

## The Palace of Fronteira glazed tiles panels

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*SUMMARY: The “Palácio dos Marqueses de Fronteira e de Alorna” estate in Benfica was built at the end of the 17<sup>th</sup>. century, within a domain that once was located at the outskirts of Lisbon, on the Monsanto foothills. Since the creation of a Foundation in the late 1980’s, which bears the same name, the Palace and the Gardens have been undergoing an extensive restoration process. After the 1755 Lisbon earthquake, 18th century, a new west wing extension was built adjacent to the main building, and the owner’s family permanently settled in Benfica.*

*From 1958, the late Arch. Prof. Emeritus Frederico George (1915 -1994) was in charge with the restoration works. In 1988, the author began working on the Palace restoration process.. Within this built ensemble, the extensive use of “azulejos”, i.e., glazed tiles is also an important Portuguese cultural addition to the building walls (both interior and exterior) as well as some roof coverings. These decorative elements also fulfil another important assignment which is to provide a structuring program to celebrate the Arts Patron – the Portuguese Field-Marshal Count Dom João de Mascarenhas (1633-1681) glorious achievements, both military and cultural, as well as, his taste, dreams and objectives.*

*The European historical and cultural tradition, with an ageing population, is well aware of the need to maintain its heritage. Special restoration procedures in old heritage buildings need to have the proposed restoring techniques to be assessed before being adopted. Since 1988, an extensive restoration methodology designed for the Palace and its gardens located at the Monsanto foothills has been carried on tailored under the available financial resources being made available. This is an important Portuguese cultural asset that deserves to be protected and studied to be enjoyed by all the incoming generations.*

*KEY-WORDS: glazed tiles, azulejo, restoration, Palace, gardens*



## 1. INTRODUCTION

Around 1667 (or 1668), it began to be built near Lisbon the “Palácio dos Marqueses de Fronteira e de Alorna” (“Palácio Fronteira”) on the Monsanto hill north side. The estimate completion year of this construction was 1675, Fig. 1. This Lisbon region was known for the running water, the rich farm land and the forests plenty of hunting resources. The 17<sup>th</sup> century palace with gardens, orchards, farming plots and forest, occupies an estimated area of 5.5 ha. (55,000 sq. m.). This is a remarkable Portuguese manor house with the enclosing estate wall, which helped to protect it from vandalism. It has been within the same family owners more than 300 years (see CASSIANO NEVES [1]).

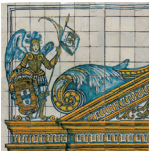


Figure 1 – The Palace of the Marquis of Fronteira and Alorna – north façade (2015).

Thirty years ago, construction pressure on the Monsanto hill due to a new expressway, the Sintra railway line tracks duplication, resulted into increasing traffic in this area, associated with pollution and vibration effects. These factors probably accentuated the deterioration problems that were being observed in the building façades and its structure. A new strategy towards the conservation of this three-hundred year old landmark building was proposed. The newly established Foundation with a Board of Curators established a well-structured, step-by-step, restoration strategy, tailored with the available yearly funds.

The built ensemble and the surrounding gardens restoration strategy used a public awareness marketing strategy towards this national heritage set. Through a global visitor’s program – the general public, the educational institutions (teachers, school students, retirees), the cultural events (music, literature, poetry, television programs), catering, associated programs (Friends of the Foundation) helped the public to be aware of the urgent need to implement restoration measures with adequate funding.

More flexible state and private funding policies helped to begin a medium to long-range program where the ensemble could always be visited, although some parts were closed during the interventions. This methodology is an interesting case study for public institutions’ curators managing the built heritage under their responsibility, with low available budgets and an increasing pressure to maintain their ensembles.



## 1.1. Heritage Concepts – an English approach

In 1877, the visionary William Morris helped to found an unique British society - the S.P.A.B. (Society for the Protection of Ancient Buildings), with this important general guidelines (see S.P.A.B. [2]): (a) Repair not restoration; (b) No testing on old buildings with unproved materials; (c) Responsible methods; (d) Complement not parody; (e) Regular maintenance; (f) Information; (g) Essential work to a building's survival; (h) Integrity; (i) Fit new material to old and more ancient fabric will survive; (j) Workmanship; (k) Materials demand for the same type, however new, helps keep them in production; and, (l) Respect for age i.e., bulging, bowing, sagging and leaning are signs of age to be respected.

Probably, regular maintenance is the most practical and economic form of preservation. Contemporary international heritage orientations include the constructed object, the built surrounding spaces, if possible, vast domains with related natural or built landscapes.

