APPLICATION OF GUT MATRIX IN THE INSPECTION OF A HERITAGE CONSTRUCTION IN FORTALEZA-CE

APLICAÇÃO DA MATRIZ GUT NA INSPEÇÃO DE UMA CONSTRUÇÃO PATRIMONIAL EM FORTALEZA-CE

APLICACIÓN DE LA MATRIZ GUT EN LA INSPECCIÓN DE UNA CONSTRUCCIÓN PATRIMONIAL EN FORTALEZA-CE

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RESUMO

As construções históricas são elementos físicos de grande valor arquitetônico, social e cultural para a sociedade. E justamente pelo fato de serem construções, estas estruturas estão sujeitas a diversos cenários de degradação, sejam eles por meio do ambiente ou antrópicos. Inserida nesse contexto, na cidade de Fortaleza, Ceará, a Estação Ferroviária Doutor João Felipe, uma construção histórica que foi muito importante para o sistema de transporte fortalezense, apresenta muitas manifestações patológicas. Desta forma, o presente trabalho visa contribuir para a preservação desta construção através da aplicação da Matriz de Gravidade, Urgência e Tendência (GUT) para avaliar as manifestações patológicas pela ótica de sua gravidade, urgência de tratamento e tendência destas piorarem rapidamente ou de forma lenta. Para isso, realizou-se uma inspeção in situ na construção com a aplicação de um checklist para determinar os graus de riscos das manifestações patológicas de acordo com suas gravidade, urgência e tendência. A partir dos resultados, obteve-se a lista de prioridades, as recomendações para correção das manifestações patológicas e a determinação de seus prazos de correção, mostrando assim, que a Matriz GUT é uma ferramenta poderosa no auxílio à priorização da resolução de problemas patológicos nas construções.
Palavras-chave: Matriz GUT. Priorização. Estação Ferroviária Doutor João Felipe. Construções históricas.

ABSTRACT

The heritage constructions are structures of high architectural, social and cultural importance to society. Moreover, because they are constructions, their structures are subject to various scenarios of structural degradation, either by environmental and/or anthropic agents. Inserted in this context, in Fortaleza city, located in Ceará State, there is Doutor João Felipe Railway Station, a very important heritage construction to the Fortaleza transportation system, and which presents many pathological manifestations. Thus, through the application of the Gravity, Urgency and Tendency (GUT) Matrix in the Doutor João Felipe Railway Station, this paper aims to contribute to the preservation of this construction, evaluating the pathological manifestations from the perspective of its gravity, urgency of treatment and the tendency to get worsen rapidly or slowly. For this purpose, an in situ inspection was carried out in the construction applying of a checklist to determine the degrees of risk of the pathological manifestations, according to their gravity, urgency and tendency. From the results, the list of priorities, the recommendations for correction of the problems and the determination of their correction periods were obtained. Therefore, the GUT Matrix is a very important tool to help prioritize the resolution of pathological problems in heritage constructions.
Keywords: GUT matrix. Prioritize. Doutor João Felipe Railway Station. Heritage constructions.

1. INTRODUCTION

The civilizations rely on documentation from their past to gain insight into their evolution, then it becomes necessary to document and preserve procedures that demonstrate that evolution. In this perspective, old constructions are largely based on constructive techniques or materials no longer used on a large scale, being representative of the evolution of civilizations, they are historical landmarks of great relevance and must be preserved.

The heritage constructions are structures with importance artistic, cultural, religious, documentary or aesthetics for a society, in other words, they represent the cultural identity of a community. These structures, as other types of structures, are also subject to structural degradation, among natural actions (thermal effects, chemical or physical attacks) or anthropic actions, as alterations in buildings architecture and interventions. For that, and considering its high cultural value, this special group of structures must be appropriately maintained as way to keep its structural safety conditions (BRANDÃO et al., 2018).

Brazil preserves a rich historical-architectural heritage with many old buildings throughout the country, as in Ouro Preto city in Minas Gerais State, Vitória city in Espírito Santo State, São Luís city in Maranhão, Fortaleza city in Ceará State, among many others. Unfortunately, some of those buildings are already in ruins and others are still subject to restoration processes, which require a lot of planning and care in their execution.

It is important to take into account that up to the present moment there are 21 World Heritage Site in Brazil, places that are considered by the scientific community of unequaled and fundamental importance for humanity due to its historical, archaeological, natural, environmental value, or a set of such factors to be recognized by the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2017).

Some of the most usual structural pathological manifestations in heritage constructions are: the appearance and progression of cracks; the displacements of the structural elements, being able to drastically affect the resistant behavior of these structures; armature corrosion; carbonation; settlement on the sidewalk floors; microorganisms development (molds and fungi) that cause degradation in the paint and allow the appearance of other pathological manifestations, such as efflorescence.

