Permanence in Architecture:
Building Adaptive and Resilient structures

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Abstract

Since the mid-twentieth century, historic architecture has been increasingly affected by sea level rise and local storm on the island of Nantucket in Massachusetts. Since then, the community has adopted rigid architectural preservation guidelines. This thesis considers Nantucket’s changing environmental condition as the primary historical driver of architectural adaptation on the island, leading to a new understanding of enables permanence and drives change in architecture. The study considers theory and case-study analysis of resilient architecture to reconceptualize the island’s vernacular architecture and encourage the preservation of Nantucket’s history and ecology in the twenty-first century. Last, this research studies structural functionality, form, and materiality to reduce architecture’s deterioration and improve building’s performance with climate change. Through a theoretical design proposal to “Envision Resilience Nantucket Challenge” as part of the Spring 2021 D8 architecture studio at the University of Florida. The architectural intervention looks to establish architectural permanence through temporal occupation.
Introduction to Permanence

The typical intention of architecture is to endure over time and give a “sense of permanence;” which is a term that could be defined as absolute or relative, and it depends on the cultural and natural context where the building is located. Moreover, the term absolute permanence refers to the static condition of architecture through time; consistency is key to preserve the physical qualities of buildings. On the other hand, the concept of relative permanence is a dynamic process in which the physical qualities of buildings changes and produces different variations from the original design through time. The first-time permanence appeared as a formal term in architecture was in the “Ten Books on Architecture”, in which Vitruvius explains the term as an absolute concept that encourages buildings to resist deterioration over time. Architectural durability is here associated with materiality and the prominent spaces used for the construction of monuments. It suggests a historic pattern that is represented in monuments such as the Great Wall of China, the Pyramids of Giza, and the Pantheon in Rome. In addition, the concept of durability in Western architecture refers to the consistency of design components of representing the primary conceptual ideas and essence of the project. These ideas could be expressed with the use of architectural components such as, beams, columns, roof, stairs, ramps, external and internal walls. On the other hand, permanence in architecture has different performance in Eastern culture. In this cultural context, buildings are valued its structures serve its community and the practical aspect of structures are more relevant than the historic value of structures. A precise application of this cultural representation is in shrine Ise Jingu a ritual that has taken place over hundreds of years. The periodical

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reconstruction shrine Ise Jingu represents the redefinition of an architectural idea adapted to the communities’ needs according to the specific construction time. It demonstrates the reconstruction of the essence of a project with a determined intention through the process of elaboration. As it is shown, permanence in the history of architecture is a term that not only refers to the durability of physical qualities of a building but also refers to the conservation of initial architectural ideas repeated with cultural traditions.

In Contemporary architecture, *permanence* is defined as a relative concept which depends on the society’s perception of the architectural experience and the context influence the conception of functional structures. In numerous examples, architecture demonstrates ambiguity in terms of permanence and impermanence; leading to the inclusion of the term “temporal architecture” as an alternative design intention. Consequently, architectural permanence has been redefined beyond its physical intervention; to respond and adapt to climate and culture, as Long explains in “Architecture Impermanence.” The authors explain the influence of collective psychology on the physical design of architecture in a determined moment. Long also refers to the importance of change in culture to satisfy a certain area's social and natural needs. Long demonstrates the dynamic system of architecture as a subject of change and reflects the reality of the site. Moreover, the question of architecture is present in other literature. Rooda Ruurd says, “Buildings are single substantial structures that can be demolished by men or nature or both in time. In architecture, the gradual destruction of buildings by nature in time is weathering.” Change in architecture is the result of external forces which modify the structure from its original condition, demonstrated through time.

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In the twenty-first century, permanence in architecture is a relative concept that refers to the structure's ability to resist and adapt to external changes without losing its essence. For that reason, this study will focus on contemporary applications of tectonics and the concept of permanence in a site that has been modified by climate change. The site of study is the Island of Nantucket and this location has demonstrated historical preservation through architecture and construction traditions. This study will improve upon the idea of permanence on an island of constant change by creating a new prototype of Nantucket’s architecture a new vernacular that responds to sea-level rise (SLR) and seasonal storms.

Figure 1: Resnick, Noah. “Ephemeral Permanence.” University of Detroit Mercy. School of Architecture. This figure demonstrates applications of relative permanence in sites surrounded by nature.