In 1931, the English Heritage with Government grants was established for the preservation of ancient monuments and, in 1953, for historic buildings (see ENGLISH HERITAGE [3]). Some general guidelines regarding the required actions were made namely: (a) the purpose of repair; (b) the need for repair; (c) to avoid unnecessary damage; (d) the analysis of historic development; (e) the analysis and the causes of defects; (f) the adoption of proven techniques; (g) the truth to materials; (h) the removal of later alterations; (j) the restoration of lost features; and, (k) the safeguard of the future.

## 1.2. The glazed tiles panels

The Palace Fronteira has two major groups of “azulejos” (glazed tiles) panels regarding their spatial location: (1) the exterior glazed tiles; and, (2) the interior glazed tiles. Whereas the first group is subject to weathering (sometimes severe variations of hot and cold temperatures, solar UV radiation, rainwater and sprinkling water, pollution), the late group is protected from these extreme actions. Nevertheless, some other damaging actions also must be considered: (a) vandalism; (b) plant growth through masonry joints; (c) poor maintenance by using “wrong” materials; and, (d) inadequate intervention techniques. Although some actions may have a strong influence in the degradation process, a combination of several factors may lead to a fast decay rate. The exterior glazed tiles panels are extensively used on several masonry walls: (a) the Palace exterior façades; (b) the Formal Garden; (c) the Great Water Tank; (d) the Kings Gallery; (e) the Exterior Veranda; and, (d) the Baroque “Ss” Fountain and the “Refreshing House”.

Glazed tiles panels are also extensively used in the interior walls of the palace with stunning decorative effects. After more than 300 years under continuous use, their condition can be considered excellent. The existing problems may be related to the support (masonry walls) unexpected displacements (ex. foundation settlements) that may lead to joint openings on the walls surfaces. Some unique spaces deserve to be mentioned: (a) the main entrance staircase; (b) the Room of the Battles; and, (c) the Dining Room.

## 2. THE BUILT ENSEMBLE

### 2.1. The Palace

On the First of December of 1640, a group of nobles sided with the Duke of Braganza and rebelled against the sixty year Spanish rule in Portugal proclaiming him - King John IV, Fig.



2 - a. As a result, during the next thirty years the Portuguese armies met several times the Spanish armies in battle –“The Restoration War” in which the Count D. João de Mascarenhas was an important military leader rising to the post of Field-Marshal, see Fig. 2 -b. In 1668 a peace treaty was finally signed and D. João de Mascarenhas carried on building a unique Palace at his country estate domain, in Benfica.



a. The King Dom João IV.



b. Count Dom João de Mascarenhas.

Figure 2 – Two Portuguese cavalry nobleman – the King and the Field Marshall.

When in 1667, the Prince Dom Pedro asked his friend the Count Dom João de Mascarenhas (1633-1681), to invite him for a hunting party in his Benfica property outside Lisbon, the Count had to excuse himself, because he needed some time to improve the existing modest hunting lodge to adequately host such a royal guest, (see GIL, J. et al. [4]).

Protected from the Atlantic Ocean winds and hot summers, the Benfica estate is nestled at the footsteps of the Monsanto hill north zone. This region once at the outskirts of Lisbon was an ideal location for the aristocratic hunting parties and leisure activities. An early 16<sup>th</sup>. century small chapel and a hunting lodge already existed when the new renovation project began in 1667 or 1668.

The extensive earthworks – landfills and excavations, deemed necessary for the garden’s “*parterres*” being created and the water galleries mined into the Monsanto hill core, nearly brought the owner into bankruptcy. All the water resources from the Monsanto hill were conveyed to the surrounding Palace water tanks and lakes. This remarkable feat of hydraulic engineering and public works surveying resulted in the excellent integration of the new building under construction with the natural landscape, see Figs. 3 and 4.

The source of inspiration for the actual building design was the Italian architect Sebastiano Serlio (1475-1554), whose architectural treatises had a strong influence in the master plan concept and the spatial dimensions created more than three hundred years ago, (see FROMMEL [5], AZEVEDO [6]). Rubens “*folio*” engravings which shows the Genoa Palace – Villa Sauli by Galeazzo Alessi in 1555-1556 is also another possible source of inspiration (see KUBLER, G. [7]).

