From Defence to Dialogue

The transformation of military heritage into a museum and public space

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Adaptive Reuse of Heritage Graduation Studio
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Foreword

This graduation project marks the final stage of my Master's degree in Architecture at TU Delft. The Adaptive Reuse of Heritage studio focuses on the repurposing of heritage locations. For this project, I worked on the transformation of the Kitchenbuilding at the Kolonel Palmkazerne in Bussum.

The combination of architecture, heritage and the social relevance of military sites interested me from the beginning. This project offered the opportunity to bring these interests together in a design project that focuses on both the historical values and the future importance of the building. Throughout my draduation project, I really enjoyed working on a design that brings together the past and the future. The Kitchenbuilding presents a unique challenge in this context: a building with a rich history, while at the same time providing a space with the opportunity for a new public function.

I would like to thank a number of people who have supported me throughout this process:
First I would like to thank my supervisors, Lidy Meijers and Thijs Bennebroek. Your inspiring guidance, constructive feedback, and trust have made a significant contribution to this project. The freedom I was given throughout my graduation project gave me the confidence to develop my own design vision and shape the project in my own way.

I would also like to thank my dear parents for the support and trust they have shown me, not just during my graduation project, but throughout my entire Bachelor's and Master's programs! Dad, thank you for your critical eye regarding the texts and storylines of my projects and reports, that kept me sharp. Mom, your creative skills helped me greatly with the layout of my reports, models, and drawings, that was truly greatly appreciated. It's special that you've always given me the freedom to develop myself in different ways, I'm incredibly grateful to you both for that. Erik and Léoni, I would also like to thank you both for your support throughout the years. It means a lot to me to be able to celebrate this milestone with you.

Dear Sophie, thank you for letting me call you sometimes while complaining, but for always reassuring me with wise words that everything would turn out okay. And of course, Gijs! Thank you for your support over the past year; your technical insights have really helped me at certain times. I may not have been at my best in these last few weeks, but thankfully it's now really all finished! Finally, I'd like to thank all my friends and fellow Architecture students. Thanks to you, the past few years at the faculty have been not only educational but also great fun. Thank you for all the coffee breaks, chats, projects and lovely memories.

Abstract

The Ministry of Defence is undergoing organisational growth through recruitment efforts and public involvement. In addition, many former military buildings have lost their original function, while at the same time there is a growing need for public facilities that provide information and education. This graduation project researches how the Kitchenbuilding at the Kolonel Palmkazerne in Bussum can be repurposed as a Museum and Information Centre for the Ministry of Defence.

The research question of the project is how the spatial layout and routing of a museum in an existing military building can contribute to both information provision and recruitment, while respecting the historical value of the building. To answer this question, a research-by-design method has been applied, combining literature review, case studies, a value assessment and a site analysis. Specific attention has been paid to routing, spatial organisation and climate zoning.

The results show that a central gathering space, combined with a visitor route that brings together orientation and freedom of choice, provides a suitable starting point for a Defence Museum and Information Centre. Furthermore, the research reveals that new functions can be added without losing the building's historical identity. By preserving the main structure, the relationship with the assembly point and local spatial interventions, a design is created in which information, education and recruitment are linked to the military history of the location.

The project shows that the repurposing of military heritage can contribute to new public functions, while preserving historical values and creating space for future developments in society.

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1.1 Problem statement

The Ministry of Defence is currently facing a period of growth and change. Due to the shifting geopolitical situation in Europe and rising international tensions, national safety is becoming a major priority on the social and political agenda once again. As a result, the Ministry of Defence has entered a new phase, characterised by investment in personnel, equipment and public visibility.
To support this growth, the Ministry of Defence is actively focusing on recruitment through campaigns (Ministerie van Algemene Zaken, 2025), online information sessions and physical walk-in days (Ensie, z.d.). The need for new staff and greater public support makes it important to make the organisation accessible and visible to a wide audience.

In addition, there is the Defence Museums Foundation, an organisation that oversees three military museums: the National Military Museum in Soest, the Marinemuseum in Den Helder and the Marines Museum located in Rotterdam (Ministerie van Defensie, 2025).These different locations provide information about specific Defence departments, but there is no central location where history, knowledge, information and education come together.

At the same time, many former Defence sites, such as shelters, bunkers and barracks, have lost their original function. In response, the Ministry of Defence has initiated a large-scale transformation programme aimed at preparing its real estate for future use through demolition, renovation and adaptive reuse. (RVB Aan de Slag met 'No Regret-locaties' van Defensie | Rijksvastgoedbedrijf, 2024).

This context introduces an architectural challenge that combines the adaptive reuse of military heritage with the contemporary needs of the Ministry of Defence. The project therefore explores how an existing military building can be transformed into a Defence Museum and Information Centre. Particular attention is given to spatial organisation, routing and the preservation of heritage values, creating a place where information provision, education and recruitment come together.

Figure 1: Locations of the military museums

1.2 Scope

1.2.1 Location choice

The Kolonel Palmkazerne is a former Cold War defence site that has lost its original function, creating space for a new programme. Located on the edge of Bussum, the barracks were strategically positioned in 1938 within the New Dutch Waterline and in relation to key infrastructure. During the Cold War, the site remained relevant due to its role in military defence and logistics, with its isolated position reflecting the defence principles of dispersion and control.

Post-war urban expansion surrounded the site with residential areas, creating a tension between the closed military domain and its civilian context. This layered history and current transitional position make the Kolonel Palmkazerne a suitable location for redevelopment. At a time when the Ministry of Defence is increasingly focused on openness, education and knowledge sharing, the site offers a opportunity to explore how military heritage can be transformed into an accessible and future-proof environment, while keeping its defensive character and historical significance.

1.2.2 Program choice

The absence of a central location where information, history, education and recruitment activities of the Ministry of Defence come together forms the starting point for the programme choice. In a period of geopolitical uncertainty and organisational growth, there is an increasing need for places where the public can engage with the role, history and future of Defence. Within this context, a museum and information centre for the Ministry of Defence is proposed, combining recruitment with education and knowledge sharing on the history and evolving role of Defence in society. The Kitchen Building is a suitable location due to its strong connection to everyday military life. The architectural challenge lies in identifying which elements hold cultural and historical value and integrating these with a new public programme.

