Revalued Shelter
Botanic Archive
and Research Centre

Heritage Intervention of Soesterberg Airbase

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AR4AH120
Adaptive Reuse of
Heritage Graduation Studio

Abstract

This project explores the reuse of the Cold War aircraft shelters at Soesterberg Airbase by transforming them into a Botanic Archive and Research Centre. At first, these shelters were constructed for defense purposes due to the likelihood of wars. They have strong concrete walls, a sealed system and strict entry regulations indicating a sense of protection and endurance. Although their military functions are no longer necessary, the architectural features still exist and are considered as valuable heritage.

Instead of establishing a new use without thinking, the project interprets them by reconsidering them. Thus, it takes the heritage as an important basis for making design decisions. By changing the previous concept of military anxiety to that of ecological worries, the project alters the conception of defense to suggest continuity, preservation and dedication. Using a design approach based on research and referring to the current seed archives, the project examines how the spatial layout, environmental control and limits can benefit the plant maintenance while keeping the original structures of the shelters.

PART 1

1.1 Motivation

The Cold War did not form part of China's everyday spatial memory in the same way it did in Europe, which makes this studio a critical entry point for a Chinese student to understand how political tension, fear, and anticipation were materialized through architecture. Military structures such as aircraft shelters offer a direct spatial reading of this period, beyond historical narrative. At the same time, their highly specialized, defensive, and inflexible nature makes them an extreme case for adaptive reuse. Precisely because these buildings resist transformation, they provide a unique framework to question how architectural value can be interpreted differently, rather than simply preserved or optimized.

1.2 Problem Statement

Vliegbasis Soesterberg is located on the Utrechtse Heuvelrug in the Netherlands and forms part of a former Cold War military airbase that has been preserved as a cultural and historical landscape (Het Utrechts Landschap, 2011).

During the Cold War, the site was functioned as a NATO airbase, where aircraft shelters were constructed as defensive infrastructure designed to protect aircraft against potential attack. Today, the former airbase has been transformed into Park Vliegbasis Soesterberg (Fig 1.2), a managed landscape in which ecological protection, heritage conservation, and limited public use are prioritised (Het Utrechts Landschap, 2011).

The aircraft shelters are preserved as cultural-historical objects. Their material solidity and defensive spatial configuration are recognised as heritage values, while their original military function has become obsolete. As a result, the shelters remain physically intact but only selectively and temporarily used.

At the same time, ecological regulations and management frameworks impose strict limitations on access, disturbance, and spatial intervention. Expansion, intensification of use, and substantial physical alteration are highly restricted (Reglementen Park Vliegbasis Soesterberg; Sovon & Van den Bijtel, 2019).

This results in an architectural problem: a highly enclosed and rigid spatial typology is preserved within a contemporary landscape that demands adaptability and long-term use, while the conditions that define its heritage status simultaneously constrain architectural transformation.

1.3 Relevance

Cold War military architecture, especially Soesterberg Aircraft shelter, can be understood as anticipatory construction. Buildings such as aircraft shelters were not designed in response to an existing attack, but to the expectation that an attack was highly possible to occur. Thick concrete walls, blast-resistant structures, and defensive envelopes (Fig 1.3) were material expressions of this expectation. In this sense, Cold War defensive architecture reveals similar logic to financial bubble, which the continuous preparation for conflict reinforced the belief that war was inevitable. Defensive buildings did not simply protect against violence; they actively actively took part in sustaining a social state in which the probability of being attacked was assumed and amplified. Architecture, therefore became part of a self-reinforcing system of fear.

While this anticipatory logic was historically tied to military conflict and deterrence, anticipation continues to shape contemporary society in different ways. Climate change, ecological degradation, and the loss of biodiversity were not uncertain risks that could be avoided by defence but were ongoing conditions necessary for long term care, continuity, and responsibility. This difference challenges architectural models that are based on isolation, protection, and

Fig 1.2 Park Vliegbasis Soesterberg

Fig 1.3 Blast -resistent Slide Door

exclusion.

Therefore, within current architectural field, the reuse of military heritage is often approached through strategies that prioritise the insertion of new programmes into existing structures. Although it protects against abandonment, it still treats architecture as a neutral container and ignores their underlying spatial logic. In highly specific and durable constructions such as aircraft shelters, this risks overlooking the architectural values embedded in enclosure, structure, materiality, and environmental control (Pronkhorst, 2024).

This project positions architectural intervention as a process of reinterpretation rather than replacement. Through the examination of how the spatial and structural characteristics of defensive architecture can be revalued under contemporary ecological and societal conditions, the project contributes to ongoing discussions on heritage transformation, adaptive reuse, and the role of architecture in responding to long term environmental challenges.

1.4 Scope

1.4.1 Program Choice - Botanic Archive and Research Center

The choice of a botanic archive and research center as the program of this project directly originates from the transition in anticipatory logic specified in earlier sections. While Cold War aircraft shelters were designed to protect military assets from sudden destruction, contemporary forms of anticipation increasingly focus on the preservation of life under prolonged and unstable conditions.

A botanic archive is a program of defense without dependence on deterrence or counterattack, but on continuity and care. It is designed to safeguard biological resources against long term climate change, ecological degradation, and recurring biological risks. Unlike conventional cultural or commercial reuse programs, the botanic archive maintains a strong defensive character, making it conceptually compatible with the inherited identity of the aircraft shelter.

By introducing this programme, the project does not replace the shelter's original logic, but reinterprets it. The aircraft shelter's capacity for enclosure, control, and environmental buffering is redirected toward the protection of botanical life, allowing the site's defensive identity strengthened rather than neutralised.

1.4.2 Program Zoning Analysis *(Fig 1.4.2)*

1.4.2.1 Archive (Preservation)

The archive zone is the most protected and controlled part of the project. It is meant to hold the seeds and botanical specimens under stable environmental conditions for long term preservation. This zone prioritises **thermal stability, controlled humidity, limited access, and minimal disturbance**. Daylight should be completely eliminated, and circulation is strictlytly controlled to minimize risk. Spatially, the archive core is positioned deep within the aircraft shelter system, taking advantage of the existing concrete mass and enclosure.

1.4.2.2 Processing and Research (Testing and Adaptation)

Processing and research spaces support the handling, examination, and testing of botanical material before and after storage. This part includes intake, quarantine, preparation areas, laboratories, and experimental environments such as research greenhouses. Environmental conditions here are more varied than in the archive, allowing **controlled exposure to light, air, and changing climatic conditions**. Circulation follows a linear and filtered sequence, ensuring that materials move without cross-contamination. Architecturally, this part shifts the shelter from a static container to an active testing ground, where plant resilience under extreme but realistic conditions can be observed.

1.4.2.3 Workspaces (Documentation and Production)

Zone	Quantity	Area (sqm)	Condition
Archive			Low Temperature (<-16℃)
			No daylight
Seed vault	1	900	Thermal stability
Cold storage	1	250	Low humidity
Buffer storage	1	150	Minimal access
Packaging room	1	50	Backup power
Control Room	1	20	Fire protection without water
Research			
			Separated airflow
Intake room	1	50	Cleanable surfaces
Quarantine room	1	50	Controlled circulation
Drying room	1	100	Variable light and climate
Dry lab	1	120	Daylight and ventilation
Wet lab	1	120	Linear material flow
Experimental greenhouse	1	300	Biosecurity control
Workspace			
Herbarium	1	300	Stable temperature (16- 20℃)
Digitisation studio	1	100	Low UV
Research office	30	300	Daylight
Meeting rooms	2	50	Acoustic comfort
Seminar / workshop room	1	200	Control of dust and pests
Public Display			
Exhibition space	1	400	Stable temperature (16- 20℃)
Learning area	1	150	Controlled daylight
Reception and lobby	1	150	Thermal comfort
Total Area			**3760 sqm**

Fig 1.4.2 Programme Zone Table

This part hosts the spaces the documentation, analysis, and production of botanical knowledge. Thus, it contains herbaria, digitisation areas, offices, meeting rooms, and seminar spaces. These spaces allow **greater flexibility and benefit from daylight and visual connection**. Environmental, spatial, and structural control is still a quality in care, but it is less dominant in this part of the project. Utility, interaction, and long-term working conditions are now the primary concern. Positioned between protected zones and more accessible areas, this part acts as an interface between preservation and interpretation, supporting the translation of stored biological material into research outputs and shared knowledge.

1.4.2.4 Public Display (Interpretation and Access)

The public interface is open and accessible to visitors, students, and non-specialist users. It includes exhibition spaces, learning areas, and entry zones help to tell visitors why the archive exists, whilst maintaining this area's security. Public circulation is clearly separated from staff and material routes, and environmental conditions are designed **for comfort rather than strict control**. This part makes the anticipatory nature of the project legible, allowing the former military shelter to be experienced as a space of care, education, and ecological responsibility.

1.5 Objective

This project positions architectural intervention as a process of reinterpretation rather than replacement. By examining how the spatial and structural characteristics of defensive architecture can be revalued under contemporary ecological and societal conditions, the project will contribute to ongoing discussions on heritage transformation, adaptive reuse, and the role of architecture in responding to long-term environmental challenges.

Thus, the objective of this project is to explore how a Cold War aircraft shelter can undergo an architectural reinterpretation by shifting its anticipatory logic. Rather than neutralizing or erasing its defensive identity, the project seeks to understand how this identity can be redirected toward contemporary forms of protection. The aircraft shelter is characterized by heavy concrete mass, limited openings, controlled access, and a clear separation from its surroundings. The project asks how these same characteristics might be transformed to support an architecture concerned with survival, continuity, and ecological preservation.

Instead of treating technical adaptation as the primary goal, the project focuses on how spatial organization, thresholds, and architectural form can express a new understanding of defense. The aim is to investigate how architecture can move from anticipating war to anticipating extreme environmental and biological conditions.

1.6 Research / Design Question

1.6.1 Main Research Question:

How can a heritage intervention reinterpret the Cold War aircraft shelter by shifting its anticipatory logic from militarised fear toward ecological preservation, through the spatial and typological transformation required by a botanic archive and research centre?

1.6.2 Sub Questions

1.6.2.1 Spatial Condition

How can a highly enclosed aircraft shelter be spatially reconfigured to meet the permeability and environmental requirements of a contemporary botanic research centre?

1.6.2.2 - Typology

How can the shelter's singular, semi-cylindrical typology be adapted to accommodate the multiple spatial and functional requirements of a botanic archive?

1.6.2.3 - Heritage Intervention

How can architectural transformation negotiate between programme demands and shelter's designation as a highly protected heritage structure within value-assessment framework?

PART 2

2.1 Theoretical Framework

Architectural debates use terms like **anticipation** and **expectation** to convey seemingly interchangeable meanings. However, the logical structure of these terms is different. Anticipation is broadly defined as an architectural condition in which the present is organised in accordance with an uncertain future, through choices of enclose, material, resources, and thresholds. Expectation follows a narrower mode within this broader condition, because it corresponds to an plausibly imagined outcome arising from the existing speculation of patterns. Nute defines an architecture of expectation as one that generates anticipation by means of visible resources, signs of readiness, and spatial possibilities, which support near future projection, which makes expectation closely tied to perception, experience, and use. (Nute, 2023) The distinction holds significance for the Soesterberg aircraft shelters, since it operates less through envisioned future use or experiential projection of such, but through long term stability in conditions that are hard to offer clear description in advance.