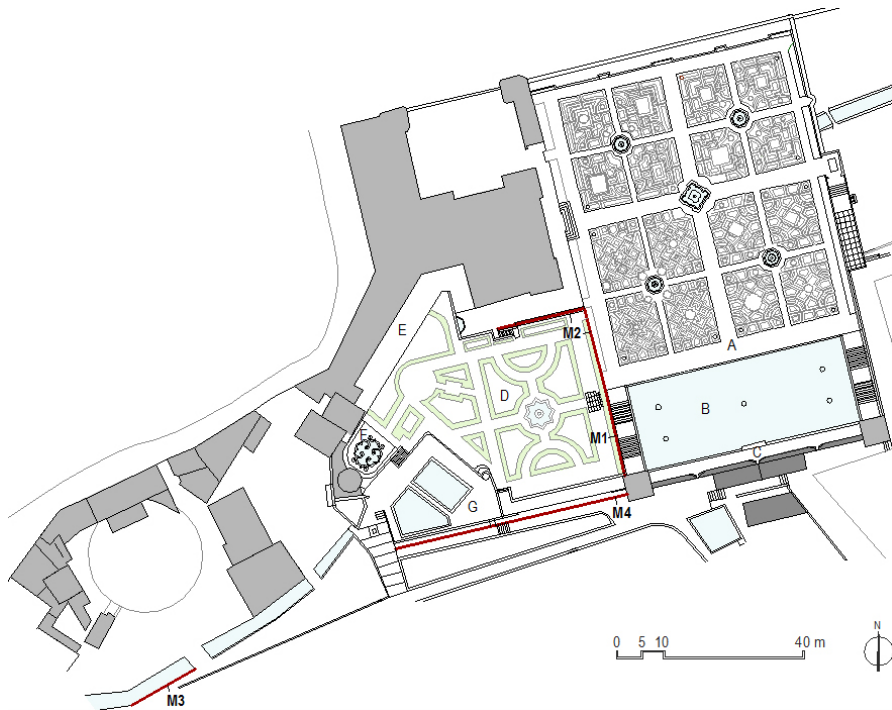
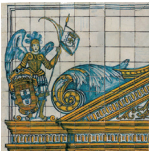


Figure 3 – The Palace Fronteira, the surrounding gardens and constructions.

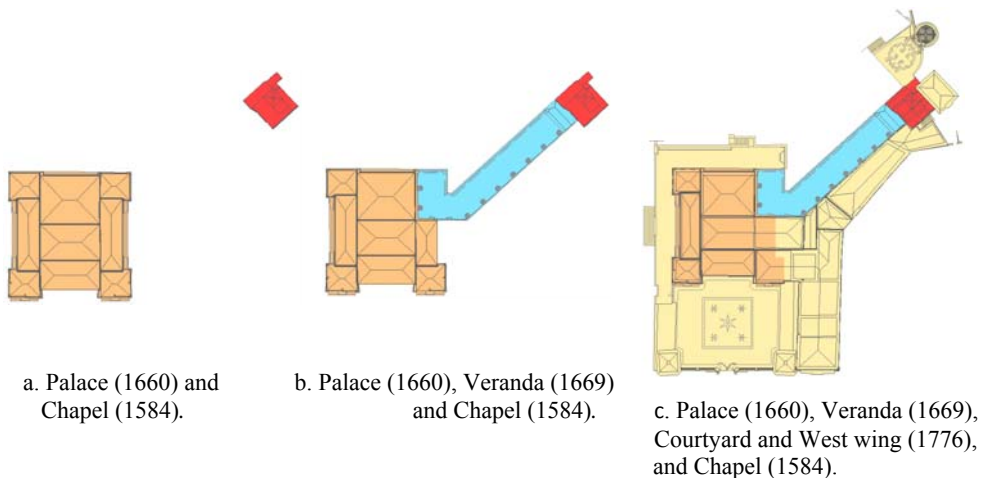
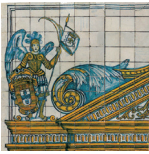


Figure 4 – The Palace Fronteira – a possible construction evolution.

Although, an early 16<sup>th</sup> century small chapel and a hunting lodge already existed in this Benfica location, the new renovation project was under way when Prince Cosme III de Medicis visited the construction site, on February 7, 1669. The construction lasted until 1675, after several years of hardship in the construction works.



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Some sources mention João Nunes Tinoco, active in the “Aula do Risco”, between 1640-80 in the Royal Palace overlooking the Tagus river, as one of the authors. However, the final result has excellent classical proportions, regardless the author, and a unique design accomplishment is obtained in this Mannerist style building. The original façade vibrates with the loggia main plane slightly recessed from the two adjacent turrets, the ground floor triple arcade with Doric-style columns supporting the first floor triple arcade with Ionic-style marble columns. The Portuguese traditional features - the “azulejos”, the painted stuccos, wisely used in the general design makes the whole ensemble unique.