**History of Nantucket: the island of constant change**

Since 1950, storms and sea-level rise (SLR) have caused increasingly severe damage to the existing properties, local communities, and ecosystem (coastal dunes and marshes) on the island of
Nantucket. Climate change has modified the risk to structures on the island by reducing the coastal marshes which used to serve as barriers to the North Atlantic Ocean. Consequently, flooding and erosion has increased due to the constant modification of the natural ecosystem.

Figure 2: Diagrams of factors of coastal change in the island of Nantucket. Project 2.1. Island Flora, Fauna, and Coastal Dune Ecosystem by Christian Rubio and Andreina Sojo.

On the island of Nantucket, urban development has been a slow process of layering cultural traditions; disrupted only when external forces (fire and flood) have destroyed what was initially built on the island. For that reason, the urban fabric looks to honor the local culture by repeating patterns and building architecture in the same site of the first forms of urban development. The island's economic activity also promoted the development of urban areas, and it attracted more visitors to the remote island 30 miles far out at sea. A study of the construction of vernacular architecture in Nantucket by Lang indicates that Nantucket's economic aspect influenced the continuity of building the “Nantucket’s traditional house.” By following these construction characteristics, it generated a relevant economic income to local business because tourists were attacked by the island's architectural aesthetics, and
Nantucket's historical and natural value. Unfortunately, the first forms of urban development from 1800s does not exist anymore due to sea level rise; the architectural footprint is underwater, and it demonstrates lines of occupation through generations, as well as the revaluation of properties through two hundred years (Miklos, 2020). As a result, the combination of landscapes and a strong cultural context has developed an architectural character that reflects the common identity and essence of Nantucket’s commercial and residential districts. Considering that, the last few generations of residents and visitors have tried to preserve and develop more prototypes of “Nantucket’s traditional house” knowing that precipitation, flooding and tides are affecting their physical condition.

Figure 3: “Nantucket’s traditional house.” Nantucket Preservation Trust. “Nuts and Bolts: The Typical Nantucket Home” June 16 and 20 Segment.

Occupants of historic architecture are exploring distinctive design strategies to continue the habitation of traditional residences and reduce its deterioration from water and wind. Some strategies to prevent the environmental damage include the creation of barriers, the elevation of infrastructure, relocation of urban development, dry proofing, and wet proofing structures. Some examples illustrate the elevation of residential architecture 6 feet above the ground plane. In addition, the use of concrete and brick piers as a base to elevate buildings above the ground, has begun to be considered to envision permanence in the land and adaptation to flooding caused by tidal inundation and heavy rains projected

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over the next century. Furthermore, based on the study three areas from “Envision Resilience: Nantucket Challenge,” Washington street, Brand Point, and Downtown area, it is estimated the least affected area on the island among the three study areas is going to be Washington street. In one hundred years, this site is estimated to have 10 feet of water above the actual ground level. On the island, Sea Level Rise is an external force that makes the community vulnerable to climate change, and it affects the continuation of the island’s architectural traditions. Flooding generates a progressive deterioration on the exterior of waterproof buildings caused by friction from hydrostatic pressure, which creates a porous surface. As FEMA (Federal Emergency Management Agency) indicates, “When enough water builds up outside of a building the force created can cave in walls, bring underground structures like septic tanks to the surface or in extreme cases lift the building out of the ground.” Moreover, the impact of flooding generates damage to the infrastructure and erodes the exteriors and could damage the interiors spaces with the infiltration of water through doors and windows. Therefore, the deterioration of flooding in architecture is dictated by few factors as rate of water rise, depth, velocity, and debris impact. In Consequence, climate change is a condition that generates concerns to the public about preserving the existing urban development and what could be future architectural interventions in Nantucket.

Figure 4: Sea Level Rise in Washington Street. Project 3.1: “Dynamic Systems” by Andrea Aristeguieta, Gizangely Marrero, Morgan Mulholland and Andreina Sojo

Permanence of Vernacular Architecture in the Island of Nantucket: Introducing ideas for “Envision Resilience, Nantucket Challenge.”