1.2.3 Functional Layout and Space Requirements

The Kitchen Building has a surface area of approximately 2,200 m^2. Based on this surface area, a Programme of Requirements has been drafted, as shown in Figure 2. To give an idea of the size of each room, Figure 3 shows a schematic representation of the surface areas of each room, based on the Programme of Requirements.

Space	Surface (m²)	Capacity	Public / private
Entrance / foyer	180	200	Public
Museumshop	80	20	Public
Restaurant	100	100	Public
Wardrobe	50	-	Public
Exhibition area	800	200	Public
Interactive area	400	80	Public
Auditorium	300	100	
Office	150	30	Private
Toilet facilities	70	-	Facility
Changing room	100	20	Facility
Technical room	80	-	Facility
Pantry	50	-	Private
Circulation	150	-	Facility
Total	2510		

Figure 2: Functional layout and space requirements

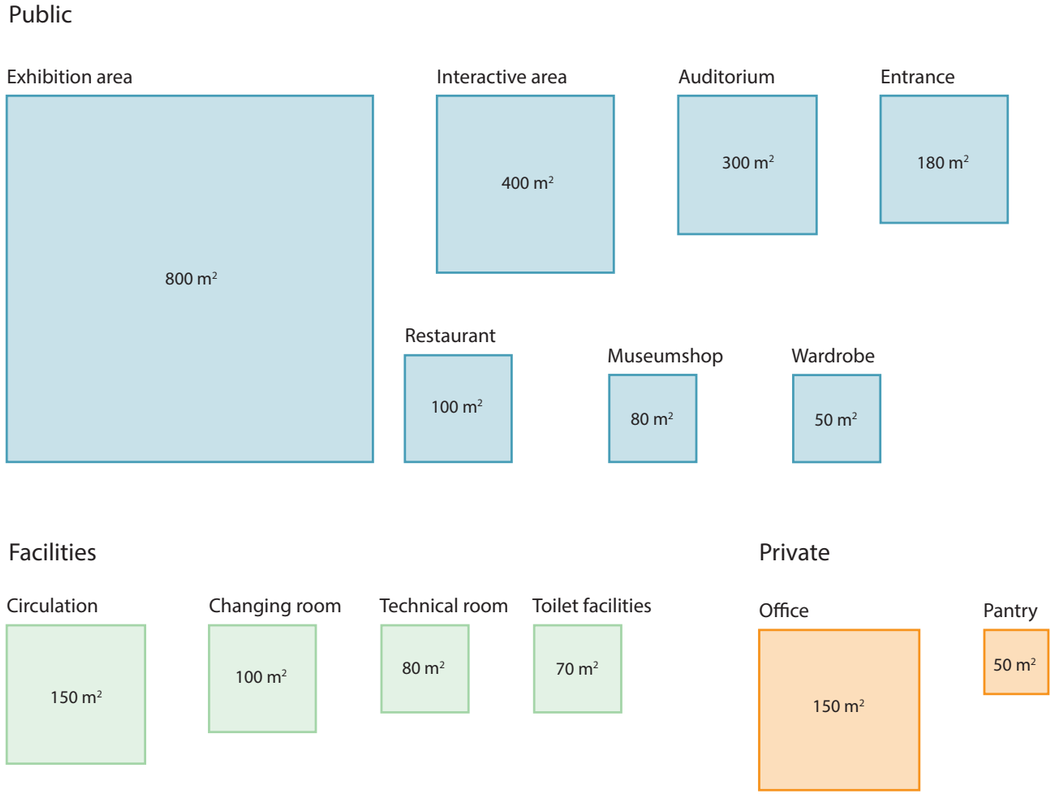

Figure 3: Functional layout

1.3 Research and design questions

A museum has proven to be relevant both as a recruitment tool and as an information point for the Ministry of Defence. This raises the question of how a museum can be designed to respond to the need for flexible exhibition spaces, as the information presented today may become less relevant in the future. A carefully considered spatial layout is essential to support a flexible and adaptable programme.

To achieve this, it is necessary to investigate how spatial organisation and layouts function within museums. In addition, routing forms a key aspect of this research, as visitor routes directly influence experience, orientation and the interpretation of information.

Research question:
'How can the spatial layout and routing of a Defence Museum in an existing military building contribute to both public information provision and recruitment, while respecting the historical value of the building?

Sub questions:

Routing
'How can routing in a museum both provide direction for information and leave room for individual exploration by different visitors?'

Zoning
'Which spaces are essential in a museum and how does this relate to the route through the building?'

Climate zoning
'What elements are crucial to maintaining an optimal visitor experience and ensuring the objects on display are presented to the greatest possible advantage?'

1.4 Relevance

The Ministry of Defence is currently undergoing a period of growth and change as a result of increasing geopolitical uncertainty and changing security challenges at both national and international levels. The Ministry of Defence aims to significantly expand the organisation in the coming years, supported by active recruitment and greater public visibility. This recruitment drive has led to the organisation growing by 20% over the past four years (Ministerie van Algemene Zaken, 2025b). At the same time, it is becoming increasingly important to increase public awareness of and support for the Ministry of Defence.

Within this context, there is a need for a place where visitors can learn about the history, current role and future developments of the Ministry of Defence. Although several military museums already exist, these mainly focus on specific branches of the organisation. A Defence Museum and Information Centre could bring education, information provision and recruitment together in one central location.

The relevance of such a facility lies not only in supporting recruitment efforts, but also in strengthening the relationship between Defence and society. By combining history, education and public engagement, visitors get a better understanding of the role of Defence in both the past and the present, contributing to greater public awareness of security and defence in a changing world

1.5 Objective and motivation

I see the challenge of designing a museum and knowledge centre for the Ministry of Defence as an opportunity to connect architecture, history and societal relevance. The rich history of the Kolonel Palmkazerne provides a strong base for combining existing structures with new architectural interventions. The decision to design for the Ministry of Defence is informed by my background as a military working student at Defensity College, which gives me insight into the organisation and a sense of responsibility to contribute to a broader social discussion.

I have noticed that the role of the Ministry of Defence is receiving increasing attention within society. Discussions about national security and the future of Defence have become more prominent, creating a growing need for information and public engagement. From this perspective, a Museum and Information Centre offers a suitable public function, bringing together history, education, information provision and recruitment in one location.