This difference is materialised in architectural features including thick concrete shells, structural redundancy, limited openings, and etc. Such qualities were not symbolic expressions of fear, but practical reactions to vulnerability, shock, and environmental threat. While the geopolitical context that produced the shelters no longer exists, the architectural capabilities produced by this rationale continue to function. The shelters continues to provide enclosure, thermal capacity, environmental inertia, and spatial depth, which constitute long term stability as much as short term usage. In this regard, the shelters are not obsolete architectures, but structures whose relation to the future has lost its original object while remaining its underlying logic.

When this condition is investigated from the perspectives of heritage, the shift in the question of transformation moves from future to value. The evaluation of values conducted for the Soesterberg Airbase reflects high importance in terms of historical, architectural, spatial, experiential and landscape dimensions. These values are strongly embedded in the Cold War context in which the shelters were produced, and while they remain present, they do not automatically translate into meaningful drivers for contemporary use. As a result, the **repurposing strategies** that depend on emphasising the original identity and catalogue of the building is far from enough, especially when that identity is both highly singular and tightly bound to a specific historical narrative. In such a situation, introducing a new function also risks turning the building into a neutral container, thereby weakening the qualities that help justify its preservation.

This limitation points out the need for a different relationship between design and heritage. In *Architecture Repurposed*, reuse is described asa layered and interpretive practice in which interventions become part of a building’s ongoing history rather than external additions (Plevoets and Van Cleempoel, 2019). This approach challenges purely functional notions of reuse and emphasises the importance of deriving design solutions from the building’s internal logic. However, in cases where heritage value and identity is strongly tied to a single historical condition, repurposing alone proves insufficient. The concept of **revaluation**, as developed by Cools, strengthens the framework for such conditions. Revalue positions architectural heritage preservation as a situated design praxis that starts from a "tabula plena", acknowledging the already built world as the given condition and treating care and repair as active components of design rather than as secondary concerns (Cools, 2023). Within this perspective, heritage is not a fixed object that precedes design, but a value structure that is reactivated and continued through design decisions.

Applied to the Soesterberg shelters, revaluation does not imply rejecting their defensive logic, but translating it. Architectural qualities originally developed for military protection can be reinterpreted as assets for long term environmental stability. High thermal mass reduces temperature fluctuation, enclosure supports controlled humidity and microclimates, and structural inertia enables long duration storage with minimal intervention. These translated capacities correspond closely to the requirements of seed and botanic archives. By placing the shelter in comparison with existing seed archives, the project reframes defence as care and endurance as stewardship. In this framework, heritage actively shapes design decisions. Elements such as the primary structure, enclosure, spatial depth, and introverted composition emerge as components that should be preserved because they continue to perform under new conditions, while interventions will focus more on recalibrating access, thresholds, climate control, and circulation. Design is therefore not positioned as an action that happens despite heritage, but as a process through which heritage value is extended into the future. Revaluation becomes both a theoretical stance and a practical method, allowing the shelter to remain legible as Cold War architecture while supporting new forms of ecological care, research, and long term preservation.

2.2 Methods

This project follows a research-by-design approach in which architectural design is used as both an investigative and a projective method. Rather than treating theory as a background reference, selected theoretical concepts actively inform the design process and are tested through iterative spatial exploration. The main design strategy is structured around the concept of "**Revalue"**, which is applied not as a final judgement, but as an ongoing method throughout different stages of the project.

As a starting point, the concept of revalue is employed to position a relevant relationship between the aircraft shelter and a potential new programme. By reassessing the shelter's existing architectural capacities, such as mass, stability, and etc., the project identifies long-term ecological preservation as a programme that aligns with these value-related characteristics. This forms the basis for the decision to transform the shelter into a botanic archive and research facility. Programme selection thereby cannot be viewed as an initial position, rather as an outcome of a value-oriented evaluation.

This positioning is taken as a starting point of the **revalue** as design tool. At each moment in the course of the design process, the shelter is repositioned in order to assess what architectural value has already been properly activated and which attributes are still insufficiently addressed. These feedbacks serve to inform future design choices. Instead of pursuing a comprehensive transformation in one step, the project gives space for design interventions to be modified according to the emerging gaps between the programme intended value performance and spatial and environmental outcomes. By doing so, revalue assists a calibration process in place of a linear problem-solving approach.

To support this process, the case study of **Svalbard Global Seed Vault** (Fig 2.2.1) and **Millennium Seed Bank** (Fig 2.2.2) will be used as comparative research tools. Both examples will be consulted in order to explain their defensive and anticipatory character, as well as to clarify some spatial, environmental, and technical requirements of long term preservation. Other parameters, like environmental stability, light control, access, and maintenance will also be taken from the examples and confronted with the shelter's existing structure.

The expected outputs of this method include analytical drawings, spatial translations, and phased design proposals. These outputs document both design decisions and moments of revaluation, making the relationship between heritage values, programme requirements, and architectural intervention explicit. In this approach, theory reflectivity, case study analysis, and design development is used to bring these together in an iterative but coherent research process.

Fig 2.2.1 Svalbard Global Seed Vault, Norway

Fig 2.2.2 Millennium Seed Bank, the UK

PART 3

3.1 From Research to Design

According to the previous study, this project starts with no definite plan. It mainly considers the advantages that the aircraft shelter can still provide. Instead of considering the structure only as a historic object or an empty space, the design makes use of its physical characteritics such as the strong enclosure, heavy concrete walls, restricted access and large interior space. Although these features were originated from the former military use, they are beneficial for the new purpose. The design reuses them to carry out the local plant preservation and adaptability research, integrating the seed banking, climatic examination, public exhibition and education in one building.

Particularly, the cold vault maintains the original aim of protection by employing darkness, thick walls and constant temperature to keep the plant seeds. On the other hand, the greenhouse exposes the local species to light, air and different weather conditions, so that they can be examined under severe circumstances such as high temperature and fluctuating humidity.

3.2 Revalue Matrix as Design Tool [1]

In this project, 'Revalue' is a useful design tool instead of only a theory, which helps in making decisions about the modification of the shelter. It applies a matrix to evaluate the historical value, program requirements, intervention degrees and structural influences. This evaluation helps to decide which part of the original structure should be retained, which can be removed and which new areas should be established.

The cold storeroom and seed bank are closely related to the original shelter as they need dark conditions, constant low temperature, restricted accessibility and good enclosure. Due to the similarity between their demands and the characteristics of the present building, the new functions can be implemented with little change. Here, the high historical value is compatible with the new program and even strengthens it.

On the contrary, other areas need more modifications. For example, laboratories, exhibition halls, lecture halls, offices and green houses require more light, convenience and flexibility. As these places cannot be placed in the old shelter without substantial renovations, some are incorporated into the building while others are built outside.

Finally, the matrix does not independently generate the design but clarifies the design logic, indicating precisely why some parts are preserved, changed or enlarged.

3.3 Architectural Generation Process

Starting from a variable architectural form, the project proceeds through six major stages according to the previous investigation. These procedures record our process from heritage examination to the final design. They are not only formal design processes, but also actual spatial reactions to the relationships among the shelter, the ground, the purposes and the site.

3.3.1 Relocation (Fig 3.3.1)

First, two aircraft shelters are moved to connect them with the commander's bunker and the other shelter. They were previously separated in the former airbase. Bringing them closer together can combine some facilities like the archive, laboratory, greenhouse, exhibition area and educational places into one whole. This arrangement can also determine the central position within the site.

3.3.2 Enviornmental Differentiation (Fig 3.3.2)

Moreover, doing earthwork changes the surroundings by partly burying one shelter in the ground and spreading the soil on another. As a result, two separate low-temperature zones are formed. The dug shelter is suitable for the 2°C seed storage. Here, the normal underground temperature and the thick concrete can reduce the need for artificial

1. See Appendix A.7 for more information cooling. Conversely, the shelter which is covered with soil is used as the -16°C deep cold storage, where the soil layer acts as an insulation against external heat. Hence, during this procedure, the shelters are arranged in different locations depending on their temperature needs

3.3.3 Insertion (Fig 3.3.3)

Furthermore, rectangular massings are put in the curved shelters which change the inner composition of the shelter and produce different spatial arrangements. Before, the shelters were completely enclosed for safety purposes, but now they allow natural light, extra entrances and corridors. By doing this, the structure can perform various tasks meeting the needs of private archive areas, open research and public sections.

3.3.4 Transformation (Fig 3.3.4)

The fourth step converts the inserted volumes into architectural components. These new constructions serve as walls, windows and pathways. Since most windows are directed towards the north and south, they receive natural light and guide the people inside the building. Light now plays an important role in the arrangement rather than only being a necessary condition, thus modifying the use of the former shelters.

3.3.5 New Programme Volumes (Fig 3.3.5)

The fifth step is to construct new masses for those functions which can not be placed in the old shelters, such as the greenhouse and offices. As the greenhouse requires space, light and fresh air, it is built as a new light structure rather than being situated inside the solid concrete building. The offices also need sunlight and adjustable working places. In this project, the old shelters are used when necessary and new structures are built when the old ones are insufficient.

3.3.6 Reuse of Cut Fragments (Fig 3.3.6)

At last, the concrete pieces which are cut from the shelters are not wasted. They are used to construct new walls and outdoor areas. This combines the process of cutting and reusing. By placing these pieces in different positions, the original shape of the shelters can be seen and the old and new parts are connected.

3.4 Final Design

The final design serves as a local botanical archive and research center. It consists of three major sections: conservation, research and public instruction. According to the various needs for entry, temperature and light, these sections are associated but maintain their individual features.

On the ground floor (Fig 3.4.1), both the public facilities and some important research locations are linked together. The public area includes the main hall, reception, exhibition hall, lecture room, canteen, shop and toilet. This arrangement allows the visitors to enter the old military building and see its new ecological uses. Nearby, there is a research area which contains dry and wet laboratories, observation rooms, storerooms, greenhouses and a central control room. These places provide ideal conditions for scientific work and connect the seed bank with the experimental fields.

In the basement (Fig 3.4.2), the safe and secure zones are arranged systematically, secondary reception, decontamination room and secondary seed bank. The 2°C seed bank stored in the excavated shelter benefits from the stable underground temperature which prevents the need for cooling.

The architectural sections (Fig 3.4.3 and Fig 3.4.4) illustrates the main distinctions in the design. The cold archive relies on the heavy concrete structure, lack of light and restricted access whereas the greenhouse is exposed to light and air for plant cultivation and environmental examination.