According to Souza and Ripper (1998), the emergence of pathological problems in a given structure may indicate the existence of one or more faults during the execution of one of the stages of construction, implying failures in the quality control system itself. Thus, a building inspection, according to Neves and Branco (2009), should be seen as a powerful tool in the inspection to evaluate the state of conformity of a building, through performance, useful life, safety, maintenance, exposure to the environment, use and operation.

The importance of building inspection in relation to the diagnosis and maintenance of buildings is closely linked to the market aspect, aesthetics, usability and the accident prevention aspect, which can cause accidents involving human lives, with irreparable damage to the investor (DAGOSTIN, 2010).

ICOMOS (2003) states that is more difficult to diagnose and restore in heritage constructions, limiting the application of modern legal codes and building standarts, because of their very nature and history, therefore it needs rational methods of analysis and repair methods appropriate to the cultural context. One of the methods most commonly used in building inspection is the GUT matrix, created by Kepner Tregoe in 1977. This method assists in the prioritization of problem solving, since it helps to classify the problems from the perspective of gravity, urgency and tendency to worsen.

Thus, this work presents the application of the GUT matrix method in the inspection of a heritage construction located in Fortaleza city, in Ceará State, namely Doutor João Felipe Railway Station, aiming to evaluate the pathological manifestations from the perspective of its severity, urgency of treatment and by the tendency of those faults to worsen rapidly or slowly, and demonstrate the importance of the method in prioritizing the decision-making process regarding repairs and maintenance to be performed, in order to maintain the historical structure preserved and safe for its use.

2. LITERATURE REVIEW

2.1. Maintenance of heritage constructions

Maintenance can be understood as the set of activities to be carried out throughout the building life to conserve or recover its functional capacity and its constituent systems, to meet the needs and safety of its users (ABNT, 2013). According to Roque (2002) in urban areas, these interventions are often motivated by profitable use programs, which are underpinned by the pressure of real estate speculation, rather than by the state of degradation displayed.

Due to this mentality the constructions rehabilitation or reinforcement, some of them with recognized historical, patrimonial and architectonic interest, has been neglected. This lack of sensitivity to preservation resulted in the current state of pronounced structural damage and, in many cases, the threshold of ruin, in which most of the existing constructions are found, anticipating, in a short-term, the collapse of many of these structures. In this context, it is urgent and absolutely necessary to invest in the rehabilitation and reinforcement of this important legacy (VARUM et al., 2005).

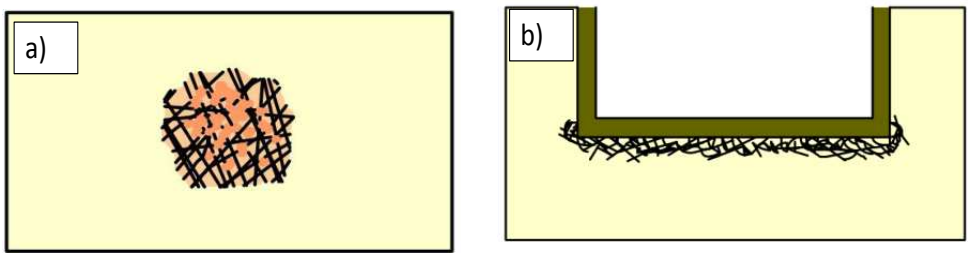
2.2. Pathological manifestations in heritage constructions

Souza and Ripper (1998) define the Structures Pathology as the study of origins, forms of manifestation, consequences and mechanisms of occurrence of faults and systems of degradation in structures. The emergence of pathological problems in a structure can ultimately and generally indicate the existence of one or more failures during the execution of one of the stages of construction, as well as pointing to failures in the work quality control system itself.

In heritage constructions, due to the great heterogeneity of the structures and material elements that constitute them, there is a greater structure complexity, thus introducing greater difficulties in perceiving the conditions they are in and the actual functioning of such structures (ARÊDE and COSTA, 2009).

For the masonry constructions, one of the main problems encountered in masonry, especially those with solid brick, is humidity, but it is not only a cause of pathological manifestations, it also acts as a mean to let many of the construction damage to occur. It is an essential factor for the appearance of efflorescence, rust, mold, mold, paint loss, plaster and even the cause of structural accidents, so it is very important to demonstrate and exemplify the different types of problems caused by humidity (VERÇOZA apud SOUZA, 2008). Figure 1 shows some examples of pathological manifestations caused by humidity.