This results in an architectural approach that combines old and new uses through spatial organisation, materialisation and zoning. Spaces that communicate the historical layers of the building can retain original materials and layouts, while areas focused on the future of Defence can adopt more contemporary spatial and material strategies. Central to the design is the architectural question of how existing and new elements can be meaningfully integrated, including technical considerations regarding material connections, reuse of residual materials and the role of existing structures in future adaptations.

2. Approach

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2.1 Methods

2.1.1 Strategy and research techniques

This research uses a design-oriented research process, combining literature study, case studies and spatial analysis. Based on the research and design questions, the focus is on spatial layout, routing, zoning and flexibility in the context of repurposing military heritage.

The literature study concerns museum routing and visitor experience. The literature by Kali Tzortzi, Museum Building Design and Exhibition Layout, concerns the degree of control and freedom of choice in museums (Tzortzi & The Bartlett School of Graduate Studies, UCL, 2007). In addition, literature from the book Metamorphosis, the Transformation of Dutch Museums (Roos et al. (n.d.)). is used. This provides insight into how spatial layouts and architectural interventions influence the experience and interpretation of museums.

Based on the above literature, four case studies are analysed: the National Military Museum, Marinemuseum, the Marines Museum and the National Maritime Museum. These museums are examined using spatial drawings and diagrams that provide insight into routing, zoning and exhibition spaces. Based on the results, spatial design principles can be applied to the Kitchen Building of the Kolonel Palmkazerne. Figure 4 shows the scheme that can be followed for the strategy and research techniques.

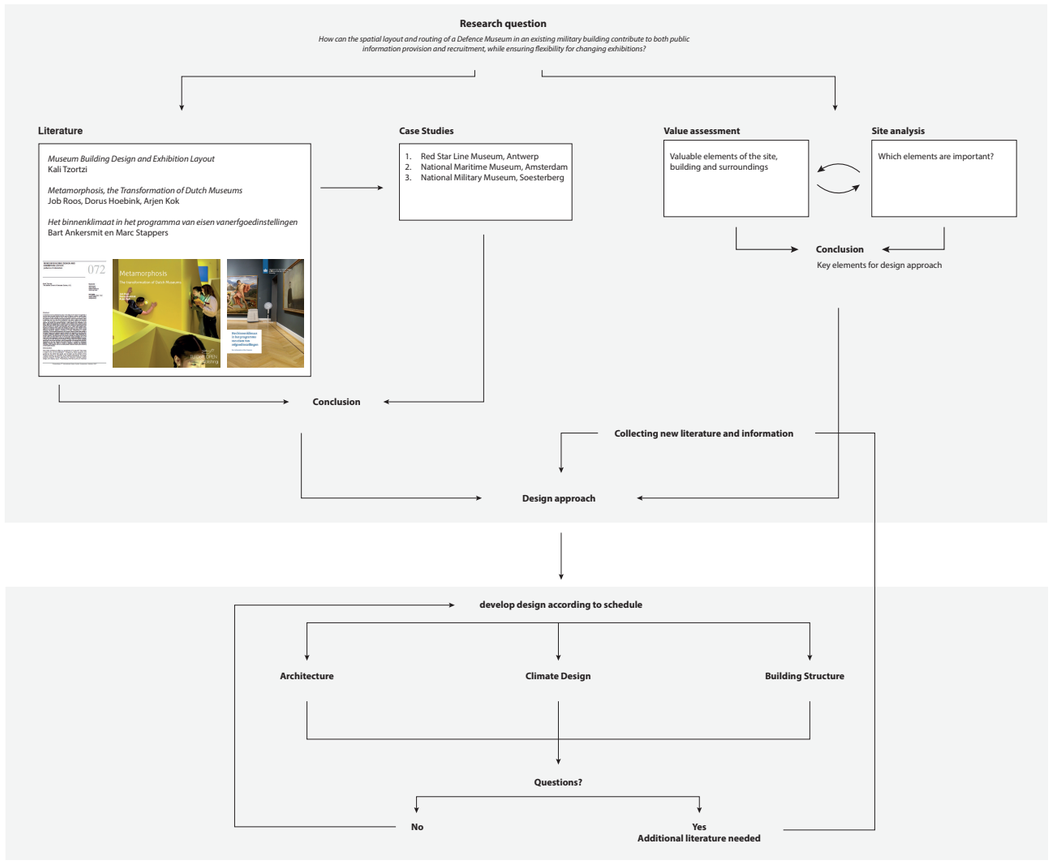

Figure 4: Scheme integration literature and design principles

2.2 Theoretical Framework

This chapter will discuss the literature on topics related to routing, spatial layouts and climate zoning in museums.

2.2.1 Routing

Routing is an important spatial principle in museum design because it determines how visitors move through the building. The structuring of spaces in a certain order influences the legibility of exhibitions, but also the degree of freedom, exploration and engagement of the visitor (Tzortzi & The Bartlett School of Graduate Studies, UCL, 2007).

In his paper, Museum Building Design and Exhibition Layout: Patterns of Interaction, Tzortzi describes a number of aspects relating to routing in a museum. A distinction is made between highly structured routes and routing with more choices. Linear, structured routes offer a high degree of control and ensure that the narrative of an exhibition is clearly conveyed. On the other hand, visitors have less freedom to determine their own route through the building. A route with many choices allows for individual exploration and different interpretations of an exhibition (Tzortzi & The Bartlett School of Graduate Studies, UCL, 2007).

Figure 5 shows a schematic representation of the two types of routing. The Kroller-Moller Museum has a dominant main route, while at Tate Britain, visitors can choose how they move through the museum.

The figure also shows a few gathering and switching points within the routing, shown in grey. Tzortzi describes this as a 'gathering space'. These spaces function as orientation points and allow for a great deal of freedom of choice within a spatial structure. In addition, gathering space can connect different functions with each other.