3.5 Design Outcome

This project indicates that the aircraft shelter can be reused without altering its original properties. We do not eliminate its defensive logic, but alter it for another use. The enclosure of the shelter is for protecting, the separation

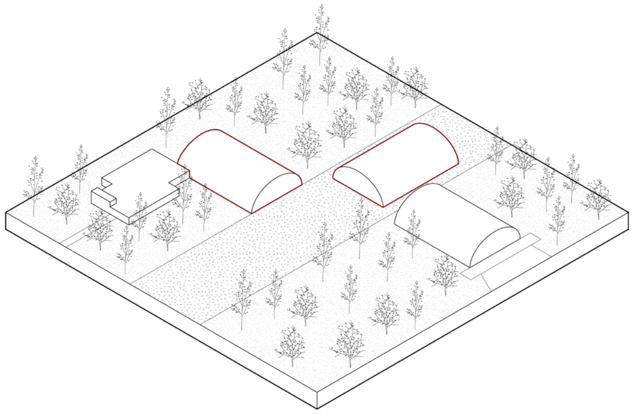


Fig 3.3.1

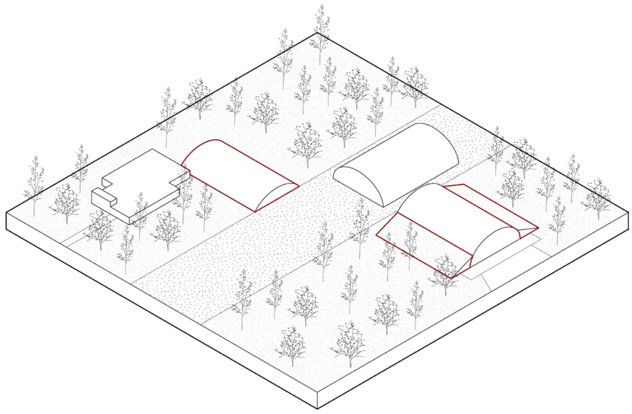
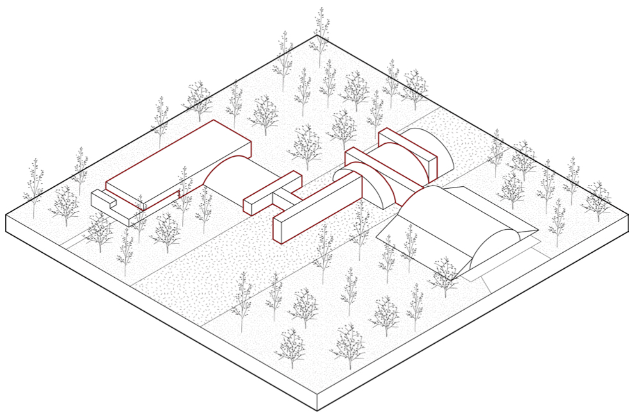


Fig 3.3.2



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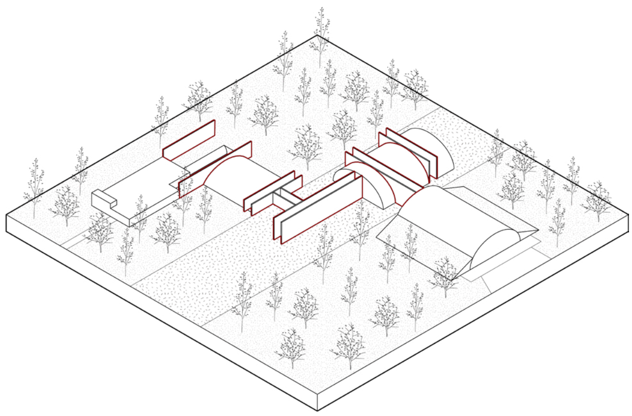


Fig 3.3.4

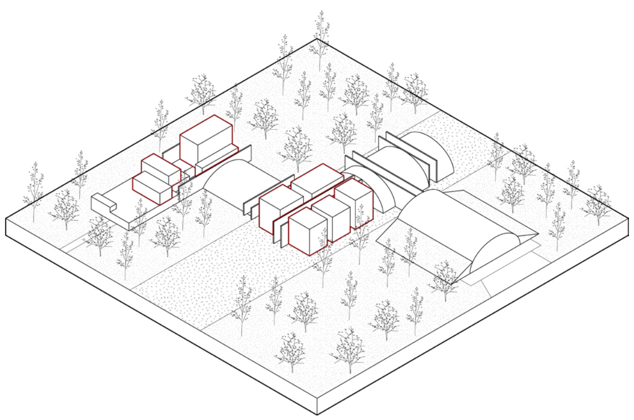


Fig 3.3.5

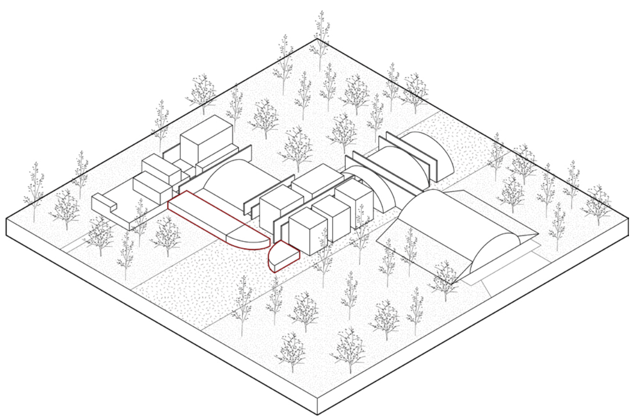


Fig 3.3.6

provides control, and the heavy concrete structure maintains the environmental stability. These physical attributes are not discarded, but applied to a new purpose. The relation between the cold storage and the greenhouse influences the overall project design. The cold storage still keeps the original idea of protection and control, while the greenhouse introduces a new concept of light, growth and flexibility. Therefore, these two parts successfully transform the former military building into an area for local seed preservation and research.