On the island of Nantucket, the character of traditional housing has a historic connection to the first forms of urban development from two hundred years ago. The continuation of the architectural style looks to celebrate and respect construction traditions by repeating the design patterns through the years. For example, Nantucket's traditional house looks to preserve nature by reducing the houses' footprint. The reason is that part of the culture looks to develop urban form that is not invasive to nature in order to keep the islands’ ecology balanced and encourage its occupants to connect with Nantucket's natural areas. In addition, local architectural development not only respects nature but also adapts to climate change with design strategies that responds to the natural changes. For example, one of the adaptation strategies applied to Nantucket’s houses is to raise the structure to reduce the risk of flooding and continue with the preservation of tectonics on the island. As demonstrated, Nantucket's traditional house looks to preserve aesthetic construction traditions from two hundred years ago and part of the coastal culture to encourage its users to enjoy open spaces with nature.

In Nantucket, the exterior of residential house is designed by following a pattern that helps to share the common heritage and reinforces the local cultural identity. As Lang explains with an excerpt from “Building with Nantucket in mind,”

“The overriding principle for building on Nantucket is that no new construction be considered as an isolated object, either in time or space. It must express the historical continuity to which it necessarily becomes a part and, similarly, its setting's pattern and position within the limited area of the island. A building carefully related to its site, its neighbors, and its heritage will have an aesthetic appeal and meaning larger than it could have alone.”

Part of Nantucket’s essence is the historical continuity through details, and it is evidence of continuing with culture through generations. Some repeated patterns are represented on the Nantucket’s
traditional housing façade, which is normally designed in a two-story building, and gray shingles and double-hung windows characterize it. Through time, it some variations of the aesthetic of the façade to make its characteristics more refined; consequently, it was an expression of contemporary styles and climate adaptation.

![Traditional Nantucket House](image)

Figure 5: Traditional Nantucket House by Carly’s Nantucket Travel Guide.

In Nantucket, the residential architecture looks to preserve the historic structures and improve the urban development. According to “Building with Nantucket in Mind,” an aspect of the construction in Nantucket specifies the importance of developing new architecture with the best qualities of materials and technologies to encourage durability of traditions in the site due to climate change. On the other hand, some techniques have been applied to preserve historic houses, such as shoring, recycling, raising, and moving buildings. In 1884, local structural mover started a new architectural tradition in the island. The first construction that was relocated is Dreamland Theater was moved to Brand Point and a second time to South Water Street. After one hundred and twenty-five years, the building was disassembled and rebuilt with original pieces of the historic building, now serving as a cultural center. 10

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In the last forty years, it has become common to move historic houses with different scales from its original site in order to reduce its risk of flooding and erosion. In 2012, Dao Engle’s 10,000-square-foot mansion was moved “80 feet to the North, then 60 feet to the East.”\(^\text{11}\) of its original location. The process consisted of excavating the site, exposing the house’s foundation, and setting the house on a set of steel beams to transport it to the new location in a period of a week. Other examples of buildings that have changed their original locating are the African Meeting house, Cottage Hospital, 14 Sachems Road, Tom Nevers House, and Sankaty Head Light Nantucket’s dynamics of refiguring and relocating the existing structures has preserved a tradition of hundred years of an enriched culture.

Permanence in Nantucket is represented through building innovations that encourage resilience to the coastal change and preservation of the history of an evolving community. Furthermore, Nantucket’s vernacular architecture reflects the memories of generations which has been eroding through time. For that reason, it is relevant to retake the essence of its architecture and protect historic structures with the proposal for “Envision Resilience: Nantucket Challenge” around Washington street, Brand Point, and the Downtown Area. Finally, considering the importance of conserving building traditions on the island of Nantucket, the design studio proposal integrates techniques to preserve and innovate the residential prototype to illustrate permanence in the island of Nantucket.

Architectural Design Studio VIII Project: Preserving Nantucket’s Culture and creating a new prototype of vernacular architecture.

Knowing the impact of the constant coastal change on the residential architecture, septic systems wells, and roads in those areas in Nantucket's cultural and historic areas; some organization has implemented programs to conserve the cultural heritage and improve the quality of life for its residents. One of the initiatives that look to preserve Nantucket's culture and reimagine the future of the island is “The Envision Resilience: Nantucket Challenge,” The organization integrates interdisciplinary teams of graduate and undergraduate students from five different universities, including the University of Florida, to reimagine the future of the coastal community of Nantucket. 12 The design intervention looks to elaborate a new proposal of adaptive architecture on the island for the next hundred years. The challenge focuses on three different analysis areas, such as Washington Street, Brand Point, and Downtown. The UF architecture studio was divided into four groups to study one of the three areas. The area selected by the group was Washington street, and the tectonic process emerges the agreements between the four members for common spaces in the site. Then, the project is further developed with an individual intervention that looks to transform over time and serve the local community in three different generations.