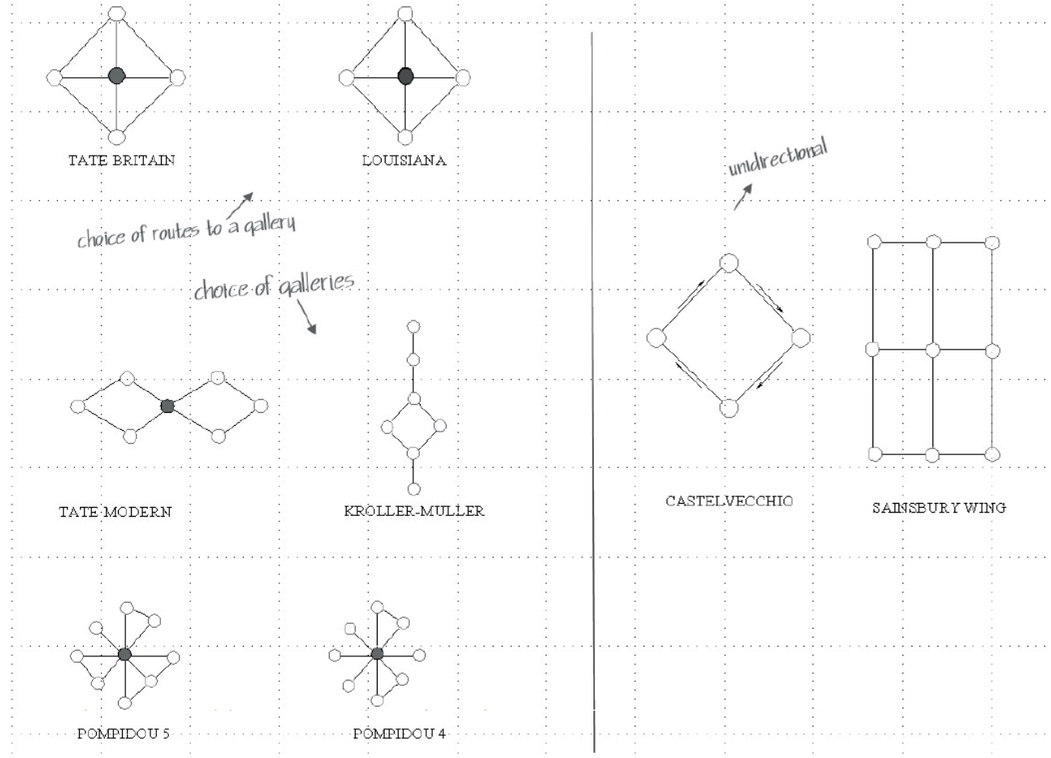

Figure 5: Types of routing in museums
(Tzortzi & The Bartlett School of Graduate Studies, UCL, 2007)

2.2.2 Spatial planning

The book Metamorphosis (Roos et al., n.d.) examines the spatial performance of a museum, where architecture, programme and experience are interconnected. The book describes the 'performance heptagram', which is a systematic analysis of a number of themes that a museum focuses on. Together, the seven elements form a unique museum experience.

In addition, it describes how so-called 'warm-up and cool-down' zones play an important role in spatial performance. Warm-up zones, such as entrances, foyers and transition areas, guide visitors in the transition from everyday life to the museum experience. Cool-down zones, such as cafes and museum shops, mark the return to everyday life, where visitors' initial reflections and conversations take place (Roos et al., n.d.). These zones contribute to a smooth and complete visitor experience. The focus of the museum thus becomes a coherent spatial whole, in which staying, meeting and giving meaning are central.

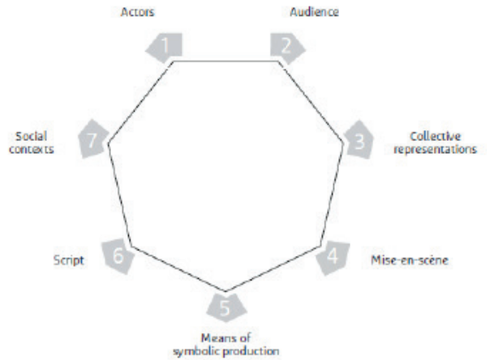

Figure 6: The museum performance heptagram (Roos et al., 1905)

2.2.3 Climate zoning

Air conditioning in a building is very important, especially in a museum setting. The Cultural Heritage Agency of the Netherlands states that there is a difference between collection areas and non-collection areas within a museum (Ankersmit & Stappers, 2020). In collection zones, human comfort is not as important, and controlling relative humidity is more relevant. The focus here is on properly maintaining the objects in this space. Non-collection zones are only used by people. The indoor climate can be fully tailored to people's comfort.

Figure 7 shows a diagram illustrating the relationship between the programme of requirements and the information provided by the Cultural Heritage Agency of the Netherlands. The zoning takes into account the different climate zones present in the building. For further elaboration of the programme and layout, it is important to take these zones into account so that each space can be ventilated and heated in the right way.