Fig 3.4.5 Axonomatrix Rendering

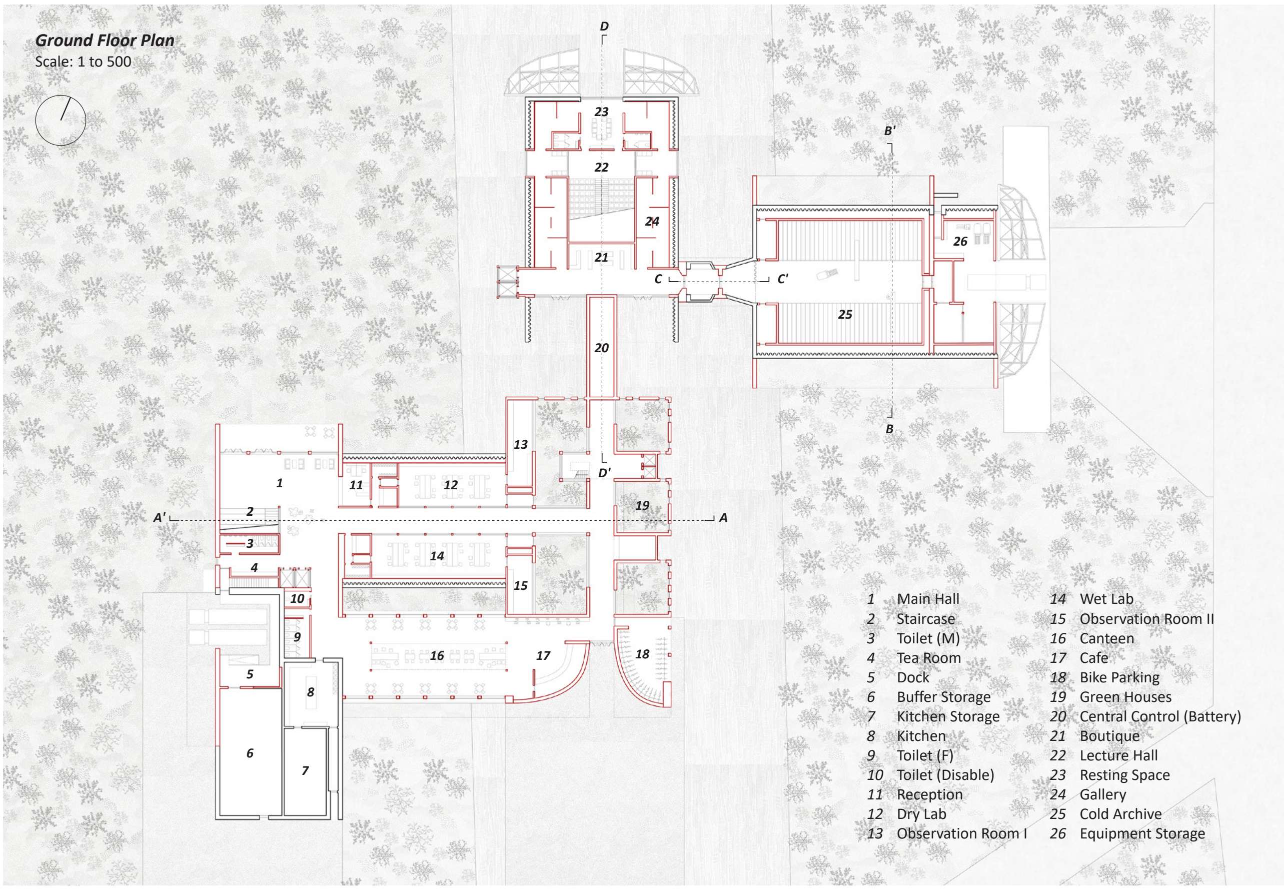


Fig 3.4.1 Ground Floor Plan

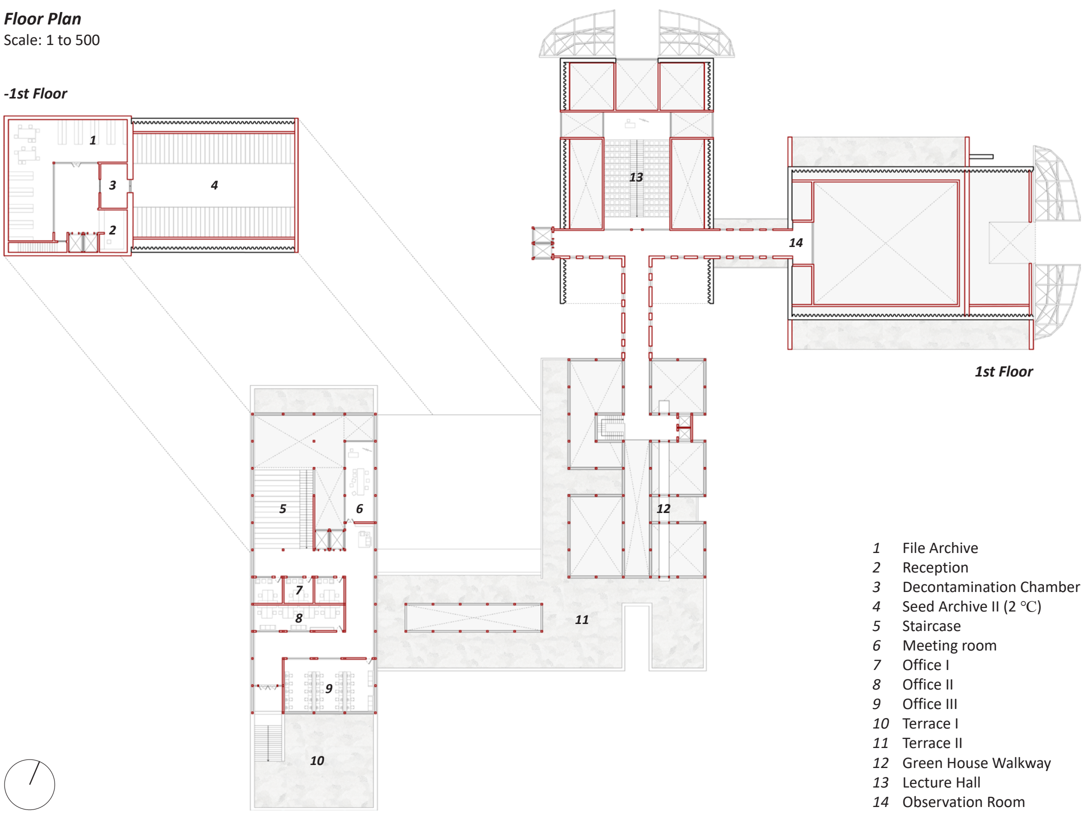


Fig 3.4.2 Basement Floor Plan and First Floor Plan

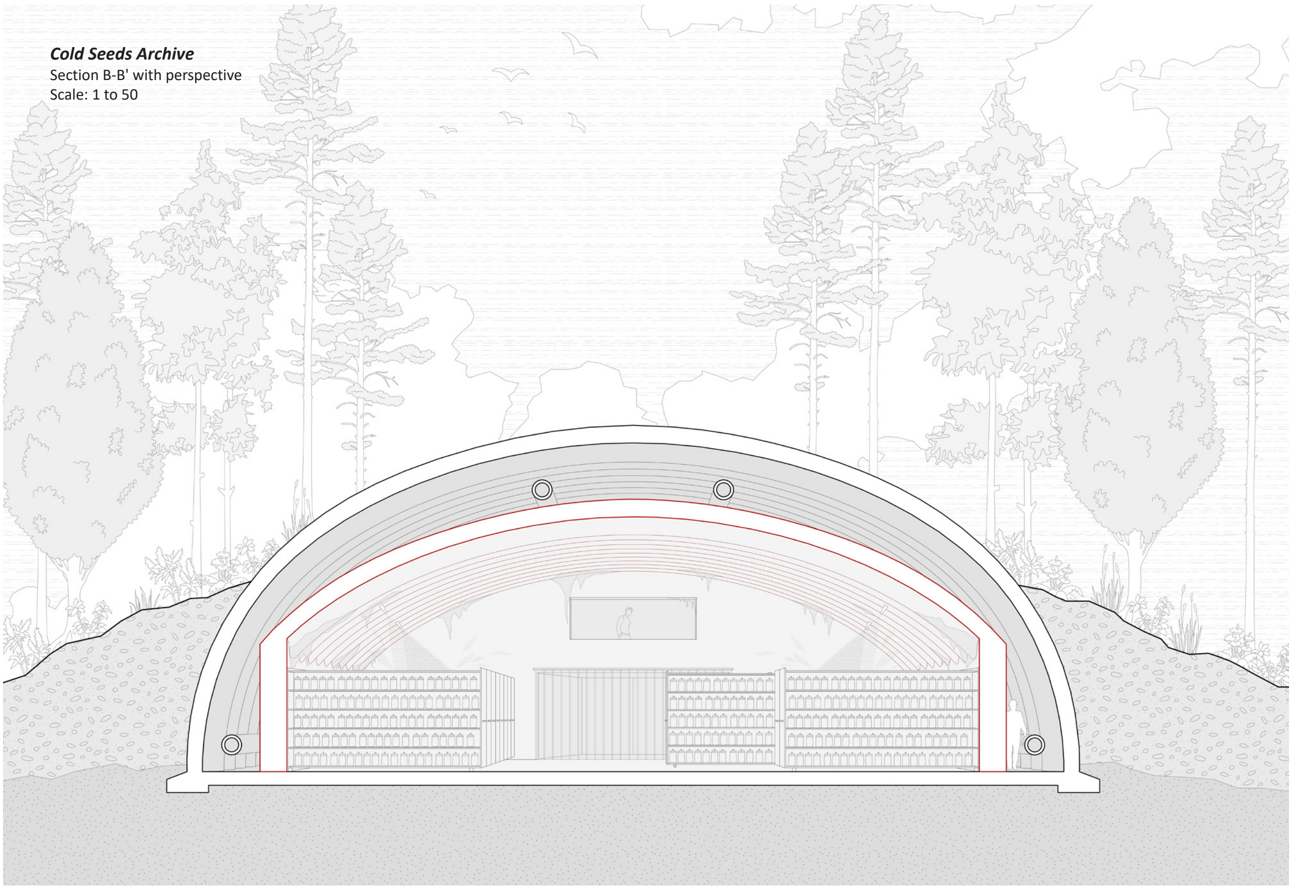


Fig 3.4.3 Cold Archive Section

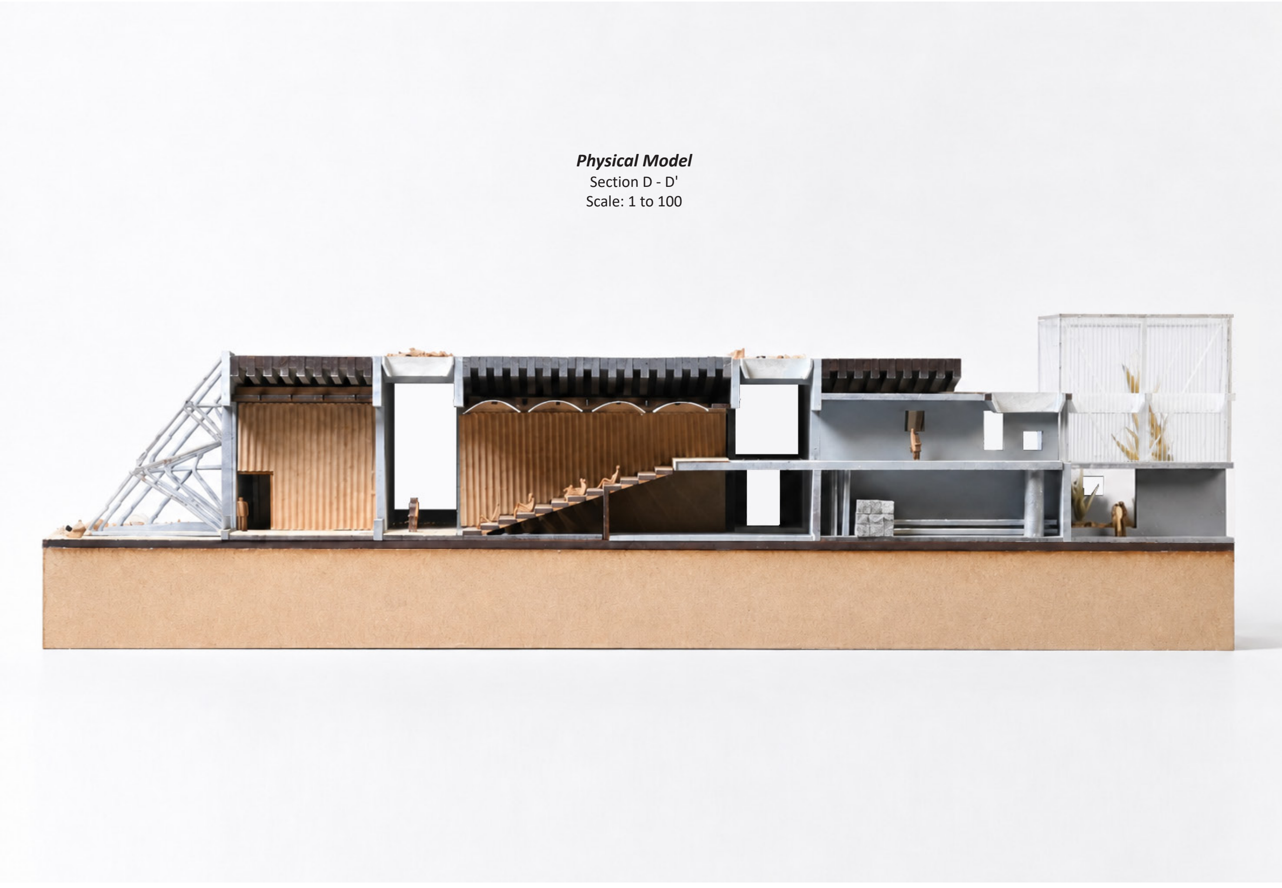


Fig 3.4.4 Physical Model Section

Part 4. Conclusion and Discussion

4.1 Implications and Recommendations

This project shows that the adaptive reuse not only confers a new function to an old building. The aircraft shelter is not merely a structure, its solid concrete body, enclosed space, restricted access and constant indoor condition are due to its former military purpose, however, it can still be utilized. Under such circumstances, the old idea of defense is applied for environmental protection. Originally designed for aircraft protection, it is now beneficial for saving local plant seeds, indicating that the original features are used in another manner.

The evaluation method is of great importance. It is not only a means to assess the historical value but also aids in decision-making. The matrix determines which parts of the shelter should remain unchanged, which parts can be reduced and which new constructions are required. Although it cannot give a completely objective answer, it explains the reasons for each action. This is advantageous for the heritage design since many decisions in reusing projects are hard to clarify. A designer must decide what to preserve, what to modify and what kind of new use is suitable. The revalue matrix acts as a basic framework for this discussion, connecting the historical value, functional requirements, intervention levels and structural impacts.

For example, the cold archive requires darkness, enclosure, low temperature and limited access, which are closely related to the original characteristics of the shelter, so the old structure does not hinder the implementation. On the contrary, it provides a basis for the feasibility of this plan. Besides, the project has other functions as well. The research centre can act as a small community facility to deal with future ecological issues. It combines local seed storage, climatic experiments, laboratory works, greenhouse cultivation, public exhibitions and education. The cold store keeps local plant seeds for a long time, whereas the greenhouses and laboratories examine how the local plants will react to future climate conditions, such as high temperature with high humidity or high temperature with low humidity. The gallery and lecture room enable visitors to observe and understand this process. Not only does it protect the plants by keeping the seeds safe, but it also prepares for possible changes. Taking into account the effects of global warming and species decrease on the local environment, a plant research centre can attract public attention to these issues.

For BK and heritage design education, the project shows the importance of setting some restrictions in the design procedure. The design is not carried out freely, but is guided by a few rules, such as using simple elements such as boxes and walls, and connecting the shelters by their original openings. These restrictions make the process more reasonable and less arbitrary. They allow each design stage to be judged according to the same basic rules, so the final form can be gradually decided rather than being selected merely depending on the visual preference, which is advantageous for other students and designers. It suggests that self-imposed restrictions can clarify the design. In contrast to decreasing creativity, these rules can offer the project a clearer direction.

4.2 Reflection and Limitations

The final outcome of this project is to implement revaluation as a design strategy. Initially, revaluation was mainly applied to investigate the aircraft shelter and select the programme of botanical archive and research institute. During the designing phase, its practicality has improved. It helped determine if the shelter should be open or closed, the addition of new components and the increase of new volumes. Consequently, the design decisions become more accurate.

The matrix connected the research questions and the final design. It could convert cultural values into design measures. For example, the cold archive preserves the shelter's closed and stable features while the greenhouse adopts a different structure because it needs light, air and a more flexible climate. One advantage of this method is that it does not regard cultural values as an unchangeable quantity. Cultural values are not only for preservation, but they can also be used as beneficial attributes. The large size, darkness and enclosed shape of the shelter can still operate under a new programme. Through this, the matrix highlights the shortcomings of the old building. In such aspects, new constructions are necessary.

