Balancing the Limits of Acceptable Change in Design

Three future scenarios for São Luís Housing

Value Based Redesign Models

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Abstract

This paper explores community-driven design scenarios for rehabilitating modernist heritage in the São Luís neighborhood of Faro, Portugal. The study focuses on low- to middle-income housing and aims to bridge the gap between policies and community priorities by incorporating the preferences and aspirations of residents in the rehabilitation process. The selected building for analysis is situated at Rúa de Emiliano da Costa 33 and 35, chosen for its accessibility. Through a comprehensive understanding of the building's context, challenges, and opportunities, this research develops three design scenarios aligned with community preferences. A comparative analysis evaluates the strengths, weaknesses, and feasibility of each scenario, leading to recommendations for future actions. The conclusion summarizes key findings, highlights significant insights, and emphasizes the importance of community-driven approaches in rehabilitating modernist heritage. This paper contributes to sustainable urban development, preservation of cultural heritage, and inclusive decision-making.

Keywords: Building rehabilitation, design scenarios, Limits of Acceptable Change,

1. Introduction

The preservation of heritage and the challenges of balancing between conservation and intervention in historic neighborhoods is very complex. Historic areas often hold cultural, architectural, and social significance that contribute to the identity and character of a community. However, finding a delicate equilibrium between safeguarding the past and meeting the evolving needs of the present can be complex.

A study conducted by Romeijnders (2023) shed light on the differing priorities between policies and stakeholders regarding the acceptability of heritage interventions. The analysed policy, referred to as the 'Modernist Axe,' placed emphasis on the preservation of heritage, allowing for the addition of similar-looking elements as a secondary strategy. However, both the community and specialists displayed a more flexible and open-minded approach towards heritage interventions. They acknowledged the potential for not only removing elements but also incorporating new ones, considering the existing heritage. Despite the insights provided by Romeijnders (2023), there remains a research gap in exploring how to effectively incorporate the preferences and insights of both the community and experts to develop a balanced approach that respects the significance of the heritage. This necessitates an investigation into community-driven design scenarios for rehabilitating modernist heritage in the São Luís neighborhood.

By considering the perspectives and insights of both the community and specialists, it becomes possible to adopt a more inclusive and adaptive approach that respects the significance of the heritage while allowing for appropriate interventions. This balanced approach could also acknowledge the evolving needs and aspirations of the community, ensuring that interventions align with their vision for the future of the neighborhood.

The primary objective of this study is to develop design scenarios for rehabilitating modernist heritage. By incorporating the preferences and insights of both the community and experts, the research aims to find a balanced approach that respects the significance of the heritage while allowing for appropriate and acceptable interventions.

For the case study, the same area as the existing study by Romeijnders (2023) was chosen, namely the São Luís neighborhood in Faro, Portugal. This neighborhood has been acknowledged by the Faro Municipality as an area of significant importance (Tarrafa Silva & Valente, 2022). The research focuses on the low- to middle-income modernist housing within São Luís, which represents a valuable part of the local heritage. Among the numerous buildings in São Luís, the house located at Rúa de Emiliano da Costa 33 and 35 has been selected for analysis due to its accessibility compared to other properties in the area.

The research question guiding this study is: *"How can community-driven design scenarios for rehabilitating modernist heritage be developed?"* To address this question, the research is organized into several chapters, each exploring specific aspects of the study.

Chapter 2 provides a detailed explanation of the research methodology employed in the study. In Chapter 3, the current situation of the building is explored extensively, aiming to provide a comprehensive understanding of the existing conditions, challenges, and opportunities related to modernist heritage in the neighborhood. Chapter 4 introduces three design scenarios developed based on the priorities identified by the community. These scenarios propose specific interventions and improvements that align with the preferences and aspirations of the community members. Chapter 5 conducts a comparative analysis of the design scenarios, evaluating their strengths, weaknesses, feasibility, effectiveness, and alignment with community priorities to assess their potential. Finally, Chapter 6 presents the conclusion of the study,

summarizing key findings, highlighting significant insights gained throughout the research process, and providing recommendations for future actions in rehabilitating modernist heritage based on community-driven design approaches.

Figure 1. The neighbourhood of São Luís (black).

2. Methodology

This paper uses the research framework Veldpaus (2015), consisting out of four questions: why, what, who and how. This research uses two of them: the values (why) and the attributes (what). However, Veldpaus' framework does not consider future scenarios, therefore the theoretical framework of the Limits of Acceptable Change (which) are added. On top of these two frameworks this paper uses semi-structured design as a research method.

The methodology consists out of four steps: building analysis, design scenarios and comparison.

Building Analysis this step entails conducting a comprehensive site visit, where on-site drawings, photos, and videos are captured to document the building's condition and climate. In addition, original and related drawings are analysed, and a literature review is conducted to gather relevant information. These activities contribute to the assessment of the building's current state. The findings from this analysis are then used to create drawings that accurately depict the building's condition.

The research adopts the Limits of Acceptable Change framework, which was previously explained. This framework serves as the foundation for the development of a scenario framework, used in the semi-structured design approach. This approach was employed to create three distinct scenarios. These scenarios are developed by considering various factors, such as community preferences, heritage significance, and feasibility. The design scenarios are then analysed and evaluated to determine design priorities.

Finally these design scenarios are compared with each other, the policies and the original situation.

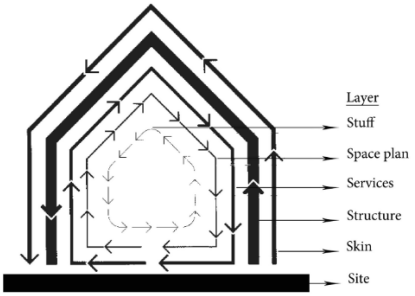
2.1. Values

Heritage values are important for classifying and preserving heritage (The Heritage Council, 2019).). Pereira Roders (2007) identifies eight distinct values: traditional values (historic, aesthetic, scientific, and age-related), community values (ecological and social), and process values (economic and political).

2.2. Attributes

Heritage attributes are categorized as tangible and intangible (Pereira Roders, 2007). Due to time constraints and also excluded from the research this is based on (Romeijnders, 2023). Because of the relatively large scale of these attributes, a smaller scale solution was sought for scenario interventions. Thus, the concept of time-related building layers was employed, extending beyond the traditional two layers (structure and infill) to include shell, services, scenery, site, skin, space plan, and stuff, each with its own service life {Brand, 1995 #69}. The research prioritizes the layers themselves for categorizing tangible attributes on a reduced scale, rather than emphasizing the service life of each layer.

Figure 2. Building Layers

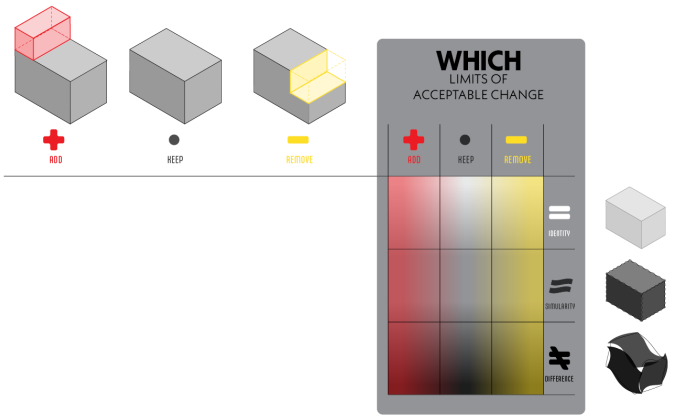


Note. Figure from Durmisevic and Yeang (2009).