The elaboration of the proposal for “Envision Resilience: Nantucket Challenge” started with a process of illustrating tectonics that responds to change in the island of Nantucket. the group’s proposal is “Dynamic Systems” consisted of a collective design intervention that explains unique site condition between Union Street and Washington Street. After three weeks working on illustrating the future condition of the land, the collective architectural intervention merges the concepts of the constructed systems from the west side of the road (which includes residential and commercial areas) with the natural marine systems on the East side of the project’s site. The application of the concept of permanence in the

site is represented through the elaboration of a residential prototype that responds and adapts to environmental change. The architectural intervention looks to preserve the site's ecological diversity by proposing a construction at a human scale which respect natural systems, create a space for habitat, and promote remarkable architectural experiences with nature. Furthermore, the design proposal creates a space of transition between the artificial fabric, referring to the urban form, to the coastal marsh and dune formation. The construction of the residential design looks to preserve the site’s diversity by developing a landmark that merges historical, ecological, architectural aspects of the island of Nantucket.

Figure 7: Drawing temporal systems and reflecting transition between Union and Washington Street. Project 3.1: “Dynamic Systems” by Andrea Aristeguieta, Gizangely Marrero, Morgan Mulholland and Andreina Sojo.

In this case, the elaboration of the collective and individual architectural design becomes the method to demonstrate permanence on the island of Nantucket. The design process incorporates traditional design ideas and strategies to adapt to climate change for future generations of occupation. The residential proposal looks to produce tectonics that adapts to sea-level rise and at the same time retakes design concepts observed from the “traditional Nantucket housing, such as the distance between the units to create an intervention that is minimally visually invasive. The intention of the design
is to also preserve the natural systems and respect their presence on the site by elevating the structure from the ground. The strategy to elevate the individual intervention was with a vertical structural support to create an open ground for the public, and later, to adapt to flooding without affecting the residential units. The idea of permanence between Union Street and Washington Street consists of continuing the diversity and integrity that the site already offers and demonstrate the continuation of natural and artificial systems in the next three generations, even though Sea Level Rise is going to modify the site.

Figure 8: Creating permanence through social and ecological adaptation. Proposal a temporal concept which merges dynamic systems. Project 3.1: “Dynamic Systems” by Andrea Aristeguieta, Gizangely Marrero, Morgan Mulholand and Andreina Sojo.

The individual work, which refers to residential design called “The 360 House”, defines a new type of occupation that responds to sea level rise and tides. The ground level is dedicated to the public; it is open and integrated into the light elevated platform’s structure. For the first twenty years, the ground level will be occupied by locals and residents. In another twenty years, flooding is expected to come from the South-West area, and the ground’s design is prepared to receive the water on site. The prediction for 2060 is the redefinition of the site with water by creating a new habitat for coastal fauna and flora while residents and occupants have recreational activities. For example, part of the program will be kayaking, an open-air activity that will continue with the tradition of the recreational activity performed on the east side of Washington Street. Furthermore, the project's first level continues the line of urban development, which is elevated 12ft above the ground. Consequently, the residential units are on the same first level, and they are elevated to reduce the flooding and erosion’s effects in the construct. The individual housing intervention “The 360 Housing” also looks to maintain the format of two-story houses of “Nantucket’s traditional housing,” and it is selective in placing windows around the construction. Part of the
architectural experience is to display natural views of marshes, change of the vegetation caused by the seasons and future body of water on the site. In addition, the materiality used in the individual dwelling looks to follow the color palette from “Nantucket’s Traditional Housing” and word panels referring to the dimensions of the exterior facades of residential housing. In terms of the language used for the architecture, the structure looks be temporal, refined, and elegant to blend with the site’s natural views and reveal the qualities of the landscape through porous surfaces. At the same time, it looks to create a contrast between the orthogonal design of the artificial system and the organic shapes from the natural system- referring to salt marshes, topographic variations and water coming from the coast. As a result, this dialogue between natural and artificial systems will help accentuate the importance of marshes and dunes in the site and how architecture could measure change.