The peace treaty celebrated with Spain that ended nearly thirty years of war, created the desired conditions for a new construction period. The owner wanted to be known as a person of culture and his residence was conceived as a small world with all the possible everyday life comforts. The storage rooms, kitchens and other functional areas were laid in the ground floor whereas the first floor (the “*piano nobile*”) was reserved for the family dwellings (bedrooms, dining hall, lounge areas, offices). A typical 17<sup>th</sup> century U-shaped plan is incipient in its layout. Small corner turrets are slightly protruding from the façade surface avoiding the traditional Portuguese plane bare façade.

A new west wing and the opposite east building single story storage rooms, the enclosed patio courtyard and the ironworks gate, were built during the 18<sup>th</sup> century and enhance the spatial U-shaped partially closed layout (see AZEVEDO [6]).

The initial building plan is supposed to have “absorbed” the original hunting lodge and incorporated within its structure the new spatial layout, Fig. 4. A central square shaped core has the dimensions of approximately 12.00m by 12.00m in plan. It is surrounded longitudinally by three rectangles with an approximate size in plan of 5.00m by 12.00m. A protruding turret with a rectangular size in plan of 5.00m by 6.00m is located in each one of the four corners generating a large square plan with the total dimensions of 25.00m by 25.00m. The fourth rectangle- the SW corner turret, was partially demolished to adapt to the existing rock (basalt) foundation conditions and to insert the Veranda, with the seven liberal arts. This architectural promenade, with 30.00m length by a width of 6.00m, was built to connect the Palace core with the existing chapel, Fig. 5 (CARITA et al. [8]).



Figure 5 – The connecting veranda with the liberal arts glazed tiles panels.



This Renaissance manor house concept is similar to the military fortress idea – the central square core “defended” by one turret located in each corner. These external corner turrets are connected by external roof covered verandas – the loggias, which communicate between these adjacent corner turrets, while enjoying the open air breeze and the natural landscape.

The actual East façade have the arch-shaped openings closed in the late 19<sup>th</sup> century by wood-framed glass windows due to space needs Fig. 6, whereas the North side is completely open, see Fig. 1



Figure 6 – East façade with enclosed loggia and gallery.

After the 1755 dreadful Lisbon earthquake, a new NW wing was built to install the family that decided to move from the Lisbon Chiado area and to settle permanently in Benfica, where they still inhabit. A new building program was carried on to accommodate more people and a new element was inserted into the NW-wing sector, adjacent to the existing Palace. This 18<sup>th</sup> century construction reveals the traditional plain architectural style, with simple façade stone masonry bordered openings – doors, windows, with the absence of decorative ornaments. Exceptionally, the NW façade, with the decorative stonework of the first floor balconies and window openings, reveals an incipient baroque gesture in contrast with the existing Mannerist-style Palace façade, Fig. 7, (C. NEVES [1], KUBLER, G. [7]).



Figure 7 – The 18<sup>th</sup> century NW Palace extension and the north baroque façade.



The first floor is approximately +4.80m above ground level and the roof cornice is at approximately + 9.60m, see Fig. 1. In the west-wing, the second floor area is located at approximately + 7.20m above the same reference level.

## 2.2. The indoor spaces – the major spaces

### 2.2.1. The Room of the Battles

Probably, this is the most important iconic space within the whole ensemble. It is located in the Palace core *piano nobile* with three major windows facing south and overlooking the intimate Venus garden. It has the interior dimensions in plan of 8.80m by 11.30m, and a maximum height of 7.00m, becoming the largest inner Palace space, see Fig. 8 –a. After the rebellion against the Spanish rule, on the first of December 1640, the country faced a 28 year war with Spain. On the wall, all around the Room of Battles, from the wooden floor up to nearly 1.70m, a series of “azulejos” panels depict the most important battles fought during this time period. On these panels, the Count Dom João de Mascarenhas, Field-Marshal of the Portuguese Army, is depicted in military actions of remarkable bravery.



a. General view.



b. The battle of S. Miguel (July 22, 1658) - detail.



c. The English allies (detail).

Figure 8 – The Room of the Battles with glazed tiles panels.





In chronological order they were (see NEVES, C. [1]): (1) Battle of Montijo (May 26, 1644); (2) Arronches skirmish (November 8, 1653); (3) Battle of São Miguel (July 22, 1658), see Fig. 9; (4) Battle of Linhas de Elvas (January 14, 1659); (5) Battle of Ameixial (July 8, 1663); (6) Battle of Castelo Rodrigo (July 7, 1664); (7) Battle of Montes Claros (June 17, 1665); and, (8) The Trás-os-Montes ambush (November 20, 1667).