2.4 Limits of Acceptable Change (LAC)

Based on the research of Turner (1996, 1998) and Pereira Roders (2007) for the limits of Acceptable Change (LAC) context, a novel diagram was developed by Romeijnders (2023) to facilitate the analysis of heritage policies. Figure 3 depicts this diagram, which comprises six subcategories. The x-axis represents changes in heritage, categorized as add, keep, or remove. On the other hand, the y-axis represents the state of heritage, categorized as identity, similarity, or difference.

Figure 3. Diagram for the Limits of Acceptable Change, consisting out of add, keep, remove (x-axis) and identity, similarity, difference (y-axis)



Note. Designed by author, modified from Turner (1996, 1998) and Pereira Roders (2007)

2.5 Semi-structured Design

The research employed a semi-structured design methodology to develop community-driven design scenarios for modernist heritage rehabilitation. The research question guided the approach, and specific objectives were defined for each scenario to provide direction. The choice of three scenarios allowed for triangulation and multiple perspectives. Data collection occurred iteratively during the design phase, using a Veldpaus framework with attributes, values, and the concept of Limits of Acceptable Change (LAC). Pilot testing was conducted with initial scenarios, leading to the adaptation of new scenarios that better aligned with the research objectives and feasibility.

3. The Original Situation

To understand the original state of the building, a building analysis was conducted, involving a review of the original drawings as well as related and similar drawings by the same architect or other architects in the surrounding area. A site visit was also carried out to generate on-site drawings, photographs, and videos. Furthermore, an assessment included evaluating the building's damages and considering the climate conditions to determine appropriate changes that would optimize its performance. By gathering all this information, accurate drawings depicting the current situation of the building were created.

3.1 Site Visit

During the site visit in May 2022, the interior of Rúa de Emiliano da Costa 35 was accessed for a short period of time. It was discovered that the ground floor of the building at number 35 is occupied by six Brazilian lifeguards, while an elderly woman and her two dogs live upstairs at number 33. On-site drawings and photographs of the location and street were produced by the author. The original drawings from 1959 of the modernist housing were obtained through the municipality offices and included other housing designed by the same architect, as well as some buildings by Emiliano da Costa, a pupil of Jorge de Oliveira. Despite an extensive search for literature for more detailed drawings, and especially technical drawings of the houses and information about the architect, the available sources were limited.

3.2 Literature Review

3.2.1. Architect Jorge de Oliveira

Based on the available evidence, including the name found in the original drawings of Rúa de Emiliano da Costa 35 and the supporting information from Agarez (2016, p. 215), it can be reasonably concluded that Jorge de Oliveira is the architect of the houses.

After an extensive search, two sources explicitly mention the architect, Jorge de Oliveira. Firstly, Agarez provides a comprehensive description of Oliveira's career in his book Algarve Building. Secondly, a thesis written by Faustino about Manuel Gomes da Costa, who was a pupil of Oliveira (2018, p. p.103). While other sources briefly mention the architect, they do not focus on his work in particular (Candeias, 2022), (Fernandes, 2006).

The Portuguese architecture of the 1940s had two distinct directions: an architecture of propaganda specific to the style of the regime, and a modern architecture made by a limited number of architects engaged in the search for new architectural forms (Faustino, 2018).In the early 1940s, a combination of traditional and modern design known as ‘Style Moderne’ was popular in Olhão and other parts of the Algarve (Faustino, 2018). Jorge de Oliveira was appointed in 1943 to address the metropolitan concern over the popularized ‘Moderne’ as a foreign influence by providing technical assistance to regional and municipal institutions in Algarve. The term "regional" was loosely defined and used to blend elements of contextual tradition and popular practice with principles of classical order, in the Algarve region. Lisbon architect Jorge de Oliveira's time works in the Algarve aimed to achieve a balance between these two often conflicting designs principles (Agarez, 2016, p. 235).

According to Agarez, rather than classifying his work as retrograde or modernist, it is important to consider Oliveiras work as conservative in the 1940s and richly eclectic in the 1950s. Both Agarez (p. 332) and Faustino (p. 132) mention the influence of the style of architecture of da Costa on Oliveira, during this last period of his career.

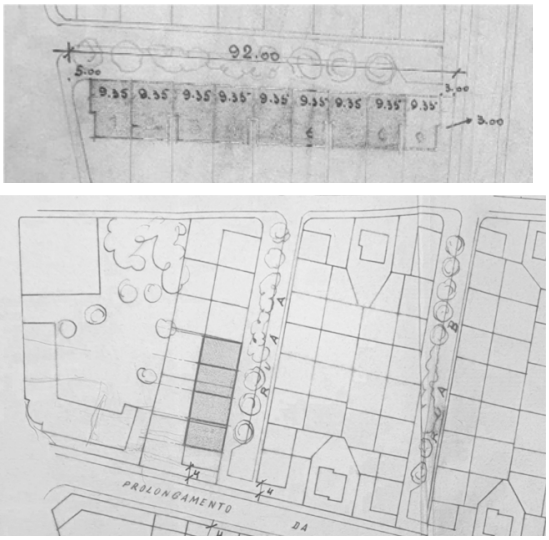
Figure 4 The expansion of Faro during 1940 (top), 1950 (middle), and 1960 (bottom)

Note. Adjusted from Faustino (2018, pp. 81,85,93)

3.2.1. São Luís

In the context of Jorge de Oliveira's architectural style in the 1950s, Algarez's book explicitly mentions Rúa de Emiliano da Costa, highlighting Oliveira's trademark feature of the "chequer-pattern concrete grid on the back elevation" (p 337). Algarez discusses the extensive terraced housing ensemble in São Luís, emphasizing the clustering of house types in groups of four to create a uniform streetscape, with the incorporation of different colours for added variety. *"Types A and B were single-family dwellings in which the partial upper floor could be extended over the terrace – an unstated example of evolutive housing design. The elevations were rather modest examples of Oliveira's search for a new way to employ some of his favourite regional elements (the tiled eave on the parapet, the Algarve chimney top, the rusticated stone planes); in an economically restrained context, the result was hybrid and awkwardly proportioned."* (Agarez, 2016, p. 337)

Figure 5 Drawing showing all eight houses designed by Jorge de Oliveira on Rúa De Emiliano Da Costa (top) and a drawing showing four clustered houses (bottom)



Note. Pictures by author from the original drawings made by Jorge de Oliveira.

Figure 5 shows that the original 1956 drawings confirm that the eight houses on Rúa Emiliano da Costa were designed as two clusters of four houses. Presently, these houses still maintain a uniform streetscape, albeit with some deviations in colour due to repainting as shown in Figure 6. The upper floor extends over the front entrance as initially intended, while the chimney top, although not visible from the street, remains a feature of the housing. The incorporation of stone planes into the architecture persists, and the presence of a concrete pattern on a small fence is represented on top of the tiled eave parapet.

Figure 6 Pictures of the Rúa de Emiliano da Costa in May 2022,

Notes. Overview of the uniform street (Top) and a picture of the façade of Rúa Emiliano da Costa 33&35 (Bottom), showing the stones, tiled eave parapet and the first floor extending over the front façade.

3.3 Damage Assessment

The assessment of the building's damage was conducted with reference to the 'Monument Diagnoses and Conservation System' (MDCS) website (TNO et al., 2015) and the book 'Designing from Heritage: Strategies for Conservation and Conversion' (Kuipers & Jonge, 2017) . An examination of both the front and back façades was carried out, utilizing a comparative analysis of original and similar drawings, photographs, videos, and other available documentation. This meticulous approach yielded several significant observations.

3.3.1 Front Façade

The front façade of the building exhibited both replacements and signs of damage. Replacements involved the complete substitution of the original wooden window frames and shutters with PVC alternatives, accompanied by the replacement of single-sided glass windows with double-sided glass. Additionally, the original green plaster was replaced with grey plaster following the replacement of a water connection element, and the original steel rainpipe was replaced with a PVC rainpipe.