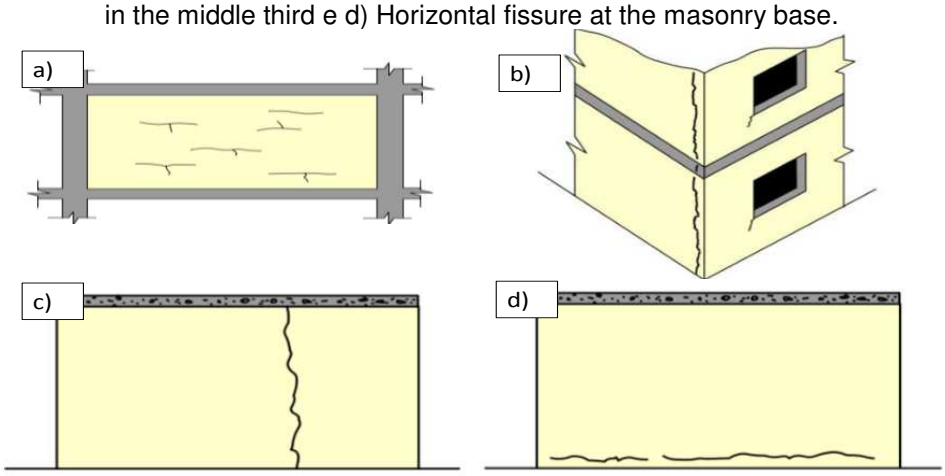
Figure 1 – Main pathological manifestations by humidity: a) Moisture on wall and b) Stain on window sill.



Source: VERÇOZA, 1991 apud SOUZA, 2008.

The most apparent result of weathering, especially in structures, is cracking, which stands out as one of the major anomalies in old building walls, being easily detected by performing visual inspection, appearing more often close to door and window openings or in the connection of orthogonal walls, especially in the corners, where the stresses that originate and progress of the cracking phenomenon are concentrated (REGO, 2016). Figure 2 shows some examples of fissures.

Figure 2 – Fissures: a) Horizontal fissures, b) Vertical fissure in the corner of the building, c) Vertical fissure in the middle third e d) Horizontal fissure at the masonry base.



Source: THOMAZ, 1996 apud SOUZA, 2008.

There is also another pathological manifestation of easy visualization, known as disaggregation or detachment, that arises with the separation or decomposition of existing materials in the structure, and can be accelerated by cracking. Usually this process is associated with ways of infiltration and water action (rain, capillarity, condensation). This anomaly is also influenced by thermal differentials, by contractions and successive expansions; lack of conservation / maintenance; pollution and the use of soft and poor quality stones (REGO, 2016). The efflorescence, is also a very common problem in masonry, can leave a bad appearance in the structure, besides forming access for the moisture to infiltrate the wall, being caused by the presence of water in the walls, generating salts that are manifested in the surface of the masonry through stains, detachment or discoloration of the paint.

2.3. The GUT matrix method

The GUT matrix method: Gravity, Urgency and Tendency, is a risk management tool that was developed by Kepner Tregoe and published in 1977. This methodology takes into account Gravity (G), Urgency (U) and Tendency (T) of the problems to be verified. For the evaluation, the method use scores that are destined to the classification of each inspected item, in order to define degrees of criticality in relation to the problems found (VERZOLA, MARCHIORI e ARAGON, 2014).

This matrix serves to classify each pertinent problem from the point of view of gravity, urgency and tendency. In determining the pathological manifestation gravity, according to Verzola, Marchiori and Aragon (2014), it is considered the possible risks and losses to the users, the patrimony and the environment, where in the definition of a Critical problem, the ranks "Total and High"; in the designation of the Regular problem, the "Medium" rank is considered; and finally, the Minimum problem definition can be incorporated into the "Low and None" rank. In each of the ranks, a corresponding score is taken, as shown in Table 1.

Table 1 - Indices that demonstrate the pathological manifestations gravity.

Rank	Gravity	Score
Total	Loss of human life, the environment or the building itself	10
High	High Injuries to people, damage to environment or building	8
Medium	Medium Discomfort, deterioration of environment or building	6
Low	Low nuisances or small financial losses	3
None	None	1

Source: Gomide, Pujadas e Fagundes Neto, 2006.

In determining the urgency of the repairs of the pathological manifestations, it is necessary to associate with each degree of urgency, the deadlines for intervention in relation to the degree of occurrence of the problems encountered in situ and at each rank a score is also attributed, as shown in Table 2.

Table 2 - Indices demonstrating the urgency of repairing pathological manifestations.

Rank	Urgency	Score
Total	Event occurring	10
High	Event about to occur	8
Medium	Predicted event really soon	6
Low	Predicted event soon	3
None	Unforeseen event	1

Source: Gomide, Pujadas e Fagundes Neto, 2006.

And for the determination of the evolution tendency of the pathological manifestations, it is associated with each degree of tendency, if the observed incident tends to continue or to stabilize in a scale of time, and again a score is attributed for each rank, according to Table 3.

Table 3 - Indices that demonstrate the tendency of the pathological manifestations to evolve.

Rank	Tendency	Score
Total	Immediate evolution	10
High	Evolution in the short term	8
Medium	Evolution in the medium term	6
Low	Evolution in the long term	3
None	None	1

Source: Gomide, Pujadas e Fagundes Neto, 2006.

Once all scores have been determined for each inspected item (Gravity, Urgency and Tendency), the methodology proceeds by calculating the product of its respective scores for each item and the priorities will be determined in the descending order of the values calculated (NEVES e BRANCO, 2009).