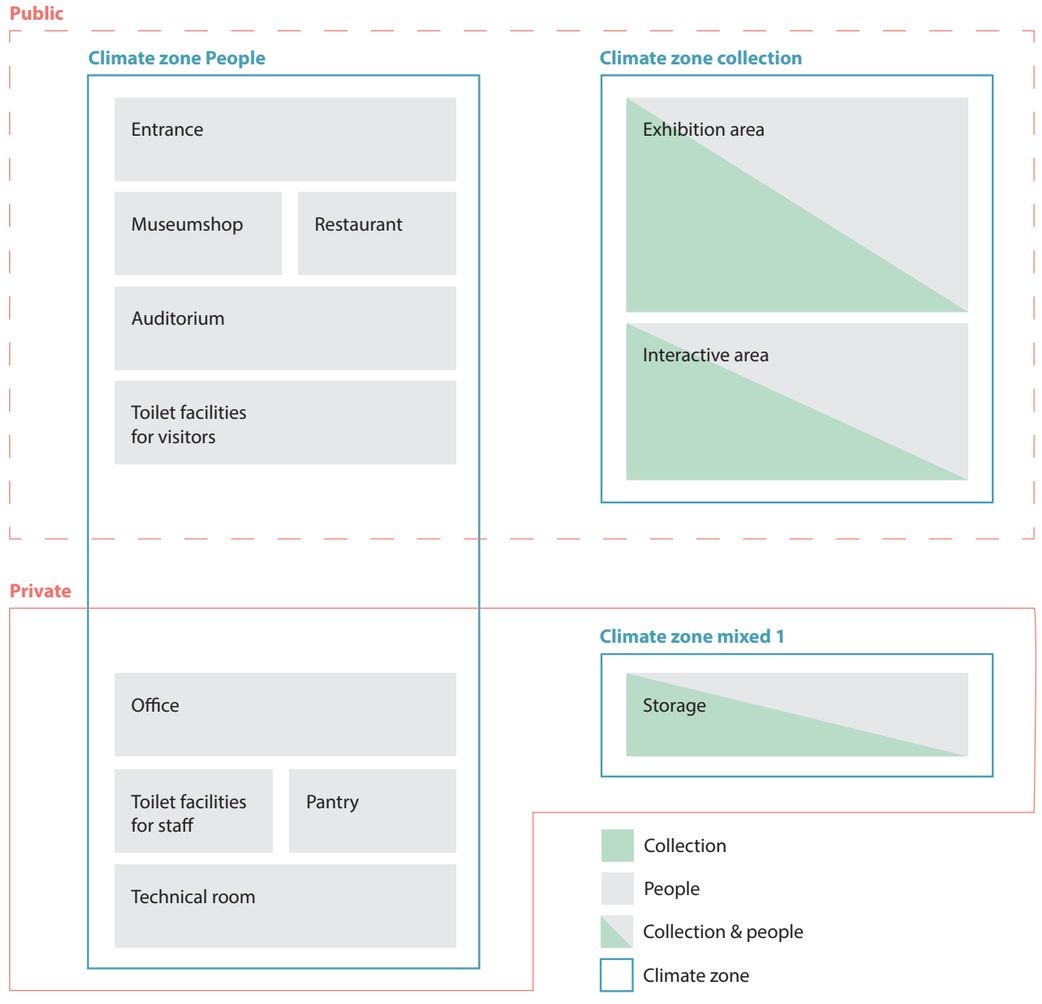

Figure 7: Relationship diagram climate zoning

2.2.4 Case studies

The literature reviewed has been applied to three case studies for further analysis:

- Red Star Line Museum, Antwerp
- National Maritime Museum, Amsterdam
- National Military Museum, Soesterberg

All three museums have a different appearance, from renovation to new museum, which is interesting to analyse these three case studies in relation to the literature discussed. Below is a brief summary of the three museums. The full analyses and diagrams are included in Appendix III.

Figure 8: Red Star Line Museum, Antwerp
(Stad Antwerpen, 2025)

Red Star Line Museum, Antwerp

The Red Star Line Museum in Antwerp is located in the former buildings of the Red Star Line shipping company. The renovation focused on preserving the building, ensuring that the site's historical identity remains visible. The museum's route follows the original migration process, so visitors follow the same linear route. The full analysis is included in Appendix III (Figure C1).

Figure 9: National Maritime Museum, Amsterdam
(Unique Venues of Amsterdam, 2025)

National Maritime Museum, Amsterdam

The renovation of the National Maritime Museum focused on improving the visitor experience. The addition of a covered courtyard has made new public facilities more accessible. The covered hall now serves as a clear 'warm-up' zone, while the new facilities have been given a 'cool-down' function. The full analysis is included in Appendix III (Figure C2).

Figure 10: National Military Museum, Soesterberg
(Nationaal Militair Museum, 2025)

National Military Museum, Soesterberg

The National Military Museum in Soesterberg displays the history and activities of the Ministry of Defence, while maintaining a strong connection between the objects and the former airbase on which the building is situated. The museum features a flexible visitor route, allowing visitors to choose for themselves which exhibitions or objects they wish to view. The full analysis is included in Appendix III (Figure C3).

2.2.5 Value assessment

The value matrix of the Kitchenbuilding is based on the literature Designing from Heritage, Strategies for Conservation and Conversion (Kuipers et al., 2017). The value matrix developed by Kuipers and De Jonge is used to systematically evaluate the values of existing buildings in the context of repurposing and renovation. This matrix is based on the idea that the value of a building is not viewed from a single perspective, but consists of a combination of different values, including historical, architectural, urban, social and technical aspects. By analysing and comparing these values per scale level (environment, building, structure and components), the matrix shows which elements are crucial to preserve. The purpose of the matrix is to make an informed assessment for design decisions.

Different colours are used in the value assessment:

- Blue: High monumental value
- Green: Positive monumental value meaning of the object or area
- Yellow: Indifferent value
- Red: No monumental value

The diagrams and explanations below present the main conclusions of the value assessment. These conclusions are based on the complete value matrix, which is included in Appendix II (Figure B1).

High monumental value
crucial to the structure and/or meaning of the object or area

- Strong position and relationship at the assembly point
  → *The main orientation of the building remains focused on the assembly point.*
- Keeping the building readable as part of the ensemble
  → *New additions respect the orthogonal structure, dimensions and hierarchy of the barracks layout.*
- Preservation and reuse of the supporting structure and basement

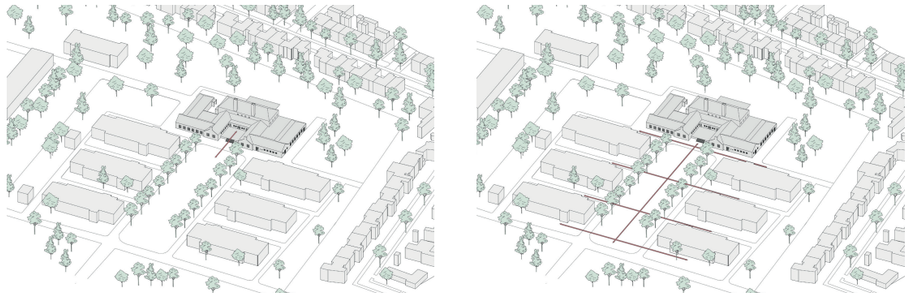

Figure 11: High monumental values Kitchenbuilding

Positive monumental value
important to the structure and/or meaning of the object or area

- Reprogramming the internal spatial layout
  → *Nonstructural walls and dividers may be moved or removed to enable new uses.*
- Reinterpretation of the transition between old and new
  → *New interventions may be visibly modern, as long as they don't overshadow the historic structure.*
- Strengthening the relationship with the surrounding greenery
  → *Openings and routes may involve the landscape context more actively in the building.*

Figure 12: Positive monumental values Kitchenbuilding

Indifferent value
of relatively little importance to the structure and/or meaning of the object or area

- Replacing interior finishes
  ⟶ *Ceilings, finishes and colour schemes may be completely renewed.*
- Adaptation of secondary spaces
  ⟶ *Storage, installation and service rooms may be freely redesigned.*

Figure 13: Indifferent values Kitchenbuilding

2.2.6 Site analysis

During the site visit, a site analysis of the Kitchen Building was made. Photos and a link to the floor plan provided a clear picture of the current state of the building. Figure 14 shows the analysis of the Kitchen Building.