The front façade also exhibited areas of damage. Notably, disintegration and cracking were observed in the white plaster on the concrete of the top parapet balustrade. Furthermore, the presence of moist spots was noted around the upper floor extension, resulting in visible effects on the plaster of the concrete.

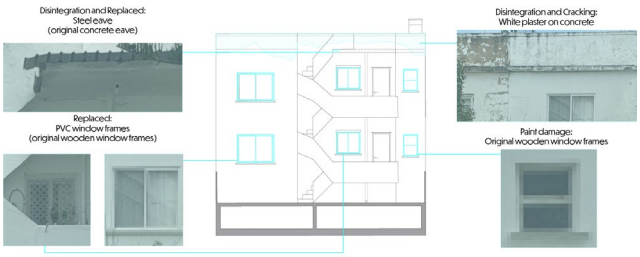
Figure 7: Front Façade with assessed damage

3.3.2 Back Façade

The back façade also underwent replacements and exhibited signs of damage. Replacements involved most original wooden, one-sided glazed windows being replaced with PVC window frames and double-sided windows.

Regarding damage, the back façade displayed several indications. Disintegration and cracking were evident in the white plaster on top of the concrete construction. Additionally, the steel eave on the roof had undergone disintegration, and the original wooden frames showed visible paint damage.

Figure 8: Back Façade with assessed damage



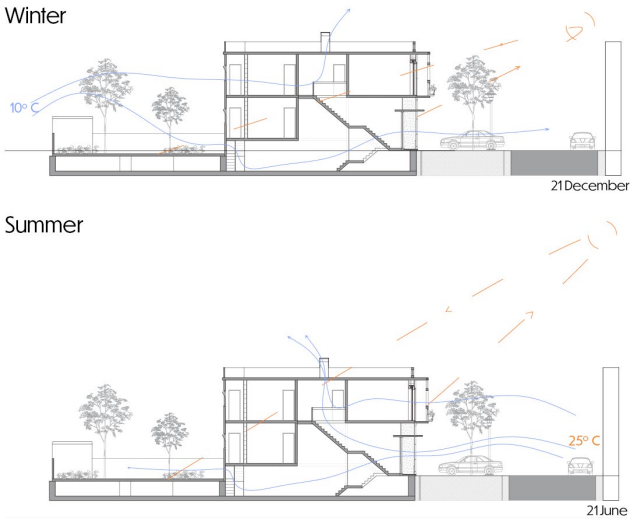
3.3 Climate Analysis

To gain a better understanding of the local climate in Faro, a climate assessment was conducted using the program 'Climate Consultant 6.0'(Kumar & Sharma, 2018). The Climate Consultant shows the local climate in Faro, based on climatic measurements from Faro airport. In appendix 9.2 Climate Consultant Results and 9.3 Climate Consultant Design Guidelines the most important results are shown.

Faro has a hot-summer Mediterranean climate influenced resembling Southern California more than the rest of the

Algarve (Köppen, 2011). The region is susceptible to variations in precipitation throughout the seasons, potentially leading to future water scarcity in conjunction with rising temperatures and reduced rainfall (Berte & Panagopoulos, 2014). Faro experiences warm to hot summers, mild winters with limited rainfall, and is known for its abundant sunshine, receiving over 3000 hours of sunshine annually (Instituto Nacional de Estatística, 2022).
An interesting thing to note is the wind direction, which changes with the seasons in Faro see appendix 9.1 Wind direction for Faro Airport. Generally, the direction of the wind is northwest in winter, while it comes from the southwest in summer.

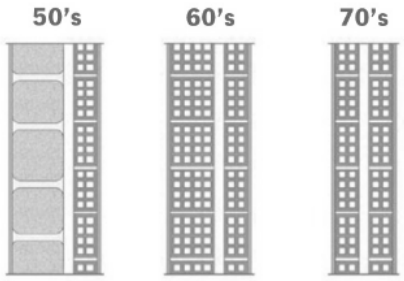
Figure 9. Sun and wind in summer and winter situation shown in section of Rúa Emiliano da Costa 33&35.



3.4 Scenario 0. Current Situation

The building's façade comprises two levels, the first floor which extends over the front entrance, creating a balcony overseeing the street. The green plastered ground floor façade has three entrance doors. Of these, the door on the right provides entry to the ground floor, while the one on the left leads to the first floor. The middle door, on the other hand, grants access to a basement level, which is only seven steps down and leads to a hallway that leads to the back of the house. Both the front and back façades are constructed out of horizontal masonry units, which was a popular building technique at the time (Silva et al., 2019; Sousa, 2000). While the rest of the building is constructed out of concrete load carrying walls and concrete floors, as shown on the original Drawings.

Figure 10.Evolution of masonry walls in Portugal



Note. Adjusted from Silva et al. (2019)

Upon entering the ground floor entrance, it is necessary to ascend four steps towards the hallway, which also serves as a living room for the six lifeguards. A second hall to the left features a wardrobe closet and leads to two of the bedrooms as well as the bathroom. A third bedroom is located on the northwestern side of the house, adjacent to a dining room, kitchen, and outdoor toilet. From the kitchen, one may ascend towards the first floor and the roof or descend towards the garden and basement. The first floor is almost identical to the ground floor in terms of interior design, with an additional bedroom and the living and dining rooms in their original locations. Due to limited space on the ground floor, it was necessary for occupants to share rooms and some rooms were swapped.

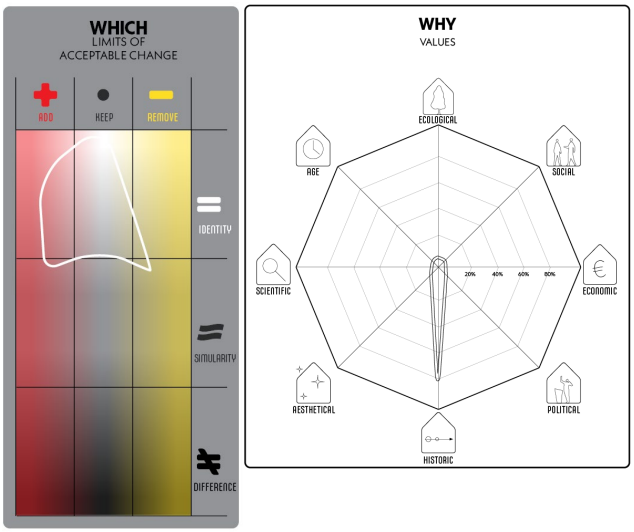
4. Three Design Scenarios

4.1 Scenario 1. Historic Identity

4.1.1 Goal

The main objective of this scenario is to restore the current state of the building to closely match its original condition. The Limits of Acceptable Change principle guides the process, focusing on removing and adding elements to achieve a sense of identity. Any objects that are not identical to the original ones are replaced with items that closely resemble them, ensuring the preservation of their historical value and the overall heritage. The goal is to maintain the building's heritage as closely as possible to its original situation.

Figure 11 Scenario 1. Goals for values and LAC



4.1.2 Design

To preserve the building's identity, minor changes have been made to the current situation. Two types of changes were implemented: replacements to align with the original design and minor modifications to enhance the climate comfort.

The PVC windows have been replaced with wooden windows that closely resemble the original ones, featuring double-sided glass. Similarly, the PVC rainpipe has been substituted with a rainpipe that closely matches the original design, and the water connection on the façade has been removed and replaced with the original green plaster.