2.4. Doutor João Felipe Railway Station

On July 25, 1870, the Companhia Cearense of Via Férrea de Baturité was installed in Fortaleza a railway to bring mountain production to the port of Fortaleza. On July 1, 1873, the first rails were laid, the Locomotiva Fortaleza being the first to circulate over them in August. On September 14, 1873, the first stretch between Fortaleza and Arronches, now Parangaba, was completed and inaugurated on November 29, 1873.

On November 30, 1873, the first railway station on Fortaleza of the Baturité Railroad was inaugurated, the place chosen for its construction was the old São Casemiro Cemetery. The second station, designed by the engineer Henrique Foglare, had its cornerstones laid on November 30, 1873, but the works only began in 1879 and was completed in 1880, the reason for the interruption was the great drought that devastated the state during the period from 1877 to 1879. The railway station was built with labor of the retreatants in land that belonged to Jacarecanga, being inaugurated on July 9, 1880, in the reign of Dom Pedro II. During the Brazil centenary of the independence, reforms were carried out that joined the first and second stations, offering a greater uniformity to the whole, the chalet being renovated and the warehouses built on the west side of the square in 1925 (CAPELO FILHO and SARMINENTO, 2010). In 1946, the definitive railway station composed by the union of the first and the second, was named the Doutor João Felipe Railway Station (Figure 3).

Figure 3 – Main façade of the Doutor João Felpe Railway Station.

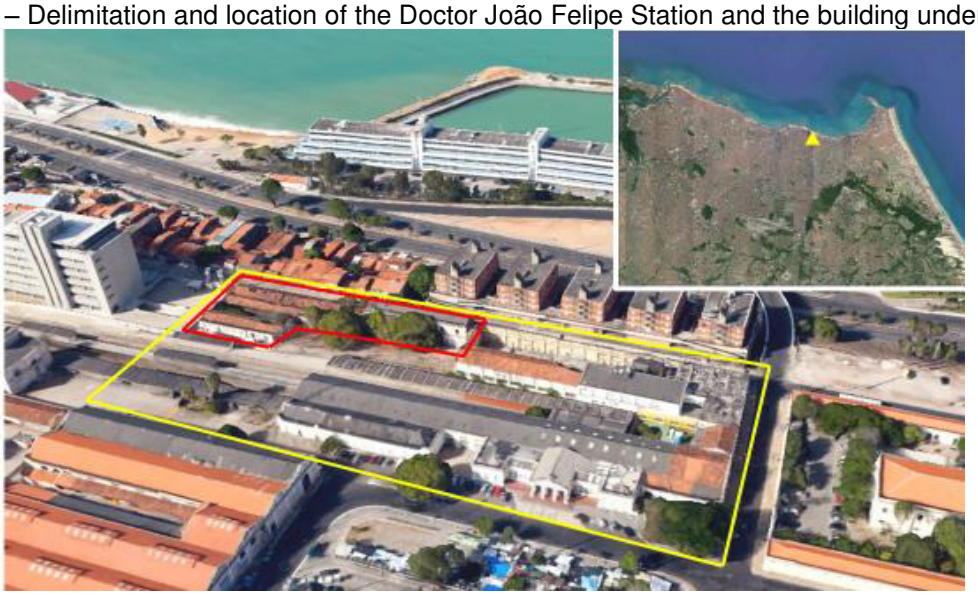


The façade of the central block of the new station has columns on pedestal surmounted by triangular pediment, and staircase demarcates the access to the interior of the building. The contiguous facades have fenestration with full arch openings, topped by cornices and plaques, being the solution adopted to integrate the old station to this one (CAPELO FILHO e SARMINENTO, 2010).

3. CASE STUDY

The building under study is part of the Doutor João Felipe Railway Station, and it's one of the most deteriorated building among those that belong to the station, therefore it should have a more detailed analysis. This building is located in the upper left corner of the area bounded by the yellow line in Figure 4.

Figure 4 – Delimitation and location of the Doctor João Felipe Station and the building under study.



Source: Adapted from IPHAN Technical Collection – Doutor João Felipe Railway Station, 2016.

The inspection methodology used in this research was based on the recommendations by MESQUITA et al. (2016): bibliographic research; field research; detection of the need for intervention; analysis of the conditions of public assets maintenance (historical analysis of buildings, photographic survey of the damages found, selection of the strategy to adopt, survey and diagnosis).