In the main battles fought during the National Independence Wars (1640 - 1667) the Count is shown in several of the eight various size glazed panels located all around this room. These 17<sup>th</sup> century Portuguese original panels were produced based on drawings made by a soldier - artist. Probably, he was present in all of these actions, due to the geography, the two army disposition in the battlefield - the infantry men, the artillery location, the cavalry groups and the different tactics, see Fig. 8 – b, c.

## 2.2.2. The Dining Room

This room, adjacent to the Room of the Battles, is the second in size with an average size in plan of 6.65m by 10.32m. The plastered ceiling reaches the maximum height of 7.00m. This space main aspect is the partially covered walls with glazed tiles panels of Dutch production, which showed the economic power and the owner's sophisticated taste. The more delicate details, the softer blues, and smaller size, are major characteristics of these Delft glazed tiles, see Fig. 9. This room has direct access to the large veranda where the liberal arts panels alternating with the gods' statues are displayed.



a. General view



b. The Poet Alcipe.

Figure 9 – The Dining Room with the Delft azulejos panels.

## 2.2.3. A transition space – the Liberal Arts Gallery and the Chapel

Overlooking the Venus Garden and the Baroque S-shaped Lake with the Cool House, the Liberal Arts Gallery with nearly 30.00m length by 6.00m width makes a nice veranda, nearby the adjacent Dining Room and the Room of the Battle's, see Figs. 5, 10 and 11.

The liberal arts gallery provides the viewer with a transition space between the Palace interior and the discovery of the exterior gardens and other built spaces.



a. Memory.



b. Understanding.



c. Will.



d. Dining Room doors.



e. The Room of Battles access.

Figure 10 – The access to the Liberal Arts Veranda.



a. Grammar.



b. Rhetoric.



c. Dialectics.



d. Poetry.



e. Arithmetic.



f. Music.

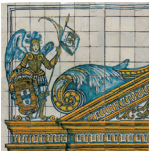


g. Geometry.



h. Astronomy.

Figure 11 – The seven liberal arts – *Trivium*, Poetry (d.), and *Quadrivium*.



At the end of this balcony is located the Palace Chapel with an inscription over door with the date of 1584. At this location an earlier Chapel construction existed and, according to the tradition, St. Francis Xavier (1506 – 1552) – the Apostol of India, celebrated his last mass before embarking on April 1541 to the Far East, where he died in China, see Fig. 12.



a. The Chapel (1584).



b. Adjacent water basin *grotto*.

Figure 12 – The end of the Liberal Arts Gallery.

The Liberal Arts veranda is flanked by marble statues of mythological gods: Diana (Moon), Mercury, Venus, Apollo (Sun), Mars, Jupiter, Saturn which correspond to the Ptolomaic construction of the cosmos. These statues alternate with the azulejos panels which correspond to the allegories of the medieval liberal arts classification: (1) the *Trivium* – Grammar, Rhetoric and Dialectics; and, (2) the *Quadrivium* – Arithmetic, Music, Geometry and Astronomy, see Fig. 11.

Probably, due to architectural composition reasons, where the six glazed tiles panels are inserted into the seven gods' statues, the Grammar theme was moved into the adjacent niche near the Palatine Chapel, see Figs. 11-d and 12-b. When the individual understands the liberal arts matters and the surrounding cosmos he is able to reach *poesis*, i.e., the poetry, see Fig. 11- d. The access to this state of mind is provided by the powers of the soul: the memory (“Memória”), the understanding (“Entendimento”) and the will (“Vontade”), see Fig. 10-a, b, c, as it was accepted in those days. The Poetry panel is surrounded by two “Della Robbia” *tondi* and two statues which represent the legend of Apollo, Fig. 10-e.

### 2.3. The outdoor spaces – the gardens and water tanks

The 17<sup>th</sup> century Portuguese plain architecture consisted mainly of buildings with simple monotonous but dignified façades (AZEVEDO, C. [6]). The Fronteira Palace with its Serlian-type façade, the 18<sup>th</sup> century extension wing, the main entrance patio, the monumental gardens, the King's Gallery with the reflecting lake, the extensive glazed tile surfaces create an unique environment that was an exception as compared with other contemporary buildings, see Fig.13.

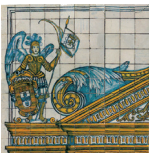


Figure 13 – The Formal Garden, the King’s Gallery and Large Lake.