Additionally, the two windows above the entrance doors have been replaced with a steel mesh, replicating the style of the original steel grating. Behind the steel grating, a similar steel frame with closable shutters has been installed to promote natural ventilation and facilitate night flushing. Insulation has been added to the space between the masonry on the back façade to enhance the winter climate's comfort. Furthermore, removable solar panels have been mounted on the roof to generate electricity.

4.1.3 Results

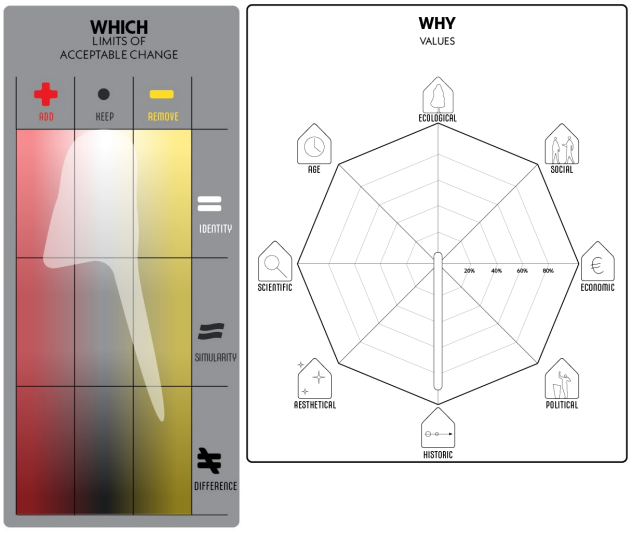
The main objective of this scenario was to restore the current state of the building to closely match its original condition. Four interventions were carried out on the building's exterior, one on the structure, and one on the services. Half of these interventions aimed to preserve the building's historical value, while the other half focused on improving the ecological aspects such as climate and comfort, which are essential for its sustainability. The outcome of the Limits of Acceptable Change and the values associated with the interventions differ from the initial goal. Half of the interventions aimed to preserve the historic value by maintaining the building's heritage, while the other half focused on the ecological value by improving the climate and comfort, which are essential for its existence.

For the limits for acceptable change a slight change happened from adding identity to removing differences. The design prioritized maintaining the building's historical value while also addressing ecological concerns. This highlights the importance of balancing preservation and improvement in achieving the desired outcome.

Table 1 Identification of indicators, tangible attributes, values, and LAC

Intervention	*Attribute*	*Value*	*LoAC*	
Replace PVC windows with wooden windows with double-sided glass	*Skin*	*Historic-Artistic*	*Remove* *Add*	*Similarity* *Difference* *Identity* *Similarity*
Replace PVC rainpipe with steel rainpipe	*Skin*	*Historic-Artistic*	*Remove* *Add*	*Difference* *Identity*
Water connection removed and replaced with original Plaster	*Skin*	*Historic-Artistic*	*Remove* *Add*	*Difference* *Identity*
Replacing windows with steel mesh and steel closable shutters	*Skin*	*Ecological-Existential*	*Remove* *Add*	*Identity* *Similarity*
Adding Insulation to back façade	*Structure*	*Ecological-Existential*	*Add*	*Difference*
Adding Solar Panels	*Services*	*Ecological-Existential*	*Add*	*Difference*
Rest of the building	-	*Historic-Conceptual*	*Keep*	*Identity*

Figure 12.Scenario 2: Results for Values and LAC

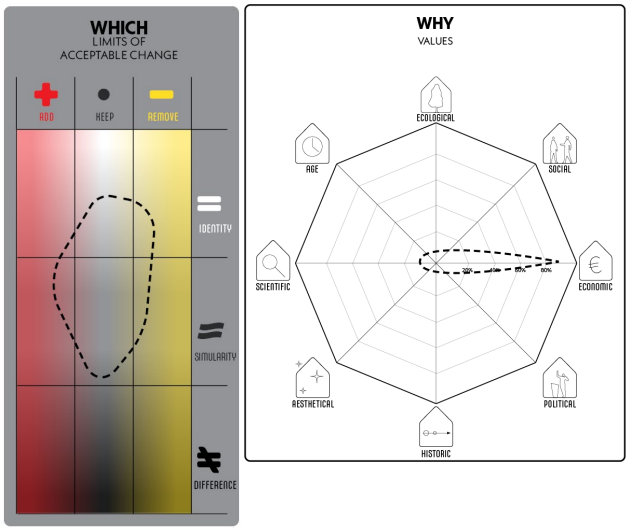


4.2 Scenario 2: Economic Similarity

4.2.1 Goal

The primary objective of this scenario is to make the building resemble its original state. The process follows the principle of Limits of Acceptable Change, which involves removing and adding elements to create a sense of similarity. Objects are replaced with similar alternatives to increase the functionality (economic value) of the building.

Figure 13 Scenario 2. Goals for values and LAC



4.2.2 Design

The primary objective of this scenario is to make the building resemble its original state while considering specific needs and functionality. The main change involves relocating the grandma to the ground floor for easier accessibility as she ages, and allocating the first floor to the lifeguards who require more space. Some walls are removed on the first floor to accommodate individual rooms for each lifeguard, and a half-level is added to the roof for additional space.

In this scenario, most changes from scenario 1 are retained. However, there are two differences: the replacement of windows with steel shutters instead of a steel mesh, and the use of steel windows instead of wooden ones for durability and user-friendliness. The design of the steel shutters is inspired by the existing dark-green steel elements used throughout the building.

4.2.3 Results

In this scenario, the main objective was to implement similar interventions throughout the building, moving away from a sole focus on the exterior (skin) as in the first scenario. The values guiding these interventions shifted from historical and ecological considerations to economic factors. The changes in values were not as significant as the initial goal since the interventions from scenario 1 were incorporated into this scenario.

The limits of acceptable change deviated slightly from the initial goal, with less emphasis on maintaining similarity and more emphasis on adding similarity and removing differences.

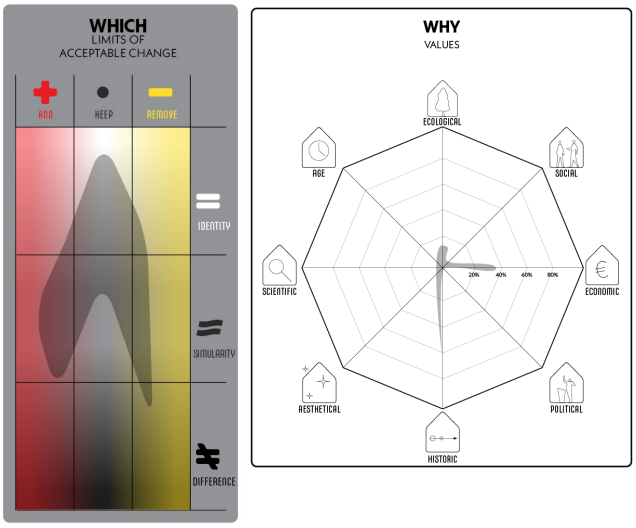
Overall, the goal of achieving economic similarity was pursued, incorporating elements from scenario 1 and adjusting align with the desired outcome.

Table 2 Identification of indicators, tangible attributes, values, and LAC

Intervention	*Attribute*	*Value*	*LoAC*	
Switch the six lifeguards with the grandma	*Space plan*	*Economic Use*		*Difference*
Remove and replace walls to create more space	*Space plan*	*Economic Use*	*Remove*	*Identity*
	Stuff		*Add*	*Similarity Difference*
	Skin		*Add*	*Similarity*
Add extra level on building for more space	*Structure Services Space Plan Stuff*	*Economic Use*		
Replace PVC windows with similar steel ones with double-sided glass	*Skin*	*Economic-Use*	*Remove Add*	*Similarity Difference Similarity*
Replace PVC rainpipe with similar steel rainpipe	*Skin*	*Historic-Artistic*	*Remove Add*	*Difference Similarity*
Water connection removed and replaced with original Plaster	*Skin*	*Historic-Artistic*	*Remove Add*	*Difference Identity*
Replacing windows with steel closable shutters	*Skin*	*Ecological-Existential*	*Remove Add*	*Identity Similarity*
Adding Insulation to back façade	*Structure*	*Ecological-Existential*	*Add*	*Difference*
Adding Solar Panels	*Services*	*Ecological-Existential*	*Add*	*Difference*
Rest of the building	*-*	*Historic-Conceptual*	*Keep*	*Identity*

Note. The unchanged interventions from scenario 1 are listed in grey.