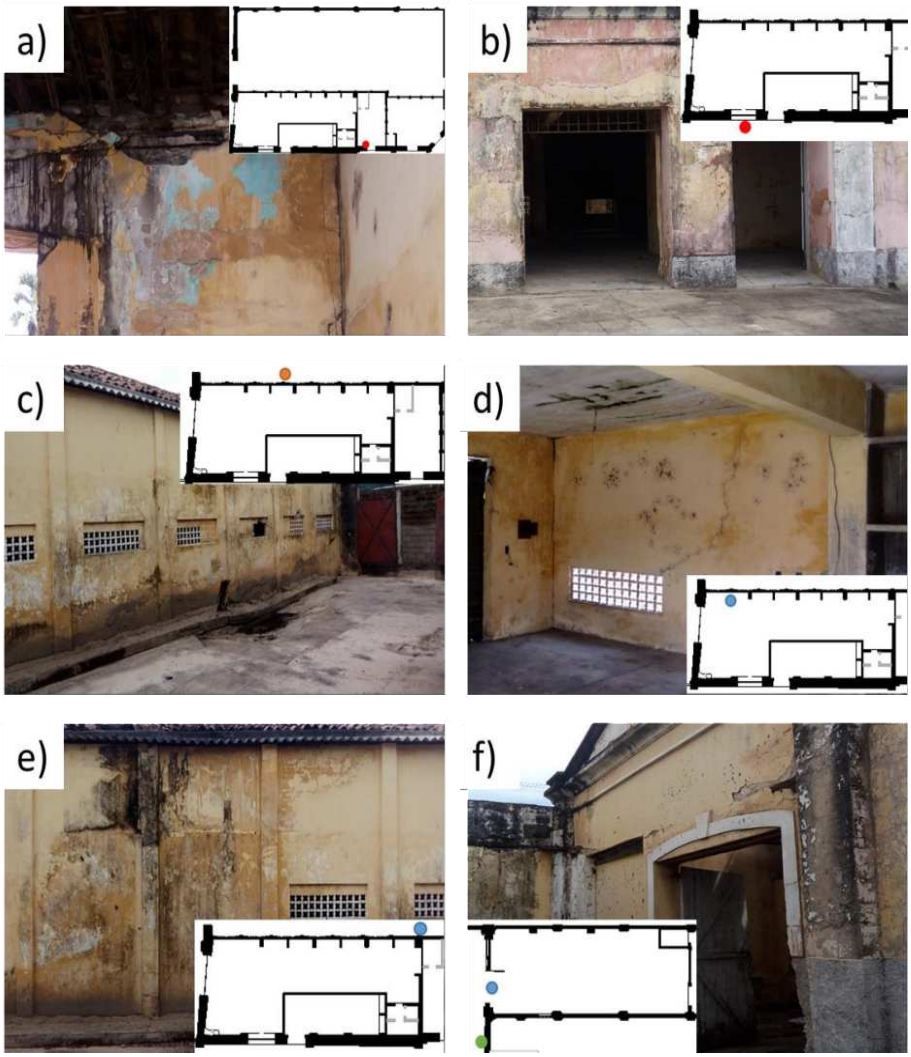
First, a bibliographic survey was carried out from which information was extracted in order to obtain the theoretical basis for the elaboration of this work. In the bibliographic review, it was also possible to obtain access to the floor plan of the building in question, present in the technical collection of the National Historical and Artistic Heritage Institute (IPHAN). An inspection of the building under study was carried out with the application of a check list created for this study, and photographic record, in order to identify all the pathological manifestations found and to apply the GUT matrix method in the building.

4. RESULTS AND DISCUSSIONS

4.1. Pathological manifestations found

In the inspection of the Doutor João Felipe Railway Station many pathological manifestations were found, some very serious. The exposed reinforcement armature (Figure 5.a) was observed in the upper part of the masonry, which presents an advanced state of corrosion due to the moisture present in the region, which generates a constant wear on the structure. Due to the loss of the mortar cover, which was caused by the environment humidity, as can be observed in the spots present on the walls of the building, there was the exposure of the reinforcement armature and the beginning of the corrosion process. Corrosion is also present elsewhere, such as in window grilles (Figure 5.b) and other metal structures.