This monumental ensemble – the Palace and the surrounding gardens, follows a cultural line well rooted into a two thousand year tradition that goes back to the Roman and Islamic ancestors who lived in this Western Europe Iberian region. At least three major water supply networks were built by mining into the Monsanto hill small tunnels (“minas”), to reach the available water inside the limestone layers, underlying the cracked basalt rock mantle. This extremely difficult hydraulic engineering achievement was critical to guarantee the survival of this location. The open-air channel water is transported into the water storage tanks with variable size in plan – “Tanque dos Negros”, “Lago Grande”, “Fonte da Carranquinha”, the fountains to create special water effects.

The recreation of the lost paradise on earth and some other design concepts to generate a perfect garden were the structuring guidelines to organize this Portuguese garden ensemble. The designer mind tried several different possibilities, to incorporate the following concepts in a solution that is under permanent calibration (see CARITA, H. et al. [8]): (1) to imagine a secluded universe protected from external interferences, where the owner can display his prestige while entertaining his guests; (2) to provide an intimate and private ambience. The Portuguese garden is rooted in the Islamic tradition-as an enclosed space that must be enjoyed within its walls as opposed to other European contemporary gardens (e.g. English, French) that absorbed the surrounding natural scenery into their design; (3) the garden must “melt” with the adjoining architectural spaces and domestic life – leisure areas, small lakes and fountains, benches, grottos, pergolas, tall exterior contour walls with “azulejos” applied on their surfaces; (4) natural environmental control – extreme climate conditions with excessive heat, humidity, wind, noise, are attenuated by the different types of trees, bushes, running water fountains, lakes and reflecting ponds, where this man made space became an attractive universe to stay outdoors; (5) the need of a perfumed breeze – the orange and lemon trees, the native natural plants, e.g. rosemary or the more sophisticated roses, with their scent in the air, improves the quality of the Portuguese garden environment; and, (6) the cultural “exchange” – the “azulejos”, a must from the Islamic art and the *grotto* inlaid shell-work (“embrechados”), where the glittering obtained from mother-of-pearl shells, crushed semi-precious stones, small pieces of broken crystal glass and bits of ancient China



porcelain, inlaid into the mortar surfaces of grottos, garden chapels, exterior veranda wall surfaces, try to recreate the exotic shimmering effect of Indian art.

The main exterior elements adjacent to the Palace are: (1) the entrance courtyard; (2) the Formal Garden; (3) the Kings' Gallery; (4) the Venus Garden; (5) the "Casa-do-Fresco" (a refreshing space); and, (6) the "Tanque dos Negros" (black statues pool).

The entrance courtyard with the Palace walls on its three sides and the main entrance iron fence and gate, on the north side, introduces the visitor into different spatial paths in this Estate. He can either access the private indoor area after the front doors are crossed or, alternatively, an outdoor promenade where several different options are offered. At the entrance to the Formal Garden, the Palace east façade has glazed tiles panels depicting scenes from the epic poem of Camões – "Os Lusíadas", with the Portuguese navigators disembarking on the "Ilha dos Amores", see Fig. 14. These important panels exposed to early morning daylight are more deteriorated than similar panels in other locations and, in one zone, an old Portland cement mortar repair patch is visible, Fig. 14 – a.



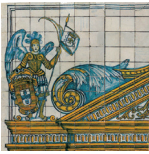
a. NE Turret - Entrance to the Formal Garden.



b. Lower edge – glazed tiles with Portuguese navigators – "Ilha dos Amores".

Figure 14 – Entrance to the Formal Garden.

One meter below the courtyard level is the Formal Garden with the magnificent dimensions in plan of 58.50m by 67.00m, see Fig. 13. The northeast corner is about four meters above the exterior road level and a great amount of human labour was required to create this vast *parterre* and surveying techniques were needed to control the earth movements.



Through a large stone staircase near the East loggia Palace façade the visitor accesses the formal garden. It has an Italian ambience with dark grey classical statues, bushes with intricate designs, vivid roses, topiary, and four small fountains placed around a central fountain.

The four sides of the garden are surrounded by contour glazed tiles panels on all sides. They depict the twelve months of the year (East), the Zodiac signs (North), the planets and constellations (West) and the twelve chivalry nobles (South). The south side has a large recreational lake with a total length of 48.2m by a width of 18.2m, used as a storage reservoir with nearly 1,000 m<sup>3</sup> total capacity), see Figs. 13 and 15.



a. West side – Jupiter.



b. West side – Cassiopea.



c. East side – November panel.



d. East side - December panel.

Figure 15 – The Formal Garden – different glazed tiles panels.