Figure 14. Scenario 2: Results for Values and LAC

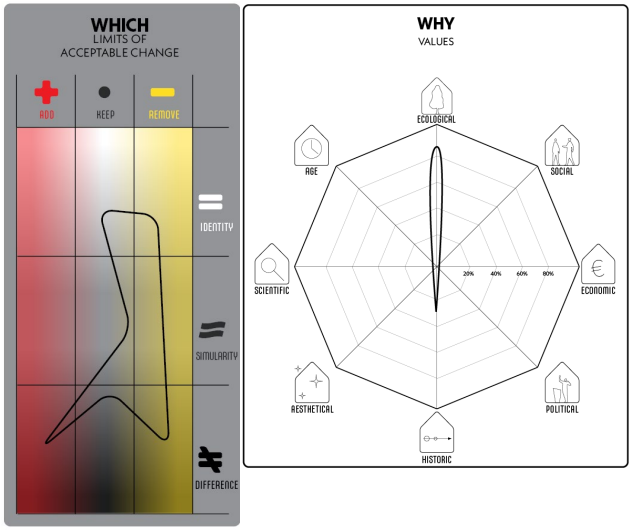


4.3 Scenario 3: Ecological Difference

4.3.1 Goal

The primary objective of this scenario is to make the building as different or contrasting from the original state as possible. The process follows the principle of Limits of Acceptable Change, which involves removing and adding elements to create contrast to the original plan, in a visible and noticeable way. Objects are replaced with different alternatives to increase the climate of the building, the ecological value.

Figure 15. Scenario 3: Goals for values and LAC



4.3.2 Design

To achieve a contrasting building design, bio-based and circular materials were utilized in this scenario. The use of these materials aligns with the goal of creating a more sustainable and environmentally friendly structure. To improve the climate inside the building, a curtain façade was installed on the back-façade to enhance insulation and promote natural ventilation and night flushing during winter. Additionally, an entire floor was added to the roof using wood from a skeleton wood construction, further contrasting with the original plans. While maintaining some of the changes from scenario 1 and 2, different bio-based materials were incorporated to ensure circularity. For instance, the entrance windows were replaced with wooden movable shutters, showcasing the use of alternative materials.

4.3.3 Results

The main objective of this scenario was to create a building that is highly contrasting and different from its original state, while prioritizing improvements in climate and circularity. The interventions in this scenario involve a wider range of attributes compared to scenarios 1 and 2, as the addition of a new level and an extra façade introduce more elements into the building.

The values associated with this scenario primarily focus on ecological considerations, as the changes aim to enhance the building's climate performance and promote circularity. The goal is to create a more sustainable and environmentally friendly structure.

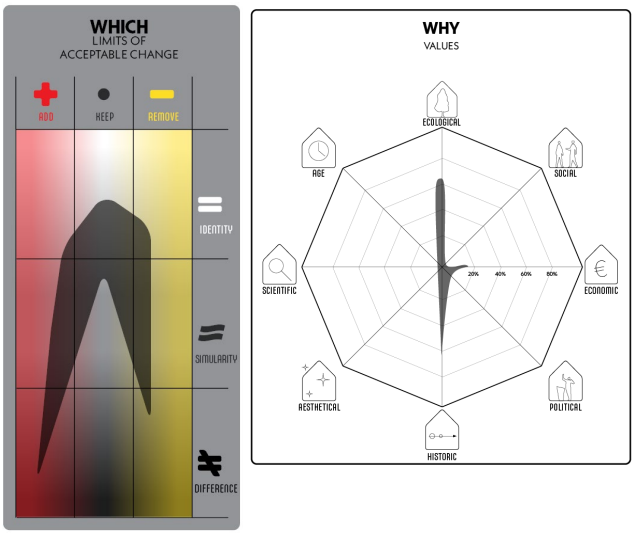
The limits of acceptable change in this scenario have a greater emphasis on adding similarity, which deviates from the initial goal of creating contrast. Unexpectedly, there are also elements of adding identity, which were not initially anticipated. This may be attributed to the challenge of introducing different attributes to the building, as the removal of original elements requires justification and cannot be done without reason.

Table 3 Identification of indicators, tangible attributes, values, and LAC

Intervention	*Attribute*	*Value*	*LAC*	
Switch the six lifeguards with the grandma	*Space plan*	*Economic Use*		*Difference*
Remove and replace walls to create more space	*Space plan*	*Ecological-existential*	*Remove*	*Identity*
	Stuff		*Add*	*Similarity* *Difference*
Add extra level on building of wood and biobased materials	*Skin* *Structure* *Services* *Space Plan* *Stuff*	*Ecological-Existential* *Economic Use*	*Add*	*Difference*
Add curtain façade of wood in front of the back-facade	*Skin* *Structure* *Services* *Space Plan*	*Ecological-existential*	*Add*	*Difference*
Replace PVC windows with better ones for the climate	*Skin*	*Ecological-Existential*	*Remove* *Add*	*Similarity* *Difference* *Difference*
Replace PVC rainpipe with similar steel rainpipe	*Skin*	*Historic-Artistic*	*Remove* *Add*	*Difference* *Similarity*
Water connection removed and replaced with original Plaster	*Skin*	*Historic-Artistic*	*Remove* *Add*	*Difference* *Identity*
Replacing windows with wooden closable shutters	*Skin*	*Ecological-Existential*	*Remove* *Add*	*Identity* *Similarity*
Adding Insulation to back façade	*Structure*	*Ecological-Existential*	*Add*	*Difference*
Adding Solar Panels	*Services*	*Ecological-Existential*	*Add*	*Difference*
Rest of the building	*-*	*Historic-Conceptual*	*Keep*	*Identity*

Note. The unchanged interventions from scenario 1 and 2 are listed in grey.

Figure 16. Scenario 3: Results for Values and LAC



6. Discussion

6.1 Findings

The building analysis involved reviewing original drawings, conducting a site visit, and assessing damages and climate conditions. Occupants were identified on different floors. Jorge de Oliveira's architectural style was evident in the São Luís housing ensemble, characterized by clustered terraced houses with regional elements. Both the front and back façades showed replacements and damage. Faro experiences a hot-summer Mediterranean climate with seasonal wind variations. The building has a two-level façade, and its interior comprises multiple rooms and a basement. Three scenarios were developed to explore different approaches for rehabilitating the modernist heritage of the building located at Rúa de Emiliano da Costa 35. Each scenario has a unique objective and set of interventions.

6.2 Comparison between the three scenarios

6.1.1 Attributes

The interventions in the three scenarios involved various aspects of the building. Scenario 1 addressed the exterior, structure, and services. Scenario 2 expanded to interventions throughout the building, while Scenario 3 introduced additional elements such as a new level and façade. Scenario 1 predominantly emphasizes the preservation of historical identity, resulting in a graph exhibiting a steep incline in the "keep identity" category and minimal changes in element removal. Conversely, Scenarios 2 and 3 demonstrate a more pronounced inverted V-shaped pattern, indicating a decreased emphasis on preserving the original identity and a heightened focus on introducing elements of similarity and difference. These scenarios entail a significant reduction in the portions of the building maintained in their original state, aligning with the objective of implementing modifications.