Figure 14: Site analysis Kitchenbuilding

2.2.7 Conclusions

A review of the literature, case studies, value assessment and site analysis shows that a balance must be found between preservation and renewal in the transformation of the Kitchenbuilding. The value assessment indicates that the building's main structure and the relationship with the assembly point must be preserved. In addition, the interior of the Kitchenbuilding can be redesigned to suit its new function.

The literature and case studies focus on spatial structures, in particular the importance of a central orientation point. Furthermore, careful consideration is required in relation to the degree of freedom visitors need in the routes they can choose in the museum. It also appears that functions with similar climate requirements should be grouped logically.

These insights form the starting point for the further development of the design of the Kitchenbuilding into a museum and information centre for the Ministry of Defence.

Figure 15: Impression old situation Kolonel Palmka-

3. Results

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3.1 Design principles

Based on the literature, case studies and site analysis, a number of design principles have been formulated for the repurposing of the Kitchen Building into a museum and information centre.

The main goal of the repurposing is to keep the building as intact as possible wherever possible. The value assessment has shown that the appearance and character of the Kitchenbuilding are of very high value. The decision has therefore been made to make local interventions that improve the structure, climate control and overall condition of the building. The key design principles of repurposing are explained below.

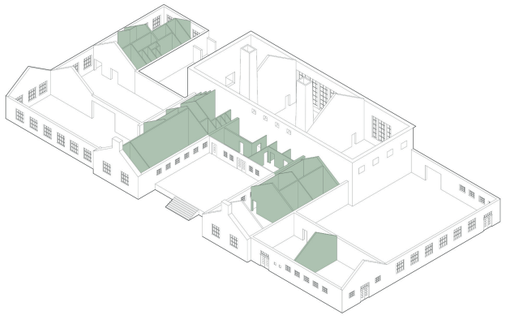


Figure 16: Design principle Kitchenbuilding

Reprogramming the internal spatial layout

The layout of the interior of the Kitchen Building is not suited to the building's future function. Partly as a result of the value assessment, it is possible to remove the internal walls in order to improve the museum's spatial layout.

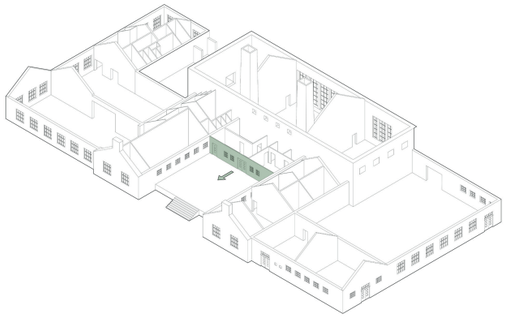


Figure 17: Design principle Kitchenbuilding

Reprogramming the frontal façade

The façade on the entrance side will be brought forward to create a stronger connection with the courtyard. This will also create a larger reception area inside the building.

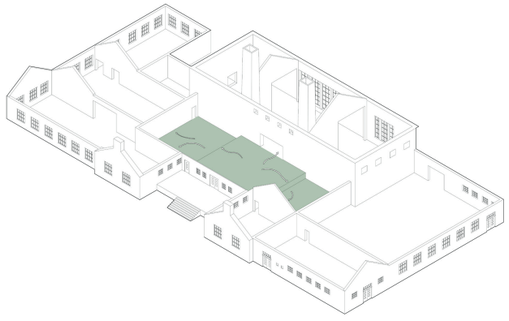


Figure 18: Design principle Kitchenbuilding

Facilitating a spacious entrance

By extending the front façade slightly and repositioning the internal walls, a large hall is created within the Kitchen Building. This serves as the entrance and circulation area. From this space, visitors can choose their own route, making every visitor experience unique.

3.2 Drawings and output

3.2.1 Demolition plan

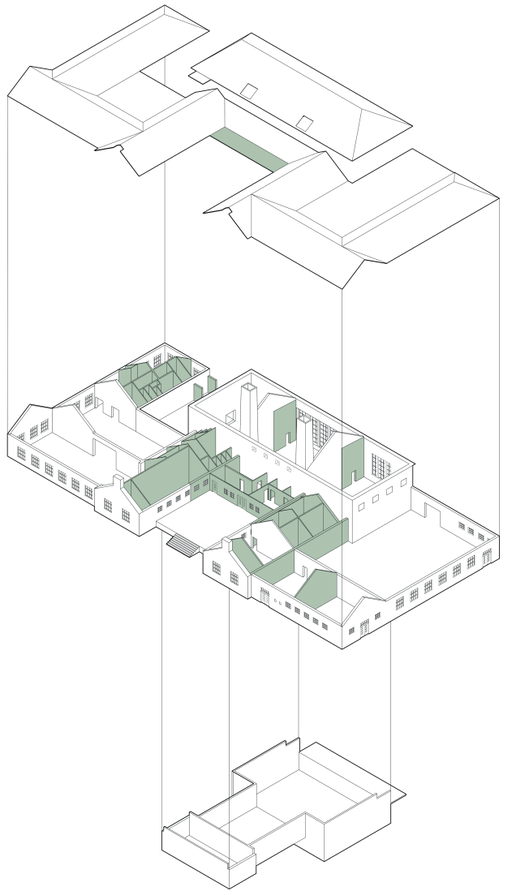


Figure 19: Demolition plan Kitchen Building

Figure 19 shows the demolition plan for the Kitchen Building. The walls shown in green will be demolished to make way for the building's future use. This supports the idea of retaining as much of the building as possible, whilst acknowledging that the internal walls do not hold significant value according to the value assessment. Consequently, the decision was made to largely alter the internal layout.

The walls on the ground floor are being demolished. The walls in the basement will remain unchanged. In addition, the chimneys will naturally remain standing, partly because they are of very high value in the value assessment.