The Kings' Gallery is flanked on both opposite sides by small turrets with steep square-pyramidal roofs covered with singular Seville-style “azulejos”, with a copper lustre, that glitters against the sky while walking on this promenade space. The First and Second Portuguese Dynasty Kings' marble statues are spaced regularly around the central person being honoured – Prince Dom Fernando, the “Infante Santo”.

The south wall with fourteen riding knights on glazed tiles panels is organized in four groups of three panels each, alternating with three *grottos*. The two 4.00m wide lateral stone-masonry staircases, each one with two flights of stairs, allow the access to the Kings' Gallery where a superb upper view of the Palace and the Gardens is possible. With 30.00m by 40.00m dimensions in plan and three meters above the formal garden *parterre*, is the Venus Garden built as a smaller *parterre*, next to the Kings' Gallery on this estate southwest side. The marble statue of a generous Venus is surrounded with an intimate set of shades and green colours originated from tall and medium size trees and other plants.

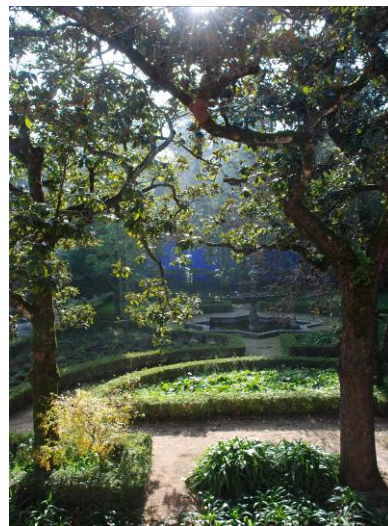


Figure 16 – The King's Gallery and the Large Water Tank.

The Room of the Battles is overlooking the Venus Garden *parterre* and the excessive light is dimmed by the grown up plants and trees, filtering the excessive summer heat on the South façade. This sustainable shade control cools the façade in the extremely hot days and reduces the amount of bright natural light entering the windows openings. Inside this space, the observer can contemplate the battles fiercely fought against the Spanish armies more than three-hundred years ago, and depicted in several unique “azulejos” panels in the Room of the Battles, see Figs. 8 and 17.



a. The central balcony window.



b. A filtered natural light scenario.

Figure 17 – The Room of Battles view over the Venus Garden *parterre*.

The Refreshing House (“Casa do Fresco”) – a cool dome-shaped space, with several water fountains with running water was an epitome of luxury and comfort in those days. In the very hot summer days where weather temperatures may raise up to 40 degrees Celsius, the evaporating water from the interior fountains decreases the surrounding temperature by a thermodynamic process of heat exchange. The whole interior is covered with inlaid small



stones (“embrechados”) which provide sound absorption on the interior dome surfaces. The inner walls have niches that function as seating places while the guests can enjoy a leisure moment.



a. The Refreshing house, S-shaped tank and the access to the upper level.



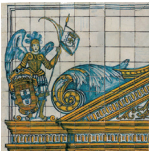
b. The inlaid small stones dome, water tank details, interior fountain.

Figure 18 – The west part of the Venus Garden.

The exterior water tank with S-shaped curve walls is surrounded by stone benches which depict the most famous “azulejos” panels with monkeys and cats, “Les Singeries”, see Fig. 19. The important glazed tiles legacy experienced different degradation rates throughout more than three centuries which deserve to be studied in order to extend this ensemble life for the incoming generations, see Fig. 20.

A typical Mediterranean basin with an Islamic concept is used along these gardens design. A unique structuring axis does not exist and the spaces are constructed with contiguous and self-contained areas disposed on different levels. The contour gardens and the Palace liberal arts veranda are intertwined through a discontinuous and discreet discovery path that is able to enhance human senses. The concept of the “Villa Hadrianna” Roman era “*ambulatio*” promenade is a good example where a large promenade walk ( $L = 230$  m) was built far from Emperor Hadrian dwellings, protected from the winds and under the shade of the trees. The “Large Water Tank” concept is similar to the “*canopus*” recreational great lake also found in “Villa Hadrianna” (see CARITA, H. et al. [8]).





a. The monkeys and cats glazed tiles panel – “les singeries”.



b. A musician cat.



c. The S-shape water tank.

Figure 19 – “Les Singeries” and the S-shape baroque water tank.



a. Wild plants growth.



b. Panel fracture – masonry wall rotation.

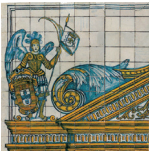


c. Paula Rego (1996) - mould joint growth.



d. North side exposure deterioration.

Figure 20 – Different “azulejos” surfaces - deterioration patterns.