6.1.2 Values

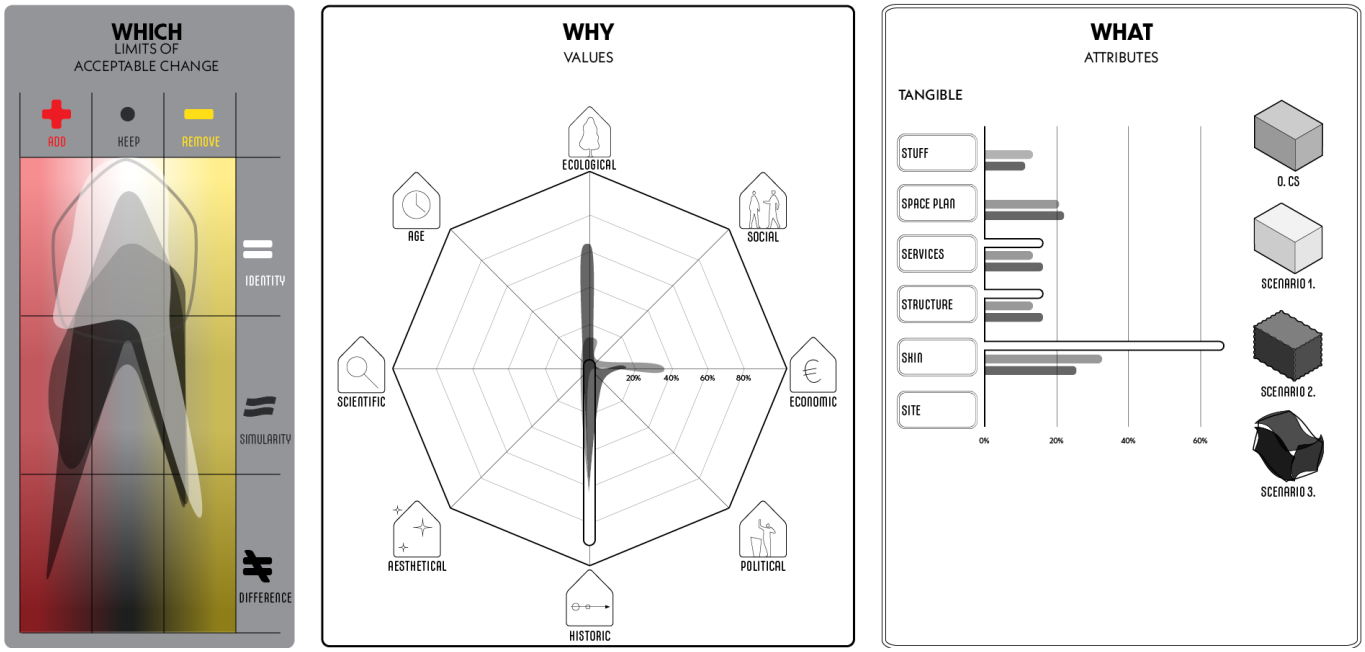
Regarding the values considered, it is noteworthy that little attention was given to factors beyond historical, economic, and ecological aspects. This may be attributed to author bias, but it may also be a consequence of the absence of previous measurements pertaining to the building's values prior to the redesign process. Scenario 1 focused on preserving historical value and improving ecological aspects. Scenario 2 shifted towards economic considerations, while still incorporating elements from the previous scenario. Scenario 3 prioritized ecological aspects, aiming to create a sustainable and environmentally friendly structure.

Figure 18: Scenario 1,2 and 3, combination of the results: values

6.1.3 Limits of Acceptable Change (LAC)

Scenario 1 aimed to balance preservation and improvement, with a slight shift from adding identity to

Figure 17 Scenario 1,2 and 3, combination of the results: Limits of Acceptable Change, values, and attributes.



removing differences. Scenario 2 deviated from the initial goal, emphasizing adding similarity and removing differences. Scenario 3 unexpectedly included elements of adding identity, highlighting the challenge of introducing new attributes while justifying the removal of original elements.

When analysing the limits of acceptable change, a distinct shift becomes evident in Figure 17 when comparing Scenario 1 to Scenarios 2 and 3. Scenario 1 predominantly emphasizes the preservation of historical identity, resulting in a graph exhibiting a steep incline in the "keep identity" category and minimal changes in element removal. Conversely, Scenarios 2 and 3 demonstrate a more pronounced inverted V-shaped pattern, indicating a decreased emphasis on preserving the original identity and a heightened focus on introducing elements of similarity and difference. These scenarios entail a significant reduction in the portions of the building maintained in their original state, aligning with the objective of implementing modifications.

6.1.3 Scenario Goals

Scenario 1 restored the building's current state to closely match its original condition. The interventions focused on the exterior, structure, and services, with a balance between preserving the building's historical value and improving its ecological aspects such as climate and comfort. It retains the building in its current state with minimal alterations.

Scenario 2 shifted the focus from the exterior to implementing similar interventions throughout the building. Economic factors became the primary consideration, while incorporating elements from the previous scenario.

In Scenario 3, the objective was to create a highly contrasting and sustainable building, introducing contrasting elements and implementing significant modifications to the building. The interventions included adding new elements such as a new level and an extra façade, with a focus on improving climate performance and promoting circularity.

6.2 Comparison between policy and stakeholder and design priorities

6.2.1 Attributes

The gamified survey questions give greater attention to the ensemble, context/setting, and area compared to the 'Modernist Axe' policy, which focuses more on buildings and building elements. There are disparities between the perspectives of policies, community, and specialists.

The interventions in the three scenarios involve various aspects of the building. Scenario 1 focuses on the exterior, structure, and services, while Scenario 2 expands to interventions throughout the building. Scenario 3 introduces additional elements such as a new level and façade. The scenarios show variations in the emphasis on preserving historical identity and introducing elements of similarity and difference.

6.2.2 Values

The survey expands the scope of values to include social, economic, political, ecological, and age-related aspects, in contrast to the policies that primarily focus on scientific and aesthetic values. There are differences in value priorities between the community and specialists.