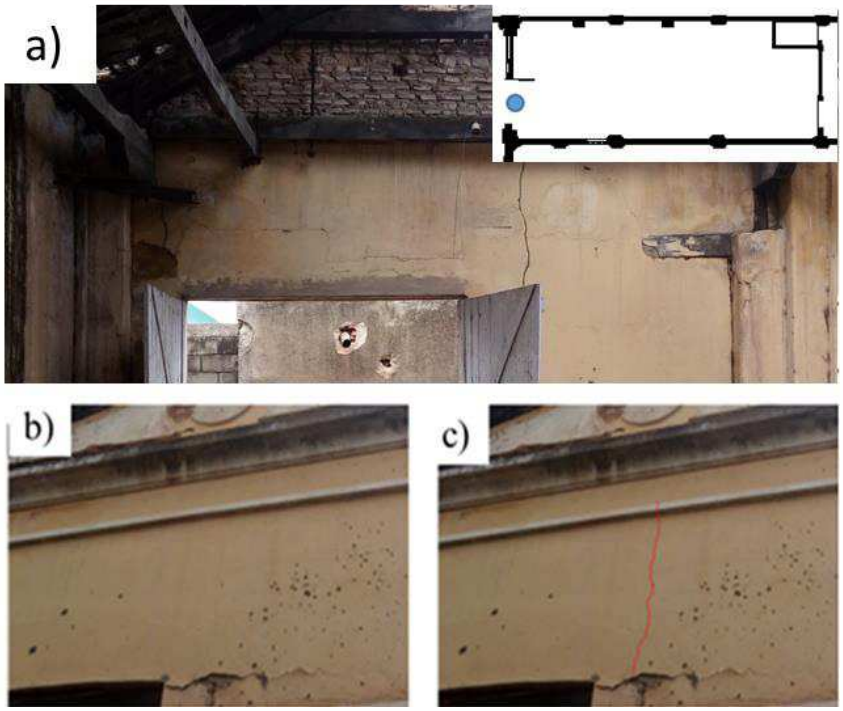
Figure 5 – Pathological manifestations in the building under study:a) corrosion of the reinforcement armature, b) grid with presence of corrosion, c) soil settlement, d) issures in the internal area generated by the soil settlement, e) stain on the masonry affected by the soil settlement and f) coatings detachments.



Another disturbing problem encountered at the station was soil settlement (Figure 5.c) due to volumetric changes caused by soil moisture, but more research is needed to classify it as either expandable or collapsible. It is important to have a soil study of the station to identify its behavior when requested by the loads of the structure, and thus avoid the emergence of other soil settlements. This condition increases the probability of cracking in the construction if the resistance of the masonry components is lower than the tensions generated by the soil movement. In the internal area to the settlement can be seen cracks arising from the problem, as shown in Figure 5.d. Another problem that helps the propagation of fissures is the absorption of moisture by solid bricks, as can be observed by the spots scattered around the building. The wall shown in Figure 5.e is located close to the aforementioned soil settlement, where it is possible to visualize the browning of the coating caused by the absorption of moisture, which reduces the durability of the structure. The wall in Figure 5.f shows some coatings detachments, also caused by the unwanted presence of moisture.

In some other regions of the building, many very serious pathological manifestations have also been observed, such as the cracks shown in Figure 6. The vertical cracks (Figure 6.a) may have been caused by soil or foundation settlement. The horizontal cracks (Figure 6.b and Figure 6.c) were caused by a joint effort of the thermal expansion of the wood inserted in the masonry and the adhesion of the building materials, which causes the crushing. It is important to note that this problem is also related to the absorption of moisture by solid bricks, which causes its expansion.

Figure 6 – Fissures in the building under study: a) vertical crack on the door, b) and c) cracks on the door, observed from the outside



It can be noticed the presence of small mortar detachments in the masonry around the frames, mainly in the base, because the bricks can be visualized (Figure 7.a). In the lower and upper part of a nearby frame, small fissures are also noticed, caused by the inability of the header and the sill to redistribute loads of the masonry (Figure 7.b). In Figure 7, are observed a crack in the lower left corner, caused by the soil settlement in this region, in addition, there is the presence of vertical cracks above the frame, due to the excessive load in this masonry together with the thermal movement of the bricks. There are small mortar detachment around the frame that leads to the bathroom, without significant damage to the masonry (Figure 7.c). In another frame, the problem of partial detachment and loss of the mortar surrounding the frame and small losses of coating at the base of the masonry caused by the action of moisture (Figure 7.d) can be observed again.

Figure 7 – Pathological manifestations in another part of the building under study: a) Mortar detachment, b) cracks above and below the frame, c) corner and vertical fissures, d) mortar detachment around the frame



4.2. GUT matrix application

From the pathological manifestations observed in situ during the inspection, it was possible to complete the checklist elaborated for this study (Table 4), together with the parameters offered by the GUT matrix, to characterize the gravity, urgency and tendency, being of fundamental importance during the decision-making process for renovations and maintenance that can be carried out in the building under study.

Based on the obtained classifications, the score for each manifestation presents was obtained from the multiplication of the points, attributed to the gravity, urgency and tendency of each subitem. In this way, it was possible to determine the order of priority of reform or maintenance of the areas observed.