3.2.2 Drawing set

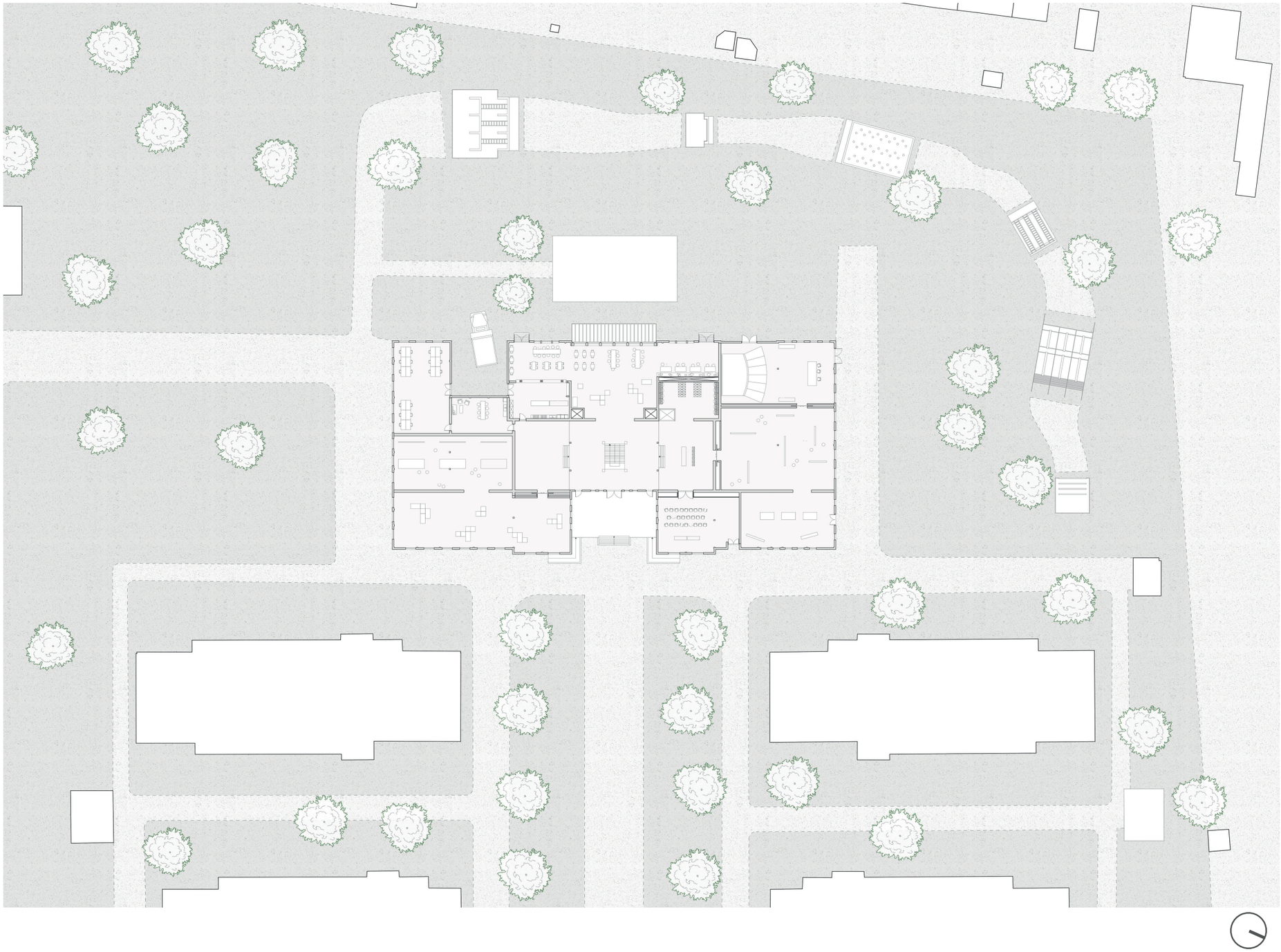


Figure 20: Situation drawing 1:500 (scaled)

Situation drawing 1:500 (scaled)

The design maintains the strong and historic link between the Kitchen Building and the assembly point. The assembly point continues to function as an important route to the museum, and forming the transition between the public domain and the former military area. By providing a clearly defined walkway across the assembly point, a natural separation is created between museum visitors and residents of the surrounding barracks.

At the back of the building, the museum experience is extended into the surrounding garden. Here, an obstacle course has been added as an extension of the experience areas in the museum. The obstacle course refers to a Defence component for the military and contributes to the museum's educational and promotional goals. Furthermore, this addition creates an active and visible interaction between the building, the landscape and the visitor.

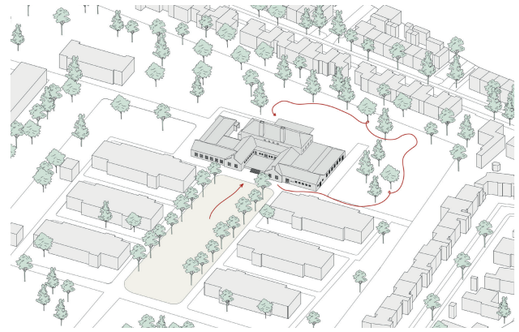


Figure 21: Connection between the assembly point and the garden at the museum

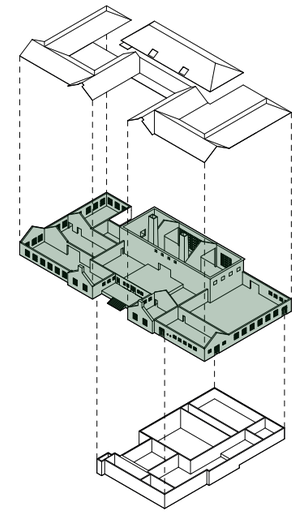
Figure 22: Impression Daytime walking route

Figure 23: Impression Nighttime walking route

Figure 24: Outdoor obstacle course

Floorplan ground floor 1:100 (scaled)

The new entrance hall forms the spatial heart of the design. The concept of moving the façade forward is clearly visible in this drawing: a central space is created that connects the various functions, visitor flows and different layers of time in the building. The exhibition spaces, located on both sides of the building, offer visitors a high level of choice: everyone chooses their own route and path through the museum.