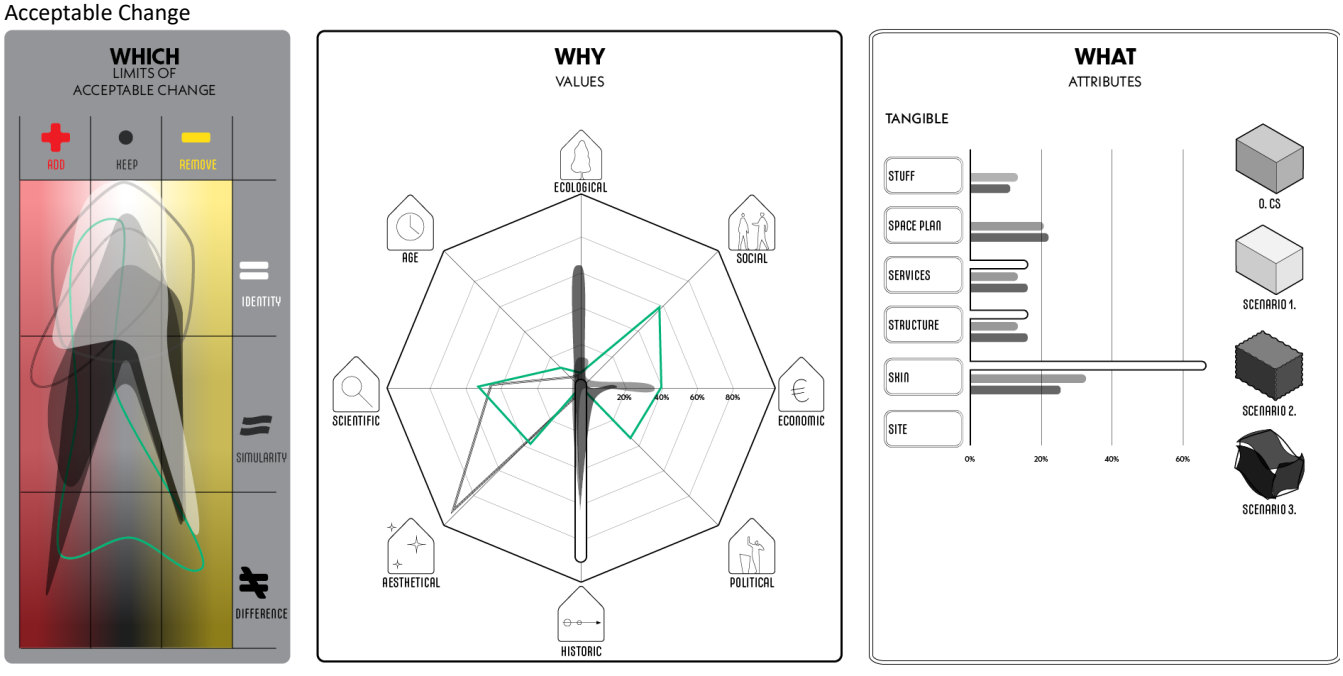
Little attention is given to factors beyond historical, economic, and ecological aspects in the three scenarios. Scenario 1 focuses on historical value and ecological aspects, Scenario 2 shifts towards economic considerations while incorporating elements from the previous scenario, and Scenario 3 prioritizes ecological aspects.

6.2.3 Attributes

The survey addresses a subset of LAC terms, and there are disparities between the policy's LAC priorities and those of the stakeholders.

There is a distinct shift in the emphasis on preserving historical identity and introducing elements of similarity and difference among the scenarios, as seen in the graph.

Figure 19 Scenario 1,2 and 3, policy (black line) community survey results combination of the results: attributes, values and Limits of Acceptable Change



Scenario 1 emphasizes keeping identity, while Scenarios 2 and 3 focus more on adding similarity and removing differences.

6.3 Limitations

Generalization: While the research provides scenarios for a specific building and context, its applicability to other buildings and settings may be limited. The findings and limitations identified in the research may not directly translate to different contexts, restricting the generalizability of the research outcomes.

Subjectivity: The assessment of values, limits of acceptable change, and scenario goals inherently involves subjective judgments and interpretations. Due to diverse stakeholder perspectives and priorities, the research outcomes may be influenced by potential biases and limitations. Different stakeholders may have varying opinions and priorities, leading to subjective elements in the research.

Simplification and assumptions: In order to manage the complexity and feasibility of the scenario development and analysis, certain simplifications and assumptions may have been made. These simplifications could oversimplify the intricacies of the real-world situation and potentially overlook important factors or interactions. The inherent complexities of the building and its context may not be fully captured in the research.

Lack of stakeholder input: The research description does not explicitly mention stakeholder engagement or input in the scenario development process. This omission may restrict the inclusiveness and validity of the scenarios and their outcomes. Incorporating diverse stakeholder perspectives could provide valuable insights and enhance the relevance of the research findings.

Limited consideration of other values: While the scenarios primarily focus on historical, economic, and ecological values, other values such as social, cultural, or aesthetic considerations may not have been adequately explored or given sufficient weight in the analysis. This limitation may impact the comprehensiveness and balance of the proposed interventions, potentially neglecting important aspects of the building and its surroundings.

7. Conclusion

The research presented various scenarios for rehabilitating the modernist heritage of the building located at Rúa de Emiliano da Costa 35. While the findings and limitations identified in the research provide valuable insights, it is important to acknowledge the limitations that may impact the generalizability and validity of the research outcomes.

Firstly, the scenarios presented in the research are specific to the particular building and context under study. Therefore, their direct applicability to other buildings and settings may be limited, restricting the generalizability of the research. It is crucial to consider the unique characteristics and circumstances of each building when interpreting and applying the research findings.

Secondly, the assessment of values, limits of acceptable change, and scenario goals involves subjective judgments and interpretations. The diverse perspectives and priorities of different stakeholders can introduce potential biases and limitations in the research outcomes. It is necessary to recognize the subjectivity inherent in these assessments and consider the range of perspectives to ensure a more comprehensive understanding.

Furthermore, the scenario development and analysis may have involved simplifications and assumptions to manage complexity and feasibility. While these simplifications are necessary, they may oversimplify the real-world situation and overlook important factors or interactions. It is essential to be mindful of these simplifications and their potential limitations in capturing the complexities of the building and its context.

The research description does not explicitly mention stakeholder engagement or input in the scenario development process. This omission limits the inclusiveness and validity of the scenarios and their outcomes. Incorporating diverse stakeholder perspectives can provide valuable insights and enhance the relevance of the research findings. Future research should strive to incorporate stakeholder engagement to ensure a more holistic and inclusive approach.

Moreover, the scenarios primarily focus on historical, economic, and ecological values, potentially neglecting other important values such as social, cultural, or aesthetic considerations. The limited consideration of these values may affect the comprehensiveness and balance of the proposed interventions. It is crucial to explore and weigh various values to ensure a more comprehensive and well-rounded approach to building rehabilitation.

In conclusion, while the research provides valuable scenarios and insights into the rehabilitation of the specific building under study, it is essential to recognize and address the limitations. Future research should aim to overcome these limitations by considering diverse contexts, engaging stakeholders, acknowledging subjectivity, capturing complexities, and broadening the range of values considered. By doing so, the research outcomes can be more applicable, inclusive, and relevant to various buildings and settings.

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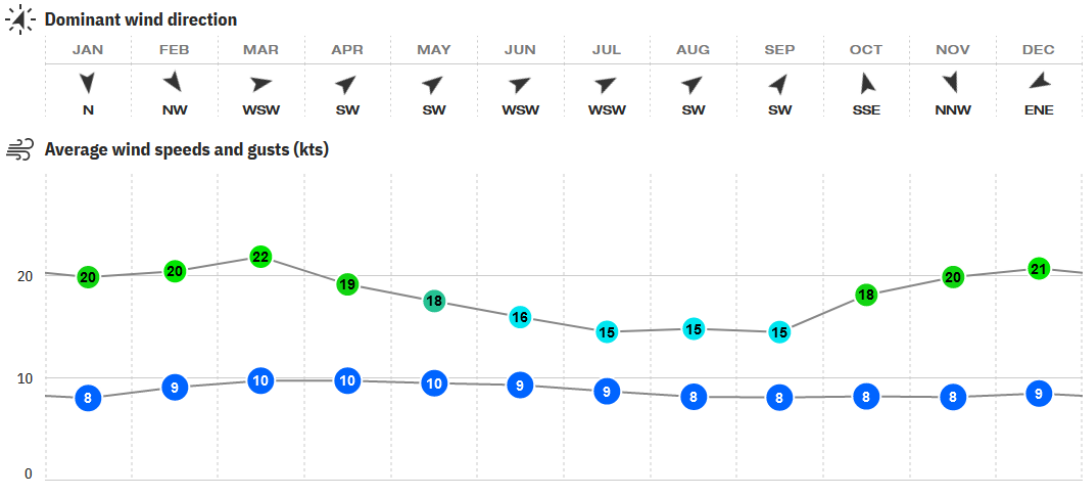
9. Appendix

9. Appendix

9.1 Wind direction for Faro Airport

Monthly wind speed statistics and directions for Faro Airport

Source: Windfinder.com. "Wind and Weather Statistic Faro Airport." Windfinder.com. Accessed February 28, 2023. https://www.windfinder.com/windstatistics/faro.