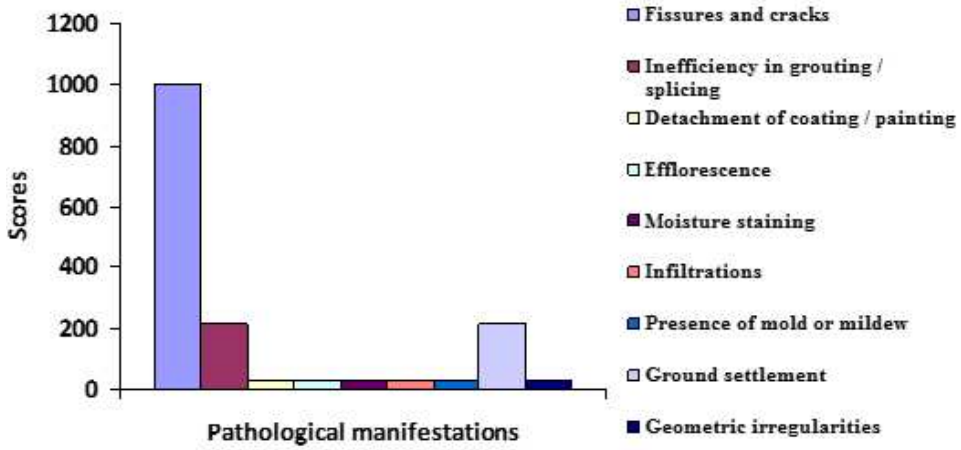
Table 4 – Check List applied in the building under study

1. Structural masonry and coating									
Pathological manifestation	Ranks					GUT Method			
	T	H	M	L	N	G	U	T	S
1.1. Fissures and cracks	**X**					**10**	**10**	**10**	**1000**
1.2. Inefficiency in grouting / splicing			**X**			**6**	**6**	**6**	**216**
1.3. Detachment of coating / painting				**X**		**3**	**3**	**3**	**27**
1.4. Efflorescence				**X**		**3**	**3**	**3**	**27**
1.5. Moisture staining				**X**		**3**	**3**	**3**	**27**
1.6. Infiltrations				**X**		**3**	**3**	**3**	**27**
1.7. Presence of mold or mildew				**X**		**3**	**3**	**3**	**27**
1.8. Ground settlement			**X**			**6**	**6**	**6**	**216**
1.9. Geometric irregularities				**X**		**3**	**3**	**3**	**27**
TOTAL SCORE									**2106**
2. Frames and roof: doors, windows, gates, gutters, roof structure									
Pathological manifestation	Ranks					GUT Method			
	T	H	M	L	N	G	U	T	S
2.1. Inefficient sealing				**X**		**3**	**3**	**3**	**27**
2.2. Material disaggregation or oxidation				**X**		**3**	**3**	**3**	**27**
2.3. Loose or broken parts		**X**				**8**	**8**	**8**	**512**
2.4. Inefficient fixation			**X**			**6**	**6**	**6**	**216**
2.5. Geometric irregularities, out of the plumb			**X**			**6**	**6**	**6**	**216**
2.6. Moisture staining				**X**		**3**	**3**	**3**	**27**
2.7. Presence of mold or mildew				**X**		**3**	**3**	**3**	**27**
2.8. Painting detachment				**X**		**3**	**3**	**3**	**27**
2.9. Inefficient waterproofing				**X**		**3**	**3**	**3**	**27**
2.10. Infiltrations				**X**		**3**	**3**	**3**	**27**
2.11. Amendments inefficiency				**X**		**3**	**3**	**3**	**27**
TOTAL SCORE									**1160**

Source: Adapted from Verzona, Machiori and Aragon (2014).

According to the data obtained in Table 4, by the GUT matrix, it was possible to compare the results of the score of each of the subitems. For the item "1. Structural masonry and coating", the graph on Figure 8 shows the score for each subitem, there it can be observed that the pathological manifestation that demands the most attention is "Fissures and cracks", since it was the one with the highest score, 1000 points. On the other hand, the pathological manifestations "Inefficiency in grouting / splicing " and "Ground Settlements" are in second place and present 216 points each. Finally, the remaining pathological manifestations have equal scores, all corresponding to 27 points, so they are all in third place.

Figure 8 –Scores of the subitems on Structural masonry and coating



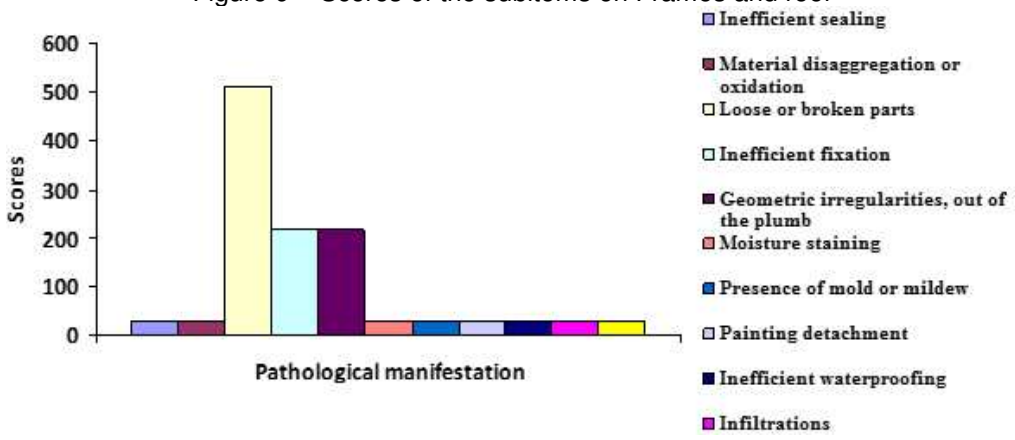
The priority order that must be followed for the repair of each pathological manifestation observed in item "1. Structural masonry and coating" is presented in Table 5. In relation to damages with same number of points, the established order took into consideration the ease of repairs, that's optimize the repair time.