## 3. THE BUILT ENSEMBLE REHABILITATION PROCESS

### 3.1. The Rehabilitation Process

Since the late 1980's the Trustees of the Fronteira Foundation adopted a step-by-step approach to implement a rehabilitation strategy of this architectural ensemble: First, the public access was guaranteed, while some building sectors were recuperated. The manor house was restored to regain its pristine condition, so that visitors and other guests would feel interested by this setting. A major priority was to guarantee the water proofing within the building (roofs, façades, floors). An extensive building survey was made and most of the roof systems were in very poor conditions due to broken tiles, water leaks, material decay, foundation settlements. During the following twenty years, the north loggia, the northeast turret, the east library, the Battle Room, the west wing, were all subjected to an extensive roof restoration process under a well-established plan.

The exterior spaces, adjacent to the Palace building, were simultaneously subjected to a rehabilitation plan. The gardens and water network systems needed to be upgraded and the water mains were replaced allowing the water fountains to work again. The Kings' Gallery marble statues were rehabilitated, some of the Formal Garden lead metal statues were restored and a few "azulejos" panels were disassembled, cleaned and re-assembled back into the original position. Several retaining walls in the gardens were appraised and a medium-size retaining wall dividing the Venus Garden from the Formal Garden was partially dismantled and built up again with traditional materials, after large top lateral deformations (tilt) were observed, indicating a state of pre-collapse. This slow paced procedure was implemented whenever funding was becoming available. Finally, an in-house training was given to the staff so that guided visits could be offered to the public.

### 3.2. The "azulejos" panels

When a new construction arises in a pristine natural environment a permanent struggle begins between the newcomer (the intruder) *vis-à-vis* the setting (the nature). In the Fronteira Palace during more than three centuries the surrounding Monsanto forest tends to engulf the built ensemble. Within this confrontation scenario the equilibrium is reached when adequate maintenance policies are implemented in order to refrain the natural downgrading actions. Whereas the interior "azulejos" panels, after a very long period under a "sheltered" existence, are in excellent conditions, the exterior ones show in some cases extensive signs of deterioration or, in some cases, they completely vanished. These exterior glazed tiles panels may exhibit several problems: (1) surface cracking; (2) painted surface delamination; (3) wall support separation; (4) infestation with wild plants; (5) weathering; and, (6) other causes (pollution, chemicals), see Figs. 20 and 21.

In some cases, old maintenance practices adopted more than fifty years ago, e.g., use of Portland cement mortars to re-assemble loose tiles, revealed to be highly detrimental for the glazed tiles maintenance practices. Probably, the despairing owner ordered the tiles to be "permanently" fixed to the wall support creating other irreversible problems.

The masonry wall support is subjected to small movements – temperature, foundation settlements, that can be accommodated with a "softer" binding agent, i.e., lime mortar. By using a more rigid support layer for the tiles (ex. Portland cement mortar), the glazed tiles panels would exhibit extensive cracking and, in some cases, tiles detaching.



a. Weathering / watering actions.



b. Humidity/ water infiltration.



c. Open masonry joints.



d. Joint closure (maintenance).



e. Surface cracking / glazing release.



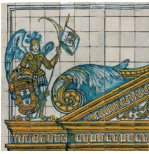
f. Panel removal for conservation.

Figure 21 – Exterior panels – different glazed tiles deterioration aspects.

Current maintenance actions to rehabilitate the glazed tiles panels may require, in some cases, the complete panel removal starting from the top tile until the lowest one, along the same column. In the case where Portland cement mortars were used this task becomes very arduous and costly. Also, during the tile removal process there is a high probability of breakage and damage. Therefore, the use of more “flexible” mortars where the binding agents are lime or hydraulic lime can be considered better options on a long term basis.

#### 4. FINAL OBSERVATIONS

The magnificent Fronteira Palace has one of the best preserved glazed tiles ensemble in Portugal (QUIGNARD, P. et al. [9]). During the last twenty five years a general plan to rehabilitate the building and the gardens ensemble was established and the objectives continuously monitored. Some national historical landmarks under budget cuts may suffer, in some cases, from a state of apathy.



The Fronteira Palace is an interesting long term case study for other Institutions with difficulties in getting results and the visitors motivated with their collections. Traditional repair techniques are time lengthy and expensive. However, in the Fronteira Palace the aim is to restore the different pieces to their near original condition, under a reasonable yearly budget plan. In some cases, new technological materials and rehabilitation solutions may be used to create higher safety levels in sectors that showed a pre-collapse state (ex. retaining walls). Continuous monitoring and maintenance actions were adopted to avoid further degradation in critical sectors. Public awareness is essential to motivate fellow visitors and public entities to become patrons of this monument.

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