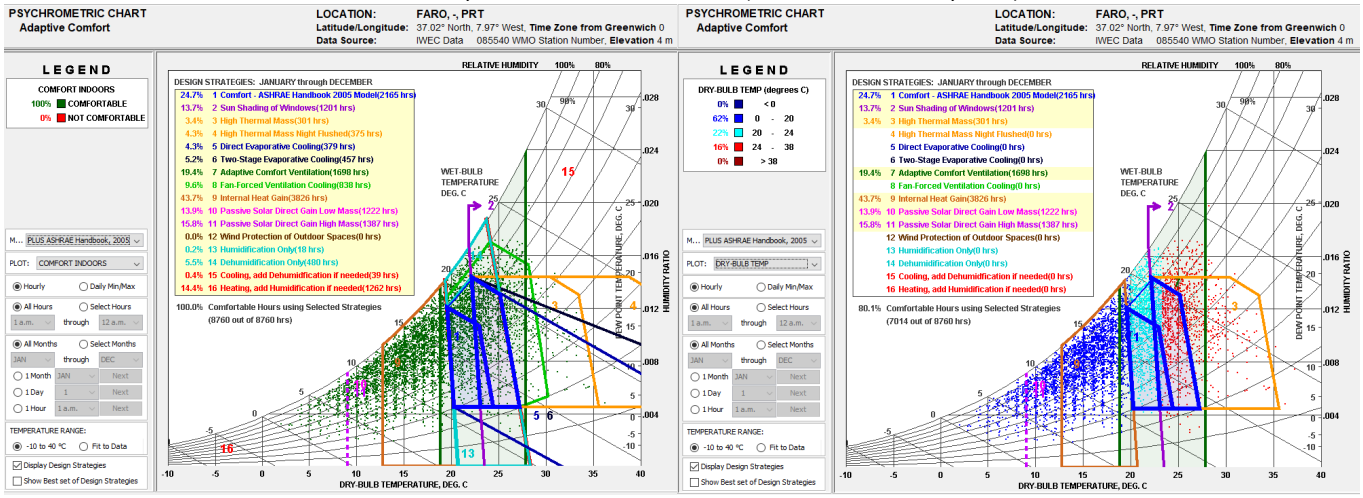


9.2 Climate Consultant Results

The Climate Consultant has the option to produce a psychrometric chart. The graph displays the dry bulb temperature on the horizontal axis and the moisture content of the air on the vertical axis [1]. The program assesses the effectiveness of various design strategies for indoor comfort, as depicted in The most effective measures include 7 - adaptive comfort ventilation (19.4%), internal heat gain (9) with 43.7%, passive solar direct gain on high (15.9%) and low (13.9%) mass (10,11), and 16 – heating (14.4%). There is a lot of overlap with the current situation, almost all the most effective design measures are already happening, namely: 2,3, 7, 9, 10, 11. Using these six measures the building reaches a comfort level of 71.3%. The following could be applied in the future: heating (16), night flushing (4), and fan-forced ventilation which could increase the comfort level to 98.6%.

Psychrometric chart in general for the climate in faro (left) and the current situation (right)

Source: Murray., "CLIMATE CONSULTANT 6.0."(Baruch Givoni & Murray, 2020)



[1] Agarez, R. (2016). *Algarve Building: Modernism, Regionalism and Architecture in the South of Portugal, 1925-1965*. Routledge. https://books.google.nl/books?id=l2JFrgEACAAJ P. 377

9.3 Climate Consultant Design Guidelines

The Design Guidelines Table presents that out of the twenty design guidelines recommended by the Climate Consultant, of which twelve are already integrated into the building. Of the remaining eight guidelines, three are deemed inapplicable. The guideline for a ventilated pitched roof (25) is inapplicable since the building has a flat roof, while guideline 27 regarding raising the building in moist soil is not relevant to the current context. Guideline 62 for lightweight construction is also not feasible, as the building is constructed using concrete and is a massive structure. Regarding guideline 42, which suggests the implementation of ceiling fans, it was not considered as it is deemed to consume electricity for minimal effect. shows which guidelines are applicable to the current situation and what guidelines could be improved (orange) and which could be added and implemented (green)

Night Flushing, identified as guideline 39, is currently not possible due to the closed-off floorplan. However, there are opportunities to open the floor plan up, as suggested by guideline 47, to enable night flushing throughout the building with openings on the two facades (guideline 36). Improvements could be made by incorporating guidelines 17, 53, and 62. Guideline 17 recommends planting more trees on the west side to provide shading. Guideline 53 suggests the addition of shaded outside buffer zones. Guideline 62 proposes the use of low-pitched roofs with wide overhangs and lightweight construction, which could be considered for implementation.

Design Guidelines

Source: Climate Consultant 6.0

Number	*Design Guideline*	*Present in current situation*	*Improvements possible?*
17	*Use plant materials (bushes, trees, ivy-covered walls) especially on the west to minimize heat gain (if summer rains support native plant growth)*	***Yes***	***Yes***
25	*In wet climates well ventilated attics with pitched roofs work well to shed rain and can be extended to protect entries, porches, verandas, outdoor work areas*	-	-
27	*If soil is moist, raise the building high above ground to minimize dampness and maximize natural ventilation underneath the building*	-	-
32	*Minimize or eliminate west facing glazing to reduce summer and fall afternoon heat gain*	***Yes***	-
33	*Long narrow building floorplan can help maximize cross ventilation in temperate and hot humid climates*	***Yes***	-
34	*To capture natural ventilation, wind direction can be changed up to 45 degrees toward the building by exterior wing walls and planting*	***Yes***	-
35	*Good natural ventilation can reduce or eliminate air conditioning in warm weather if windows are well-shaded and oriented to prevailing breezes*	***Yes***	-
36	*To facilitate cross ventilation, locate door and window openings on opposite sides of the building with larger openings facing up-wind if possible*	-	***Yes***
37	*Window overhangs (designed for this latitude) or operable sunshades (awnings that extend in summer) can reduce or eliminate air conditioning*	***Yes***	-
39	*A whole-house fan or natural ventilation can store night-time 'coolth' in high-mass interior surfaces (night flushing), to reduce or eliminate air conditioning*	-	***Yes***
42	*On hot days ceiling fans or indoor air motion can make it seem cooler by 5 degrees F (2.8C) or more, thus less air conditioning is needed*	-	-
47	*Use open plan interiors to promote natural cross ventilation, or use louvered doors, or instead use jump ducts if privacy is required*	-	***Yes***
49	*To produce stack ventilation, even when wind speeds are low, maximize vertical height between air inlet and outlet (open stairwells, two-story spaces, roof monitors)*	***yes***	-
53	*Shaded outdoor buffer zones (porch, patio, lanai) oriented to the prevailing breezes can extend living and working areas in warm or humid weather*	***Yes***	***Yes***
54	*Provide enough north glazing to balance daylighting and allow cross ventilation (about 5% of floor area)*	***yes***	***Yes***
55	*Low-pitched roofs with wide overhangs work well in temperate climates*	***Yes***	-
56	*Screened porches and patios can provide passive comfort cooling by ventilation in warm weather and can prevent insect problems*	-	-
58	*This is one of the more comfortable climates, so shade to prevent overheating, open to breezes in summer, and use passive solar gain in winter*	***Yes***	-
62	*Traditional passive homes in temperate climates used lightweight weight construction with slab-on grade and operable walls and shaded outdoor spaces*	-	***Yes***
65	*Traditional passive homes in warm humid climates used high ceilings and tall operable (French) windows protected by deep overhangs and verandas*	***Yes***	-