Table 5 – Classification of treatment priorities in Item 1

Pathological manifestation	Score	Priority
Fissures and cracks	1000	1st
Inefficiency in grouting / splicing	216	2nd
Detachment of coating / painting	216	3rd
Efflorescence	27	4th
Moisture staining	27	5th
Infiltrations	27	6th
Presence of mold or mildew	27	7th
Settlement	27	8th
Geometric irregularities	27	9th

The total score for the item "2". Frames and roof: doors, windows, gates, gutters, roof structure", have their results presented in Figure 9, in which it is verified that the pathological manifestation of greater gravity was "Loose or broken parts" that got a total of 512 points. The damages "Inefficient fixation" and "Geometric irregularities, out of the plumb" are in second place with 216 points each and the remaining damages have 27 points each, being in third place

Figure 9 – Scores of the subitems on Frames and roof



For the item "2". Frames and roof: doors, windows, gates, gutters, roof structure", the classification of repair priorities for each pathological manifestation that was found is shown in Table 6.

Table 6 – Classification of treatment priorities in Item 2

Pathological manifestation	Score	Priority
Loose or broken parts	512	1st
Inefficient fixation	216	2nd
Geometric irregularities, out of the plumb	216	3rd
Inefficient sealing	27	4th
Amendments inefficiency	27	5th
Painting detachment	27	6th
Presence of mold or mildew	27	7th
Moisture staining	27	8th
Inefficient waterproofing	27	9th
Infiltrations	27	10th
Material disaggregation or oxidation	27	11th

Finally, in general, based on the total points obtained in each item, it was possible to establish a general order of priority for the reforms and maintenance of the systems studied, as can be seen in Table 7.

Table 7 – Order of priority

Priority	System
1st	Structural masonry and coating
2nd	Frames and roof

Regarding the timeframes to correct the identified faults, according to the pathological manifestations observed and their degrees of severity, it is necessary that the repairs and maintenance be performed as soon as possible, due to the probability of propagation of the damages, being able to evolve and cause wear more serious in the structure, increasing the cost and difficulty of reinforcements.

5. CONCLUSIONS

This work showed the basic and fundamental aspects of the main damages found in the Doutor João Felipe Railway Station located in Fortaleza city, Ceará State, Brazil, based on the inspection carried out in situ through the application of a checklist and photographic records of all the pathological manifestation found essentially in its structural masonry, frames and cover, and also with the application of the GUT matrix methodology to define the prioritization process of the repairs and maintenance of the construction.

In general, the damages found were due to the action of moisture and settlements in the foundations. The masonry observed, for the most part, presented problems from the high hygroscopic movement that the solid bricks present in the presence of moisture. In most cases it is suggested only to remove and rebuild the plaster to recover a large part of the structure attained, and a waterproofing is also necessary to avoid the appearance of these problems in the future and to increase the durability of the structure.

In the case of masonry with presence of efflorescence, it is suggested to use a steel brush to clean the place, and to wash with abundant water. In some cases, some chemical may be used to aid in the removal of efflorescence, and it is necessary to study which chemical element to use, so as not to affect the durability of the structure in a negative way. Concerning soil settlement, a geotechnical study is necessary to determine the soil characteristics in question, as well as a more detailed analysis to visualize the extent of the problem. It is likely that it will be necessary to remove certain structures at the site for the introduction and compaction of a more resistant soil, or even to use the soil itself, this decision making depends on the result of the geotechnical study.

In the case of walls with window openings, there is still a need for the insertion of the sill to absorb the tensile stress in the lower part of the frame. In places where the ceiling has collapsed, the openings must be repaired, as they directly affect the appearance of some pathologies from the action of the weather, which damages the masonry. It is important to emphasize that, taking into account the age of the structure, it is possible to be expected the emergence of several pathologies in the building, mainly due to the action of the inclement weather and the humidity, as the appearance of fissures and the detachment of mortar. Being

extremely important the monitoring of the soil settlement, which can evolve and cause greater cracks in the masonry, it is possible that it makes the wall fall due to the breakage of connections between its components. At the time the building was built, there were no solutions or studies to assist in the preservation of these constructions, coupled with the lack of maintenance, caused a more rapid degradation of the components of the structure. If the absence of maintenance continues, the aforementioned pathological manifestation may propagate and cause greater damage to the structures, which will hinder and increase the price of their reinforcement. From the results obtained, it was possible to verify that there is a greater need for repairs for the item "Structural masonry and coatings", indicating that damages present in these areas were serious, besides demonstrating a greater urgency for the start of the repair procedure.

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