverse ways

of creating walls. The focus in question is the emergence of pathologies such as cracks, fissures and cracks. That according to NBR 9575, 2003 “microcracks are Aperture caused by rupture of a material or component with thickness less than 0.05 mm” where the openings are less than or equal to 0.5mm are considered cracks, an opening between 0, 5mm and 1mm are considered cracks. Above that, it is considered larger cracks or cracks (ABNT, 2010).

Some studies say that masonry and concrete constructions are certain to have occurred this type of pathology, which is a result of the low elasticity of the materials mentioned and when the strength of the material is greater than its resistance, the appearance of cracks occurs to ease the stresses. So, due to occasional movements, the structure is susceptible to openings, and that even if there are repairs, this problem may occur again. For this reason, the importance of an adequate execution and periodic maintenance.

In general, according to NBR 14931: 2004 for the execution of concrete structures, some precautions must be taken regarding the execution of walls, some will be listed that can improve their performance and decrease the appearance of pathologies such as:

- The closer the concrete is cast to its final point, the less the mortar is embedded in the elements of the iron form and structure.
- Still on the launch, appropriate techniques must be adopted in order to eliminate the segregation of materials, and especially to pay attention to the height of the launch. When larger than 2m in slender pieces, the care is greater in the appearance of this separation of materials and in the absence of mortar, which usually appear in pillars and in wall joints.
- The removal of reinforcement and all components for the execution of the wall must be avoided, in order not to compromise the formwork, especially in cases of high elements, and the concrete must be released by free fall.
- Another issue that must be executed and planned in the project are the joints, mainly that the compression forces must be positioned at a normal point and where there are fewer shearing efforts. If concrete is to be laid on structures supported by beams on walls, it must be suspended in a horizontal direction.
- Another precaution is the cure, the standard specifies that care must be taken until the structure reaches its hardness, such as: make sure to form a surface with

durability and that reaches the determined resistance and also prevent the loss of water so that its process hardening agent has the best possible performance.

The construction of walls can be done either by structural masonry or by sealing, in any case the necessary care for each case must be taken. NBR 16522: 2016 provides for the construction of walls in masonry structure, and NBR 15270: 2017 discusses sealing masonry, and in general NBR 15575: 2013 portrays the performance of wall structures.

For both cases, the generalities are:

It provides and executes elements such as: Grade beam and waterproofing, straps, lintels and against lintels, pillars and lashing beams, or rebar and grouting for cases of structural masonry.

Attention should always be paid to the materials used, such as the performance of the blocks, the correct trace of the mortar, the forecast and use of the reinforcement.

It is necessary to always follow what was foreseen in the project and properly execute the places of exits and ventilation (to execute the lintels and against lintels), the installations (to insert the pipes in the right points) and points regarding the use of water and energy.

After lifting the entire wall, the coatings must be properly cared for using the right products and following the manufacturers' recommendations, especially on façade walls that require waterproofing, adequate mortar and ornamental pieces that have a greater weight of their own.

Maintenance

The emergence of pathologies of cracks and cracks must be carefully analyzed the reasons, here will be mentioned some precautions to be taken that guarantee the recovery of the structure.

In case of foundation repression, the foundation recovery measures must be taken and with the appropriate products to seal the cracks so that as a result of the repair this type of pathology will be healed, which will already avoid problems generated due to infiltration by capillarity. In the execution phase, care must be taken when waterproofing the Grade beam, which will prevent problems like this from appearing on the walls.

Due to climatic variation, the structure normally moves and in order to cause relief of the stresses exposed in it, the structure normally moves and causes cracks and cracks, which would alleviate would be the execution of expansion joints, which as its importance has already been explained, once unforeseen should be performed when this type of problem arises.

Usually with the appearance of cracks, depending on the cause, it is advisable to remove the coating, apply sealant and redo the coating now taking into account the curing times of each coating, this in case of concrete shrinkage.

Always pay attention to the reforms and internal changes in the walls, without consulting the technical manager, especially in cases of structural masonry. And especially in cases of drilling in walls. Always pay attention to the plants and the location of structural elements, pipes, the weight that the fixing equipment will cause in the structure as the unforeseen overload and especially taking care of the equipment used for drilling and fixing.

Inspect and be aware of the deadlines for changing the grout or sealant in expansion joints, because in the absence or loss of performance, the movement in the structure will continue and cause cracks and cracks. Not counting the deadlines for waterproofing and coatings, take into account the change time.

Always check the integrity of the structures and perform the necessary cleaning with the appropriate products, avoiding, for example, the accumulation of molds that generates moisture and infiltration causing pathologies.

Roof and Painting

The next topic will be portrayed together with the two services, which is the execution of roof and painting, because due to pathologies of leaks and infiltrations molds and stains are generated in the painting, and in that sense it will be treated as how to perform in the best way and how to treat this kind of problem.

The biggest problem on roofs that causes problems is in the installation. Each type of roof and each tile used has its specific method, so this type of service must be performed with specialized labor.

Some problems may arise because they do not obey the specific trim of each tile, the cement and metal have a lower slope and the ceramic and concrete, for example. When these requirements are not obeyed, it can generate river water accumulation, or generate a lot of force in the water, causing problems in gutters and flashings.

Another important observation for a good roof installation is detailing. The project must mention the appropriate way of fixing the entire roof structure, fittings, eaves, trim, that is, contain all the minimum information necessary for a good execution, in addition to taking into account the fixation of the ceiling in the roof, supporting the own weight.

And for a good performance of the entire installation, it is expected that any meeting or fixation of its components (mainly screws) is sealed, taking care with regard to infiltration, and paying attention to the elements that assist in the correct flow of rainwater as flashings, gutters and any other element that plays this role. Always remembering to choose and adopt these elements properly for each situation.

For cases in which the project foresees the capture of river waters, perform it properly taking into account especially the appropriate falls in order to avoid installation failures. However, when the project does not foresee this case, use the gutter to drain the water in order to avoid accumulations that cause infiltrations.

Maintenance

Initially, care is taken in the building that can mitigate impacts and future maintenance costs, ceilings as well as paintings are mainly committed to the emergence of infiltration. So, repairs to these services are therefore necessary. Hence the importance of guidelines for how in times of the year such as winter, in cases of poorly ventilated environments molds may occur which generate greater moisture absorption, so keep windows open whenever possible.

And in cases where mold has not been combated with ventilation, remove with specific products, always taking care with the integrity of the coverings.

And in cases where the paint has been worn out, such as the decrease in gloss performance, even peeling, generating cracks, clean it, remove all paint, make any crack treatment that may exist, and finally perform a new finish. Always be aware of the deadlines for a new painting.

On roofs, the first step when identifying any trace of a problem or in case of preventive maintenance is to pay attention to the tiles, each material requires a change or repair time. Some tiles of certain materials over time usually have flaws and cracks due to exposure to bad weather. So, whenever you spot a problem with the parts, make the exchange immediately.

There are cases of repairs to the tiles in which it does not require changing the parts, such as the use of certain materials such as blankets, acrylic paints and other ways to increase the protection of the roof. But there are also cases where fencing does not solve the problem with the roof, so it's up to the professional to analyze and if necessary, redo the roof.