Figure 9: The redefinition of architectural occupation and projection of environmental conditions. Proposal of a new prototype of residential architecture which preserves Nantucket’s culture. Project 3.1: “Dynamic Systems” by Andrea Aristeguieta, Gizangely Marrero, Morgan Mulholland and Andreina Sojo.

Figure 10: The project interaction with interior spaces. Illustrating the occupant’s connection with Nantucket’s fauna and flora. Project 3.2: “Dynamic Systems” specifying the individual intervention by Andreina Sojo.
Figure 11: Seasonal adaptation in the first generation represented through plans. A. Ground level open to the public.

B. Commercial level with semiprivate spaces. C. and D. Housing with private spaces Project 3.3 “The 360 House”

by Andreina Sojo.
In the end, the new prototype of occupation looks to merge the diverse cultural and ecological aspects between Union Street and the historically relevant Washington Street- which in the past was the city’s train route. The design extends cultural patterns from the West side of Union Street and juxtaposes them with the East coast’s natural habitats. Furthermore, the architectural collective and individual design studies ecological and cultural changes in three generations and it also analyses its impact on a human scale while conserves cultural values. As a result, the project “Dynamic Systems” proposes a design that encourages human engagement, the continuation of Nantucket’s traditions, and ecological response to climate change throughout in a lapse of three-generation which has twenty-five years of difference between them.

Figure 12: Illustrating architectural moments. Individual dwelling Project 3.2 by Andreina Sojo.
Figure 13: Demonstrating adaptation to climate change and human occupation in Nantucket. Individual dwelling Project 3.3: “The 360 Housing” by Andreina Sojo.
Conclusion

The relevance of lasting in an island of constant change is the continuation of a dynamics artificial and natural systems on the island of Nantucket. The remote island is characterized for demonstrating the community’s evolution through history and rapid urban development that adapts to the new natural condition - Sea level rise, seasonal storms, and erosion. Therefore, the importance of encouraging the continuation of Nantucket’s heritage is to preserve the essence of the Vernacular Architecture known as the “Nantucket’s Traditional House” and demonstrate adaptation to climate change by shorting, recycling, raising, and moving buildings as demonstrated through projects in the Washington street, Brand Point, and the Downtown areas.

Figure 14: Layering Natucket’s natural and artificial conditions. Project 3.1: “Dynamic Systems” by Andrea Aristeguieta, Gizangely Marrero, Morgan Mulholland and Andreina Sojo.

The study of permanence on the island of Nantucket is a relative and absolute concept at the same time. This aspect is illustrated with the precedent of the Dreamland Theater which demonstrates the potential of transition between locations and the reconstitution of buildings by recycling original building materials. Moreover, this precedent of preserving historic buildings on the island and designing for future generations is not new to Nantucket but should inform the practice of architecture. Simultaneously, permanence in Nantucket is a relative concept when it is about reconceptualizing the essence of Nantucket’s vernacular architecture and the creation of resilient architecture envisioning its temporal
occupation through three generations. This study defined that *Permanence* in Nantucket is the ability to understand the coastal change condition and respond by adapting occupation at different scales in the island.

Finally, the design of the project, “Dynamic Systems,” defines a new prototype of occupation by demonstrating the application of distinctive design strategies to resist the forces of nature, such as elevating, replacing, and rotating architectural elements from the interior and exteriors of the dwelling. As a result, the elaboration of the design is a contemporary application of Nantucket’s vernacular architecture, which retakes the importance of the presence of nature and cultural values in public and private areas of the project 3.3: “Dynamic Systems” and project 3.2 “The 360 House”. Moreover, “Dynamic systems” articulates space to generate a habitat for the local ecosystems and innovate the experience with nature in the site between Union Street and Washington Street. On the other hand, “The 360 House” creates a private space that engages each generation with the natural surroundings and Nantucket’s seasonal change. In conclusion, the concept of *Permanence* in the island of Nantucket is the architectural capacity to engage human temporal occupation by continuing the island’s natural beauty and two centuries of an enriched culture reflected in the urban development.

![Image](image_url)

Figure 5: Approach to the individual architectural intervention. Proposal of a new prototype of residential architecture. Project 3.3: “The 360 House” by Andreina Sojo
Bibliography