However, the matrix has certain disadvantages. When more programme sections and additional criteria are added, the matrix becomes longer and more difficult to manage. It assists in making clear decisions but is inconvenient to use. At the initial stage of the design process, designers often require quick trials, drawings and immediate judgments. A big matrix may delay these processes. Therefore, the matrix performs better as a checking tool at critical stages rather than for each small design decision.

Another disadvantage is the subjectivity. The matrix uses numbers; however, the scores are still based on individual opinions. There is no significant difference between medium and high historical values. Program requirements are also hard to evaluate objectively. Thus, the matrix cannot be considered as a scientific calculation. It is better to regard it as a discussion tool which clearly shows the judgement but does not exclude it. In the later stage, the scoring rules can be made more specific.

Cultural experts, ecologists, engineers and plant specialists can also participate in the evaluation. This can reduce the dependence on one designer's view and integrate the design with environmental factors such as temperature, humidity, daylight, energy demand and structural influences. It is important to carry out further research on the environmental and scientific aspects of the design. The architectural logic of the cold archive and the greenhouse has already been established, but their actual performances still need to be investigated. The cold archive should concentrate on insulation, humidity control, energy consumption, backup systems, fire safety and maintenance. The greenhouse should formulate more detailed testing standards for local plant species, including the temperature range, humidity level, light exposure, soil conditions and growth period.

4.3 Conclusion

This project handles the research issue by changing the viewpoint of a Cold War aircraft shelter from a military defense to an environmental protection. The basic form of the shelter stays the same. It is used for seed preservation and its great size helps to preserve the environmental condition. The strict access forms a new kind of protecting measure. The final design is based on two main architectural features. The cold storage preserves its original protective ability to maintain the shelter's characteristics and thus protects the local plant seeds. On the other hand, the greenhouse works according to another principle, concerning light, air, growth and experiments. It makes the local plants experience certain climatic stresses and contributes to the study of their adaptability in the future.

Therefore, the project changes the idea of preservation which now includes not only storing but also preparing. By preserving and examining the local plant materials, it safeguards them and assesses their responses to possible future situations. Consequently, the building turns into a place for storing, investigating and public education.

Additionally, it shows that the treatment of old buildings does not require the same method for the entire structure. Some parts can be preserved, some can be removed, others can be modified or enlarged. The revaluation matrix is utilized to explain these different decisions. It associates the intensity of intervention with the value of the heritage and practical needs. In the end, the aircraft shelter still keeps its Cold War style but performs a new role. Instead of defending the area and military assets, it assists in dealing with ecological uncertainties. The project alters the defense concept to benefit the local plant life, public knowledge and long-term responsibilities.

Fig 4.0 Main Hallway Rendering

Appendices

A.1 Value Assessment

It is important to check the values of the sites and structures before any new plan or action. It helps the designer to decide what should be preserved, changed and requires special attention. The aircraft shelters have great historical value because of their long use during the Cold War, are made of concrete, have defensive characteristics and functions in the former airbase system. The investigation and construction examination consider all the components of the shelters and the shelters in the area as important. Therefore, the shelters should not be considered as common places. In addition, the evaluation shows that the former airjet route and central green path have positive value. These landscape features connect the shelters to the whole airbase and indicate that the site's value goes beyond the buildings and involves the relations among the shelters, paths, open areas and ecological landscapes. The value table indicates that the shelters are specially appreciated for their functional and structural heritage. Their value is based on their applications, systems, durability and technical performances rather than solely on their appearances. This is significant since the project not only keeps the shape of the shelter but also takes into account its present size, enclosure, stability and limited accessibility. This value assessment acts as the basis for the subsequent design decisions. Although it does not precisely determine the final form, it sets the standards for intervention. Hence, the re-assessment strategy will be established on this basis and will explore the way to apply these existing values in a new ecological program.

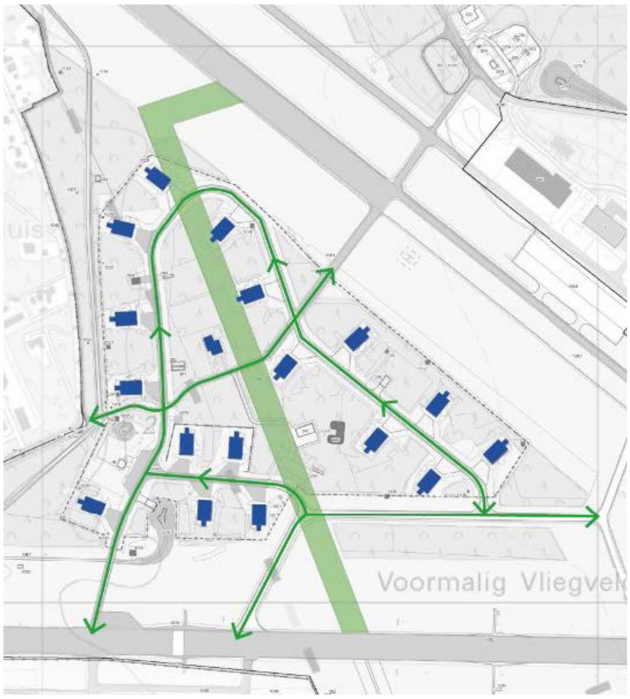
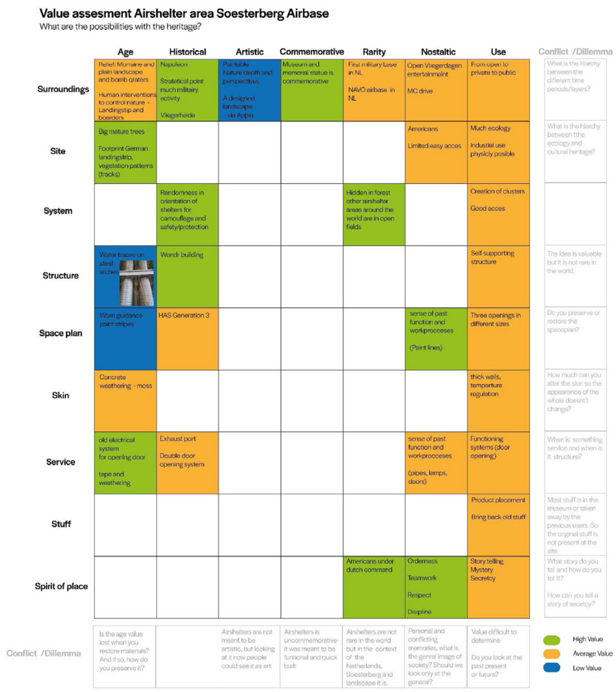


Fig A.1.1 Site Value Assessment



Value assesment Airshelter area Soesterberg Airbase
What are the possibilities with the heritage?

	Age	Historical	Artistic	Commemorative	Rarity	Nostaltic	Use	Conflict /Dillemma
Surroundings	Relief: Morraine and plain landscape and bomb qraters Human interventions to control nature - Landingstip and boarders	Napoleon Stratetical point much military activity Vliegerheide	Paintable Nature depth and perspectives A designed landscape - via Appia	Museum and memorial statue is commemorative	First military base in NL NAVO airbase in NL	Open Vliegerdagen entertainmaint MC drive	From open to private to public	What is the hiarchy between the different time periods/layers?
Site	Big mature trees Footprint German landingstrip, vegetation patterns (tracks)					Americans Limited easy acces	Much ecology Industial use physicly posible	What is the hiarchy between tthe ecology and cultural heritage?
System		Randomness in orientation of shelters for camouflage and safety/protection			Hidden in forest other airshelter areas around the world are in open fields		Creation of clusters Good acces	
Structure	Water traces on steel arches	Wondr building					Self-supporting structure	The idea is valuable but it is not rare in the world.
Space plan	Worn guidance paint stripes	HAS Generation 3				sense of past function and workprocceses (Paint lines)	Three openings in different sizes	Do you preserve or restore the spaceplan?
Skin	Concrete weathering - moss						thick walls, temperture regulation	How much can you alter the skin so the appearance of the whole doesn't change?
Service	old electrical system for opening door tape and weathering	Exhaust port Double door opening system				sense of past function and workprocceses (pipes, lamps, doors)	Functioning systems (door opening)	When is something service and when is it structure?
Stuff							Product placement Bring back old stuff	Most stuff is in the museum or taken away by the previous users. So the original stuff is not present at the site
Spirit of place					Americans under dutch command	Orderness Teamwork Respect Disipline	Story telling Mystery Secretcy	What story do you tel and how do you tel it? How can you tell a story of secetcy?
Conflict /Dillemma	Is the age value lost when you restore materials? And if so, how do you preserve it?		Airshelters are not meant to be artistic, but looking at it now people could see it as art	Airshelters is uncommemorative- It was meant to be funtional and quick built	Airshelters are not rare in the world but in the context of the Netherlands, Soesterberg and landscape it is.	Personal and conflicting memories, what is the genral image of society? Should we look only at the general?	Value difficult to determine Do you look at the past present or future?	

High Value
Average Value
Low Value

Fig A.1.2 Value Assessment Matrix

A.2 Site Selection

The central part of the site is chosen due to its close connection with heritage, ecology and future research purposes. In comparison with the edge of the airbase, this area is better protected by the surrounding scenery. It also possesses a more stable micro-climate. The former runway has already turned into a green walkway which connects the project directly to the existing landscape pattern. The restricted access of the middle region is suitable for the botanical archive. The archive requires a balance among public visiting, scientific investigation and environmental protection.

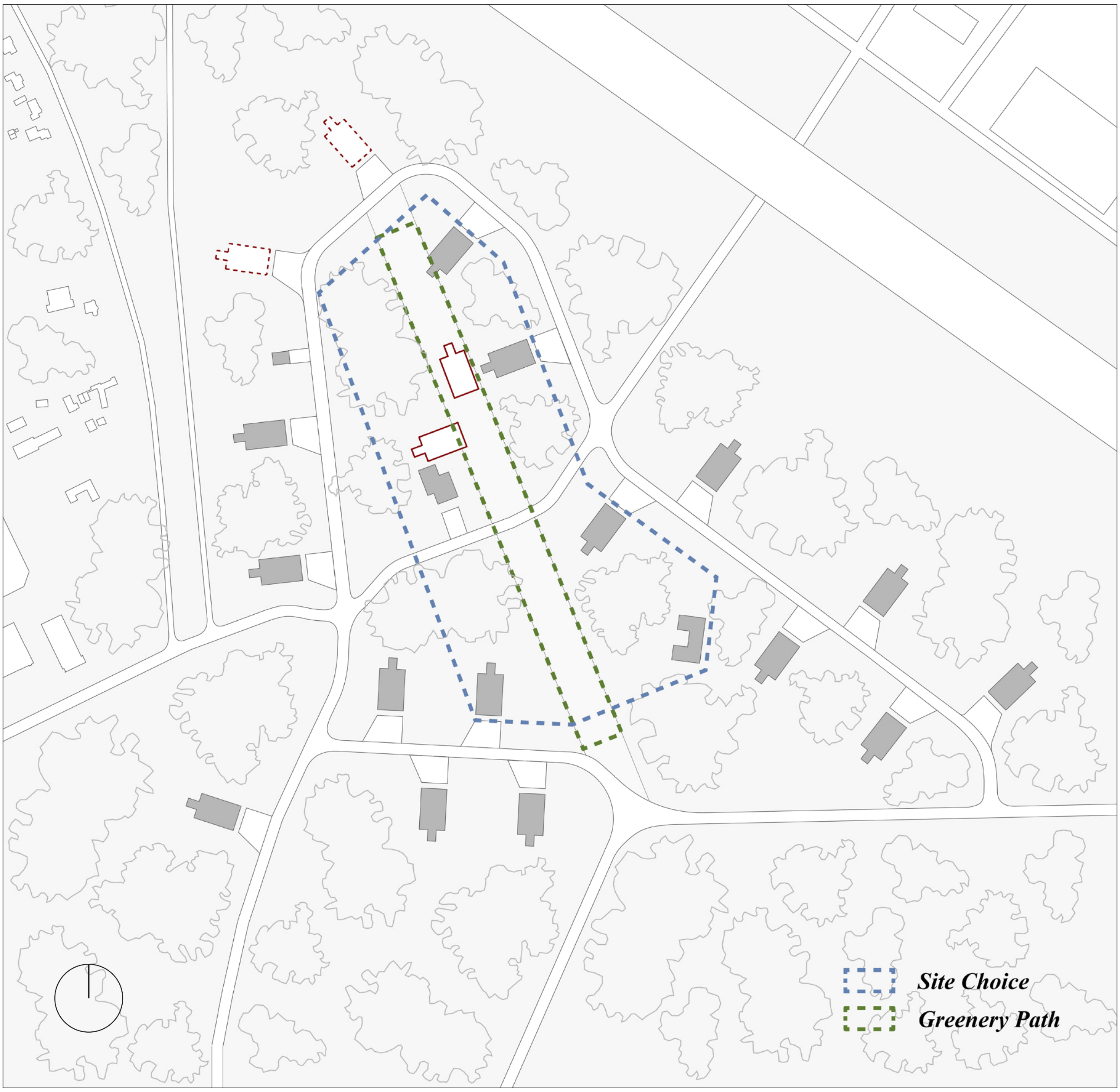


Fig A.2.1 Master Plan 1:5000

A.3 Composition Strategy

The shelters are composed according to the original design of an aircraft shelter. Each shelter possesses three openings which are employed for connection, extension and a new function. The composition diagram (Fig A.3.1) illustrates the way the shelters can be connected via these openings. One can enter, change position and extend into the shelters from its front, back and sides. By rotating and arranging these openings, the shelters can be joined together into one larger unit.

Thus, future enlargement is also possible (Fig A.3.2). Additional shelters or extra program spaces can be added in the same manner as the original openings. In this project, a completely new grid is not used. Rather, a new arrangement is set up based on the existing shelter type.

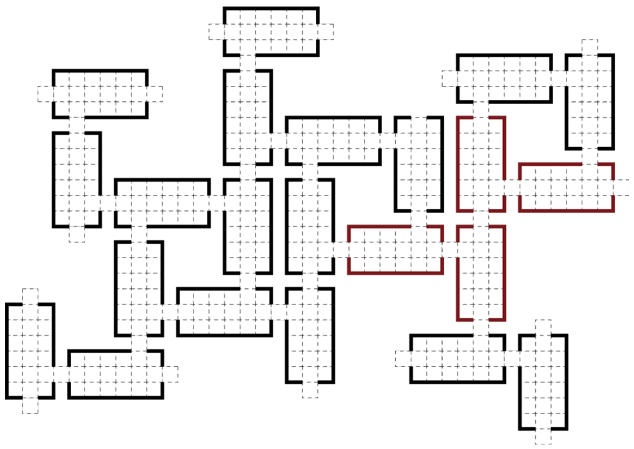


Fig A.3.1 Composition Strategy Diagram

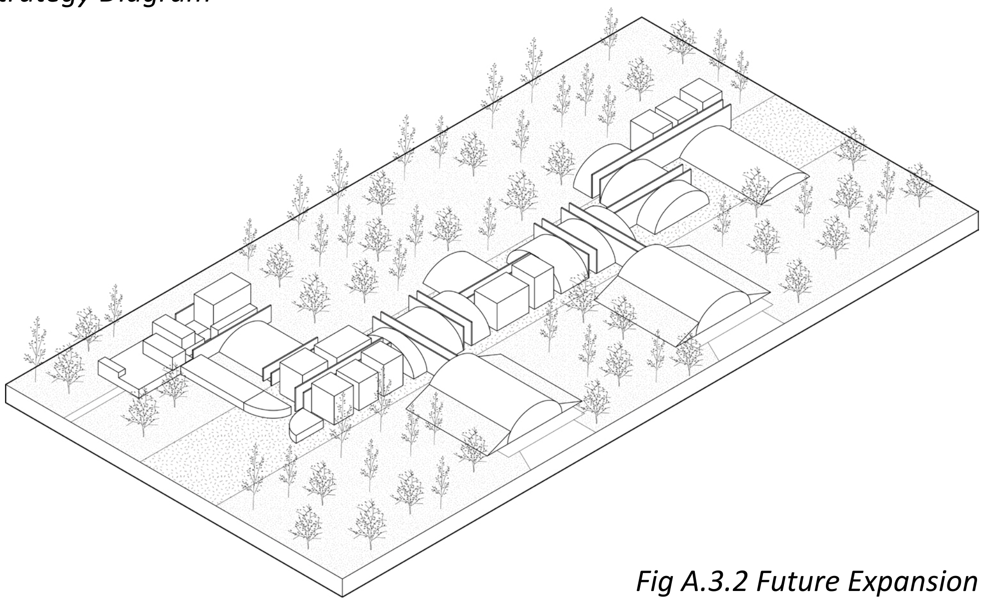


Fig A.3.2 Future Expansion

A.4 Programme Diagram (Fig A.4.1)

The programme diagram illustrates the project from the perspectives of temperature, humidity, light and access. It not only indicates the functions but also shows the kind of environment required for each site.

The cold vault is the most strictly regulated area which needs about -16°C, without any sunlight and low humidity. The 2°C seed bank is the second preserving place located in the excavated shelter, where the ground and concrete can maintain a constant temperature.

In the greenhouses and laboratories, which constitute the research area, they operate under warmer and more complex conditions. Some parts are used to investigate the effects of high temperature and high humidity, while others are used to assess the influence of high temperature and low humidity. These experiments are intended to explore the response of the local plants to the possible climatic stress in the future.

The public sections such as the exhibition hall, lecture room and working areas keep the temperature around 18°C, permitting the entry of sunlight, providing visibility and facilitating the public use. The diagram begins with the cold, dark and restricted environments and ends with the warmer, brighter and more public areas.

A.5 Seasonal Energy Flow

The seasonal energy diagrams show the relationship among the archive, greenhouse, control area and public places.

In summer (Fig A.5.1.1), the outdoor temperature varies from 22°C to 28°C. The cold archive and 2°C seed archive need to be cooled. The heat generated from these areas can be transferred to the battery and control area and either saved or applied. This connects the cold storage system with the warmer greenhouse system.

In winter (Fig A.5.1.2), the outdoor temperature is between -5°C and 2°C. The 2°C archive can utilize the cool weather and requires less cooling. Meanwhile, the greenhouse, gallery, lecture hall and work places need heat. The stored or redirected heat can help to warm up these places. Mechanical equipment is not excluded in this system. The -16°C cold vault still needs technical cooling.

Nevertheless, this method can decrease the temperature difference and enhance the efficiency of heat and cold utilization.

Programme Diagram
Temperature
Conditions
Circulation

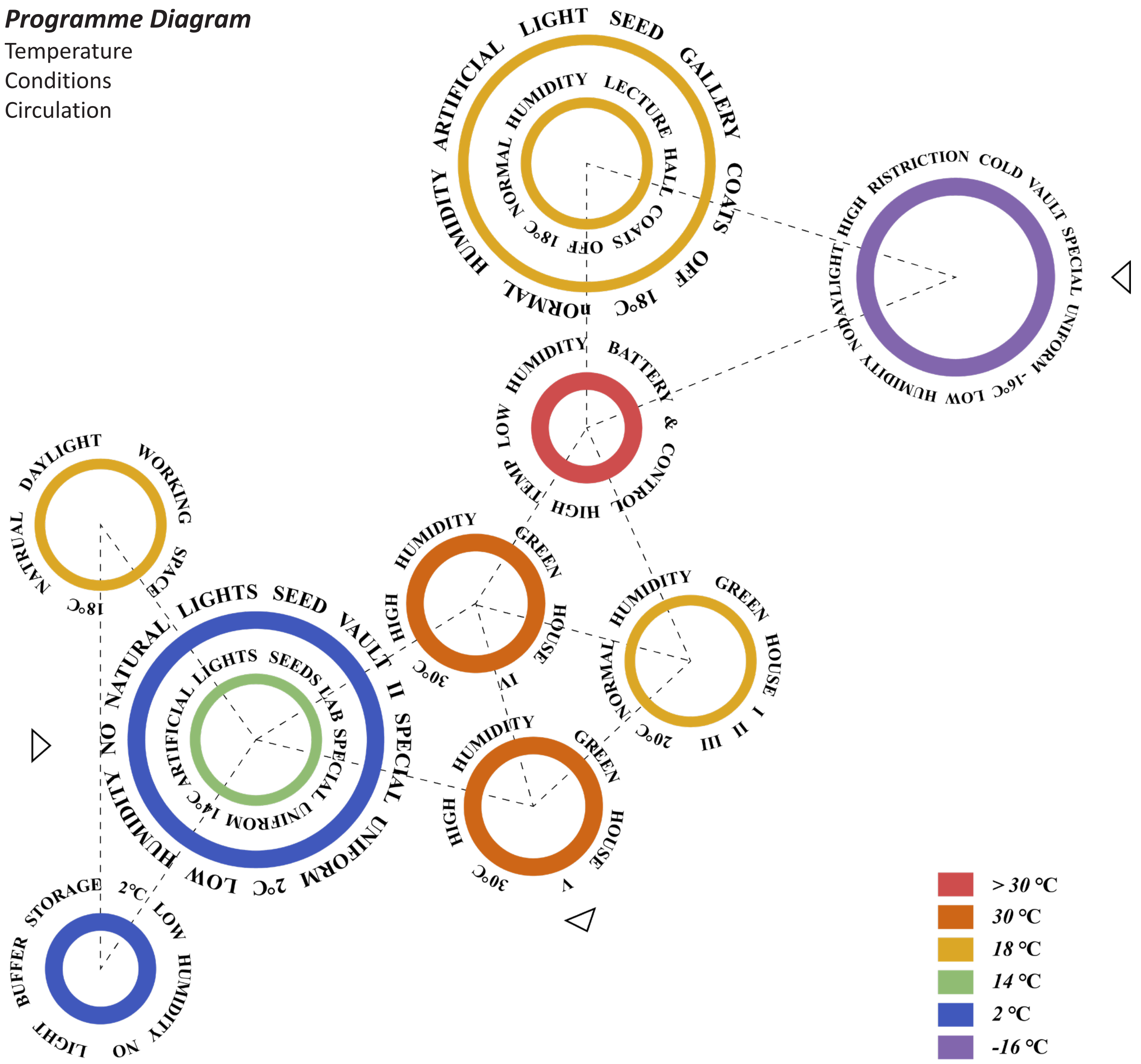


Fig A.4.1 Programme Diagram

Summer Energy Flow
22°C - 28°C

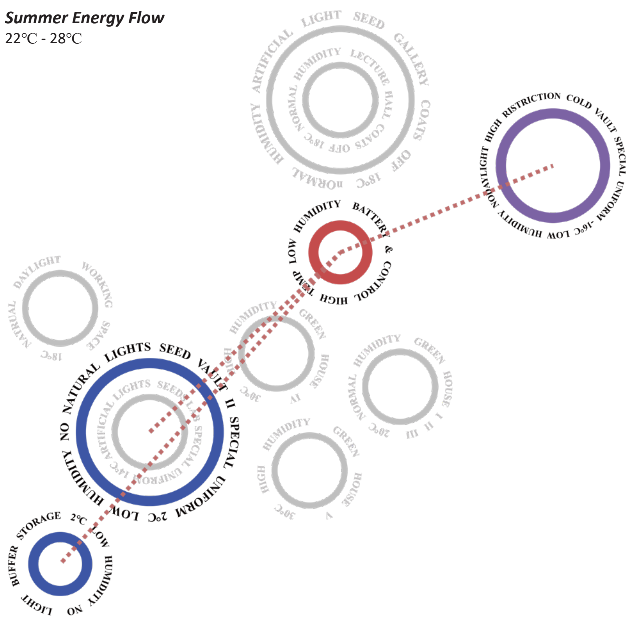


Fig A.5.1.1 Summer Energy Flow

Winter Energy Flow
-5°C - 2°C

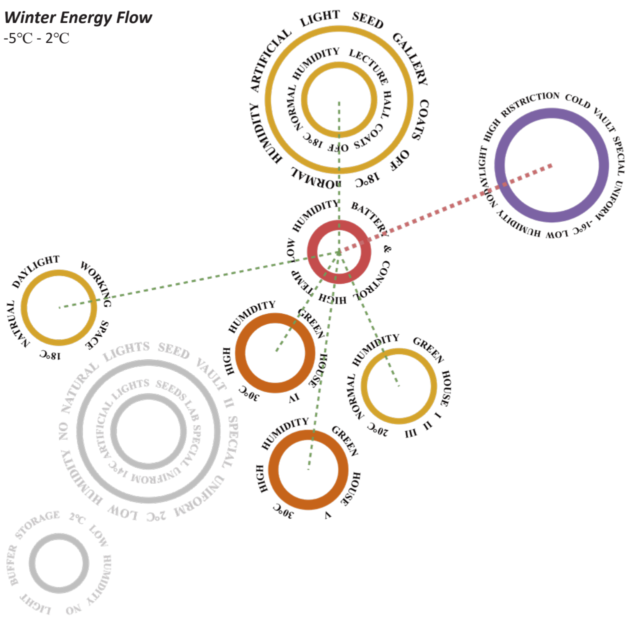


Fig A.5.1.2 Winter Energy Flow

A.6 Structural Details

A.6.1 Lecture Hall (Fig A.6.1)

The lecture hall and gallery detail shows how new interior layers are placed inside the existing aircraft shelter. The concrete shell still acts as the main framework and the principal covering. Some timber frames, a metal suspension system, acoustic panels and floorings have been built for public use. The new structure is lighter than the shelter. The timber acoustic panels and curved timber wall panels improve the sound for lectures and exhibitions. Cork panels, wooden flooring, dark carpets and terrazzo flooring create different indoor conditions.

These new layers do not cover the concrete shelter. They are situated inside it. The old shell can still be seen and the new inner parts make the space appropriate for teaching and displaying.

A.6.2 Green House (Fig A.6.2.1 & Fig A.6.2.2)

The greenhouse has an unique structure. It is separated from the shelter but joined to the research building for better support. The concrete base guarantees its firmness and raises the greenhouse above the ground. The upper frame holds up the transparent cover. The roof and wall panels allow the entrance of light and facilitate plant growth. As seen in the exploded axonometrix, the greenhouse includes the foundation, frame, covering, openings and planting place. This is required for the adaptability of the project which requires light, air and climate control.

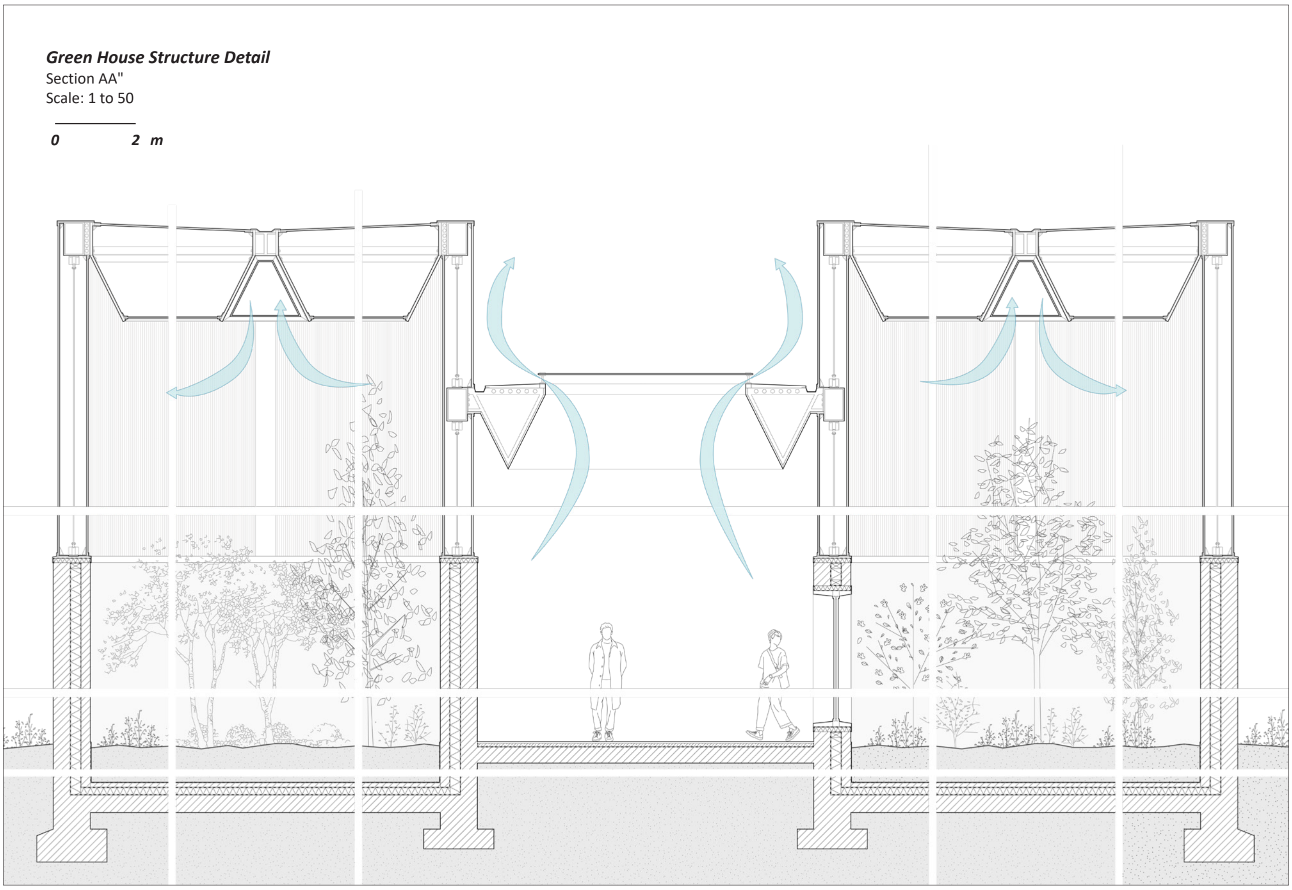


Fig A.6.2.1 Green House Structural Detail

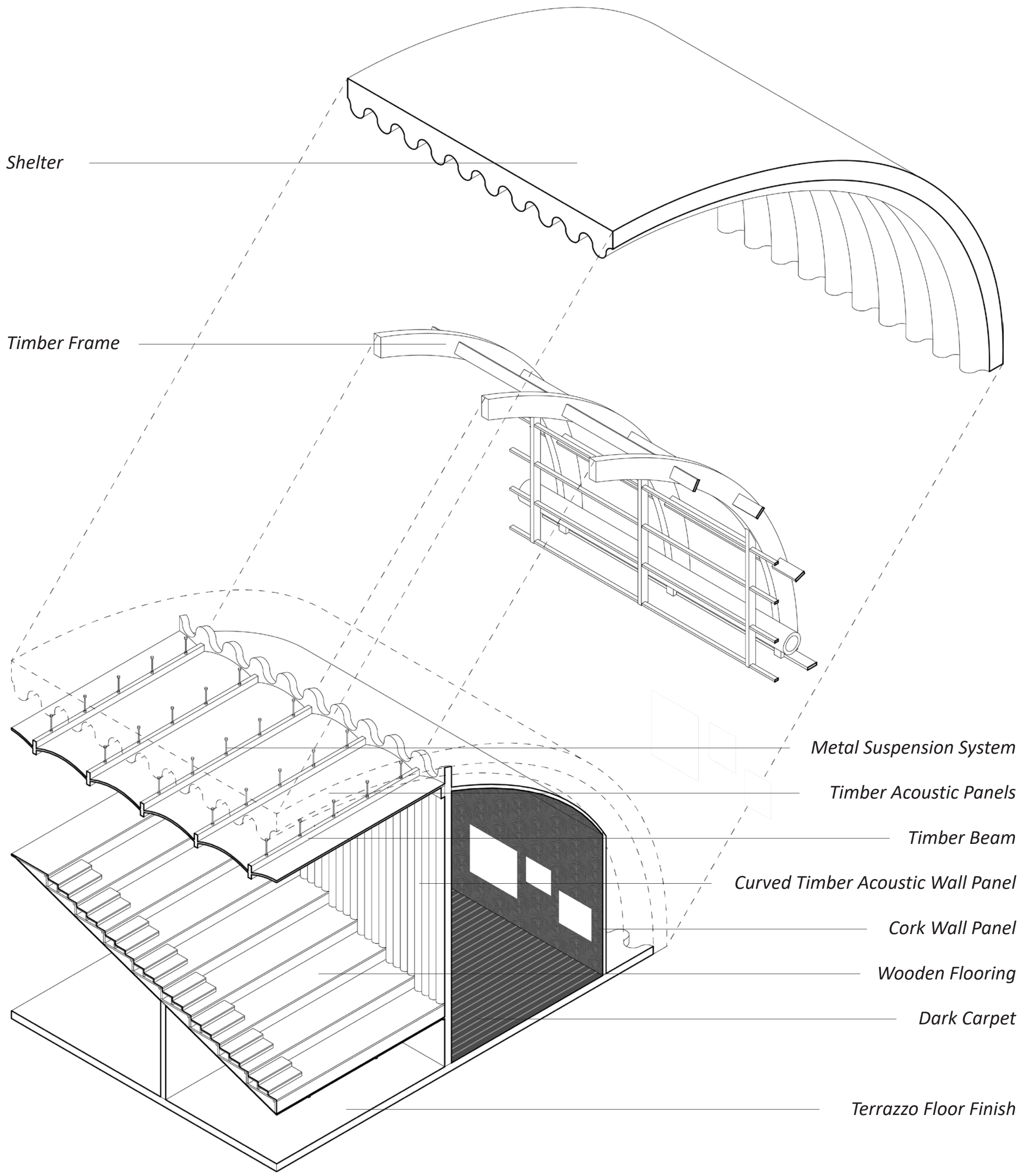


Fig A.6.1 Exploded Axonometric View of the Lecture Hall

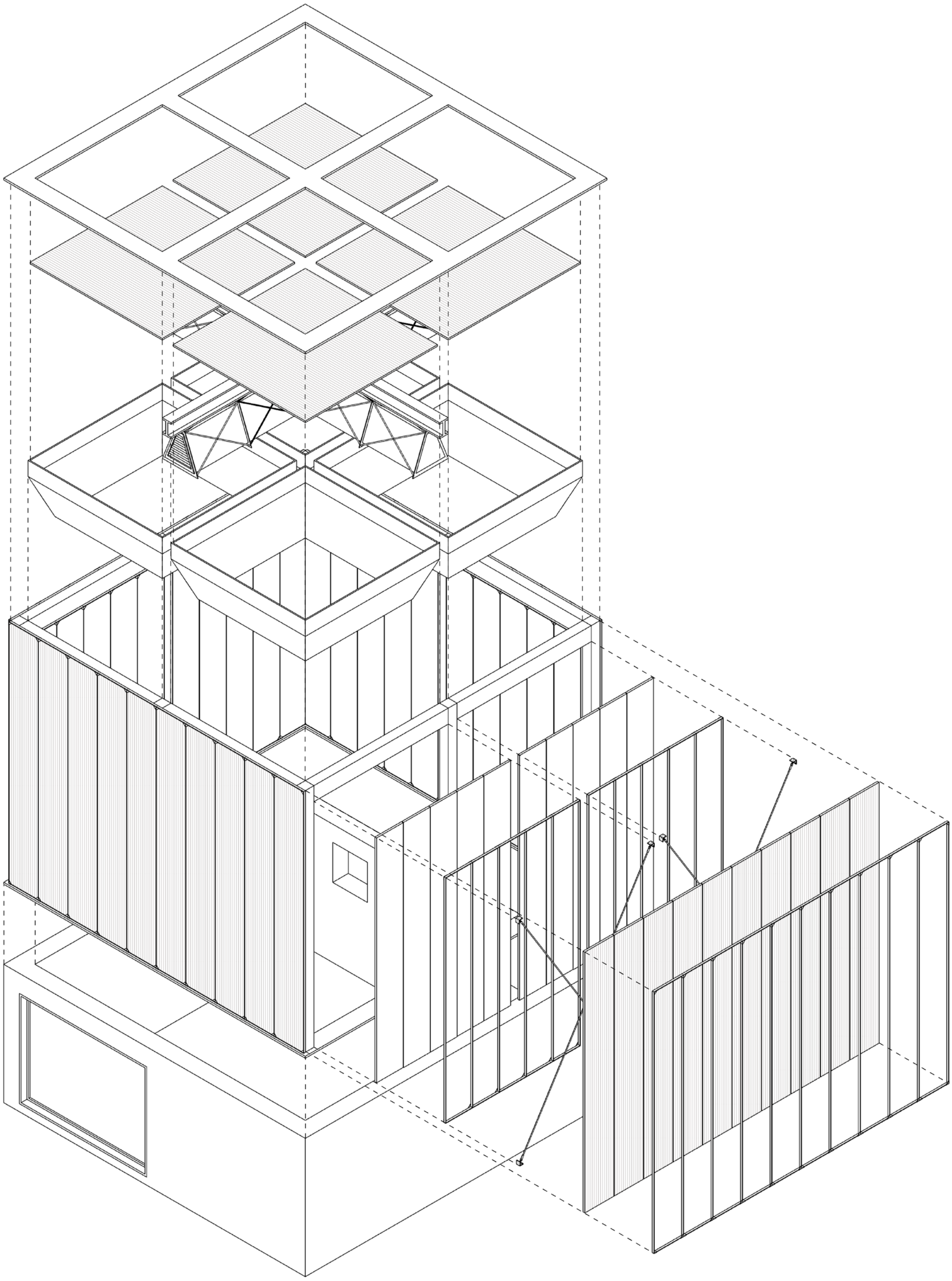


Fig A.6.2.2 Exploded Axonometric View of the Green House

A.7 Plant Selection

The plants chosen in the greenhouse are of local and regional types. The purpose is to establish a simple plant community for experimental investigation and instruction.

They are classified into three groups based on their heights. The upper group includes Betula pendula and Pinus sylvestris, about 3-7 meters high, constituting the upper layer. The middle layer is made up of Corylus avellana and Sambucus nigra, with a height of 2-5 meters, forming the shrub layer. The lower layer is formed by a mixture of grass and Pteridium aquilinum, about 0-2 meters high, representing the ground layer.

Thus, by arranging them in this manner, we can examine the different kinds of plants under various temperatures and humidities in the greenhouse.

Upper Level

Betula Pendula
3-7m

Pinus Sylvestris
3-7m

Middle Level

Corylusavellana
2-4m

Sambucus Nigra
2-5m

Low Level

Meadow mix
0-0.3m

Pteridium
Aquilinum
1-2m

Fig A.7 Plant Choice Diagram

A.8 Revalue Matrix (Fig A.8)

The revalue matrix is employed to make design decisions. It assesses each programme segment based on the previous record, program requirements, conflict degree, intervention degree, proportion and structural impact. The previous record represents the importance of each area as a historical site. The higher the score, the more consideration should be given to that area.

Program requirements indicate the quantity of resources needed for each function in the building, such as climatic conditions, accessibility, lighting, security and spatial efficiency. The conflict degree compares the previous record and program requirements to show the contradictions between preservation and new use. A high conflict degree does not necessarily mean a greater intervention, but it implies that the design should have a clear reason. The intervention degree indicates the extent of permitted modifications. A lower degree means protection or minor additions while a higher degree allows cutting, annexation or substantial changes. The proportion shows the effect of the intervention on one part or the whole structure, which helps to distinguish slight local modifications from major ones. The structural effect evaluates the influence of the intervention on the existing structure which can range from no change to reinforcement, forced alteration or base alteration.

The matrix is not an accurate calculation but a design guide. It clarifies the reasons for keeping certain parts, introducing others and altering the rest.

Function	***Area***	***Historical Value***	***Programme Requirements***	***Conflict Level***	***Intervention Level***	***Proportion***	***Structure Impact***
Seed Vault	Aircraft Shelter (Bottom)	3	3	**6**	0	50%	**3**
Cold Storage	Aircraft Shelter (Bottom)	3	3	**6**	0	30%	**3**
Buffer Storage	Commander Bunker	2	2	3	1/2	25%	1
Packaging Room	Commander Bunker	1	2	2	1/2	10%	1
Lab	Aircraft Shelter (Middle)	1	2	1	1/2	50%	1
Gallery	Aircraft Shelter (Middle)	1	1	1	1	60%	1
Lecture Hall	Aircraft Shelter (Middle)	1	1	1	1	25%	1

HIstorical Value	Programme Requirements	Conflict Level	Intervention Level	Structure Impact	Assessment
0 - None	0 - None	HV + PR	(Recommanded)	0 Remain	2nd - 1st > 0 P
1 - Low	1 - Low	0 - 2 Low	< 3 Change	1 Reinforce	2nd - 1st < 0 F
2- Indifferent	2- Medium	3 - 4 Medium	< 2 Carve	2 Force Alteration	F - 2nd > 0 P
3- High	3- High	5 - 6 High	< 1 Insert	3 Base Alteration	F - 2nd < 0 P

Fig A.8 Revalue Matrix

A.9 Kamari Model (Kamari et al., 2017)

After computing the revalue matrix, it is revealed that it can illustrate the connection between the past values, program requirements, intervention intensities and structural effects, but it cannot directly determine the design. It clarifies the relations among these factors. However, it is difficult to transform the scores into the selection of space, form and materials. The matrix serves as a checking tool, showing which parts should be preserved, changed or newly designed. Nevertheless, it is only a one-dimensional table and cannot fully reflect the overall relationship between the method, program, structure, material, climate and practicability.

Therefore, the Kamari model has been tried as an alternative method. This model comprises three main parts: acountability, functionality and feasibility. acountability indicates the initial idea of the project and investigates the issues such as identity, social value, spatial value, safety and stakeholder participation, which is similar to the first evaluation of values and research direction. functionality deals with the transformation from program to design and examines factors like comfort, energy consumption, material use, water consumption, pollution and service quality, advantageous to the botanical archive, greenhouse, laboratory, gallery and lecture halls. feasibility considers the capability of construction and maintenance and evaluates the costs, structural design, operational efficiency, maintenance, adaptability and management, which is important for the final stages to see whether the design is buildable intervention.

The Kamari model may be more suitable for the whole process from method to construction. It cannot replace the value assessment as the former is the foundation for heritage design. It also cannot completely take the place of the revalue matrix. The matrix is still useful in determining the degree of intervention. On the other hand, the wheel model offers a wider perspective for the comprehensive evaluation of the whole project. In the future work, the revalue matrix and the Kamari model can be used together. The matrix aids in the beginning to decide what to keep, discard, introduce or add, while the wheel model supports in the end to inspect the design methods, program performance and practicability.

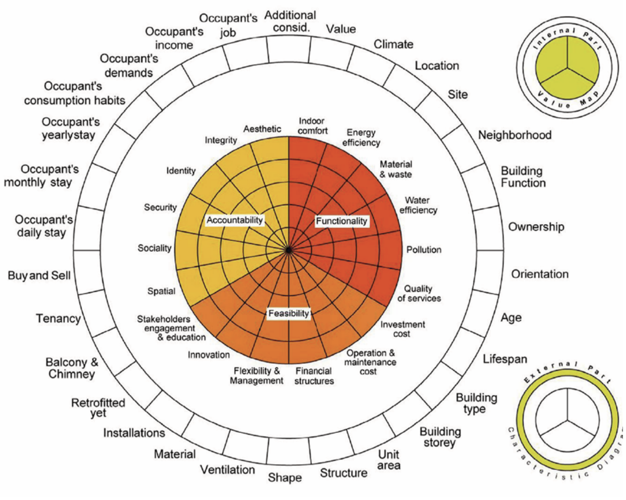


Fig A.9 Kamari model (Kamari et al., 2017)

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Figure References

Cover image. Physical model photograph and composition by author, 2026.

Fig 1.2. Park Vliegbasis Soesterberg. Photograph by author, 2026.

Fig 1.3. Blast-resistant Slide Door. Photograph by author’s coursemate, groupwork site visit, 2026.

Fig 1.4.2. Programme Zone Table. Diagram by author, 2026.

Fig 2.2.1. Svalbard Global Seed Vault, Norway. Image from Crop Trust, Svalbard Global Seed

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I am thankful to my tutors, reviewers, and fellow colleagues for their advices during the design stage. Their queries have assisted me to comprehend the connection between the cold archive, the greenhouse, the revaluation system and the final architectural concept.

Lastly, I would like to thank my relatives and friends for their persistence and support during this whole procedure. Their encouragements have helped me to persist with the project especially when facing uncertainties or modifications.