Legend

1. Entrance
2. Museumshop
3. Restaurant
4. Interactive area
5. Exhibition space
6. Office
7. Pantry for staff
8. Auditorium
9. Storage
10. Toilet facilities
11. Changing room
12. Technical room

Existing elements / construction

New elements / construction

Figure 25: Floorplan ground floor 1:100 (scaled)

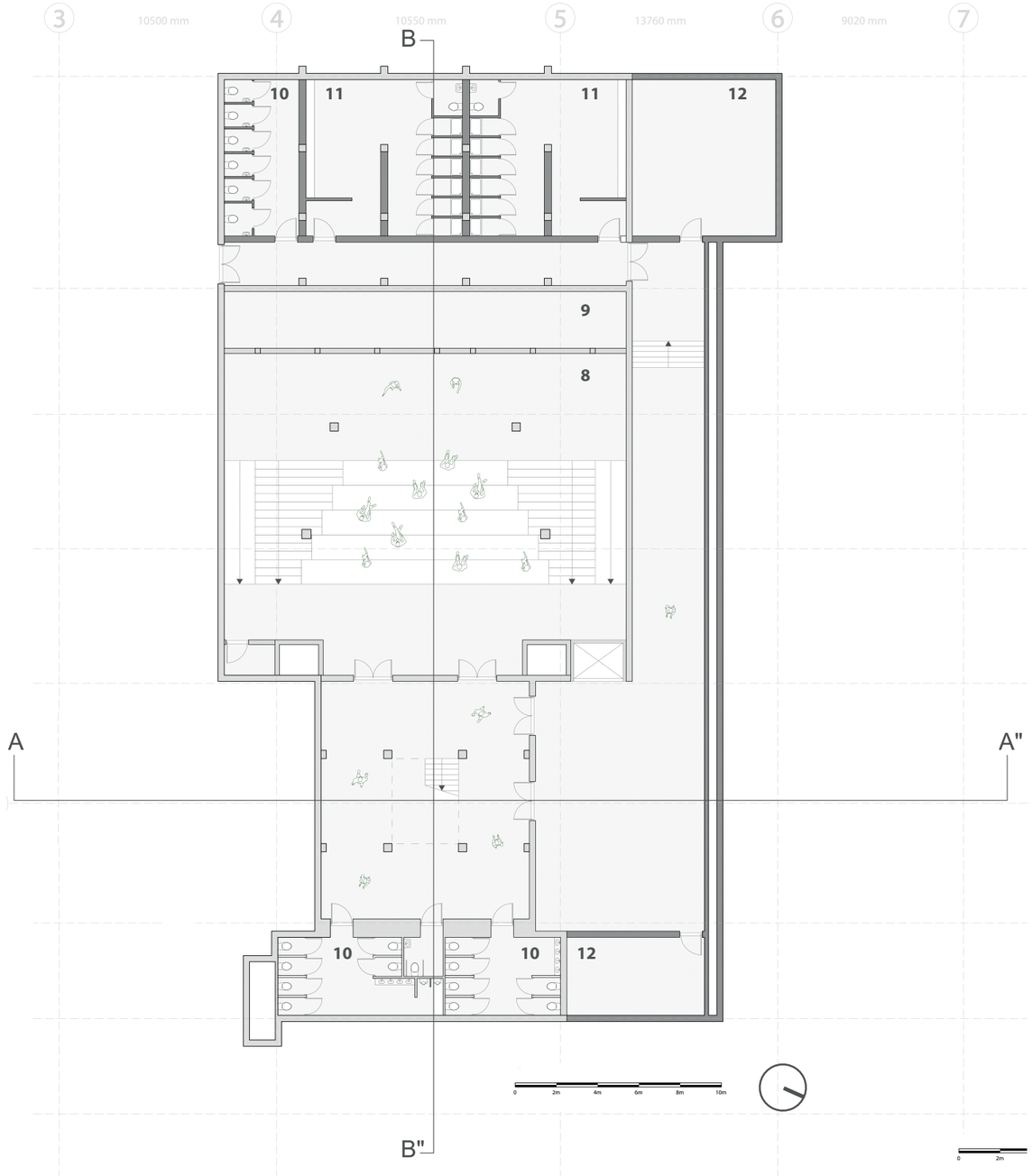
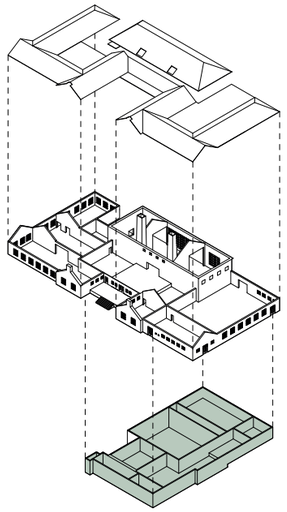


Figure 26: Floorplan basement 1:100 (scaled)

Floorplan basement 1:100 (scaled)

The basement provides space for the educational and informative elements of the programme, including lectures and information sessions. The extension of the existing basement also allows for the integration of support facilities, such as changing rooms and toilets. This ensures that the ground floor remains available for the museum's public functions.



Legend

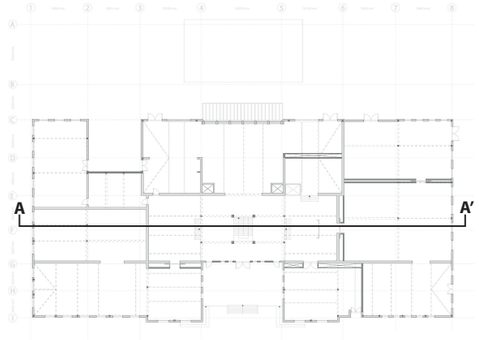
1. Entrance
2. Museumshop
3. Restaurant
4. Interactive area
5. Exhibition space
6. Office
7. Pantry for staff
8. Auditorium
9. Storage
10. Toilet facilities
11. Changing room
12. Technical room

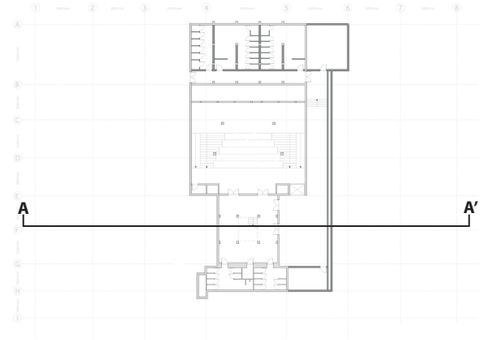
Existing elements / construction

New elements / construction

Section drawing AA' 1:100 (scaled)

The section drawnig AA' illustrates the spatial connection between the ground floor and the basement. At the centre of the entrance is an open staircase that connects the two levels and makes the basement visible from the building's public heart. As a result, the educational floor is not viewed as a separate programme element, but as an integral part of the visitor experience. The staircase functions as an important point of orientation within the visitor routes and highlights the relationship between the building's various functions and historical layers. The visual connection between the two levels contributes to the museum's open and inviting character.





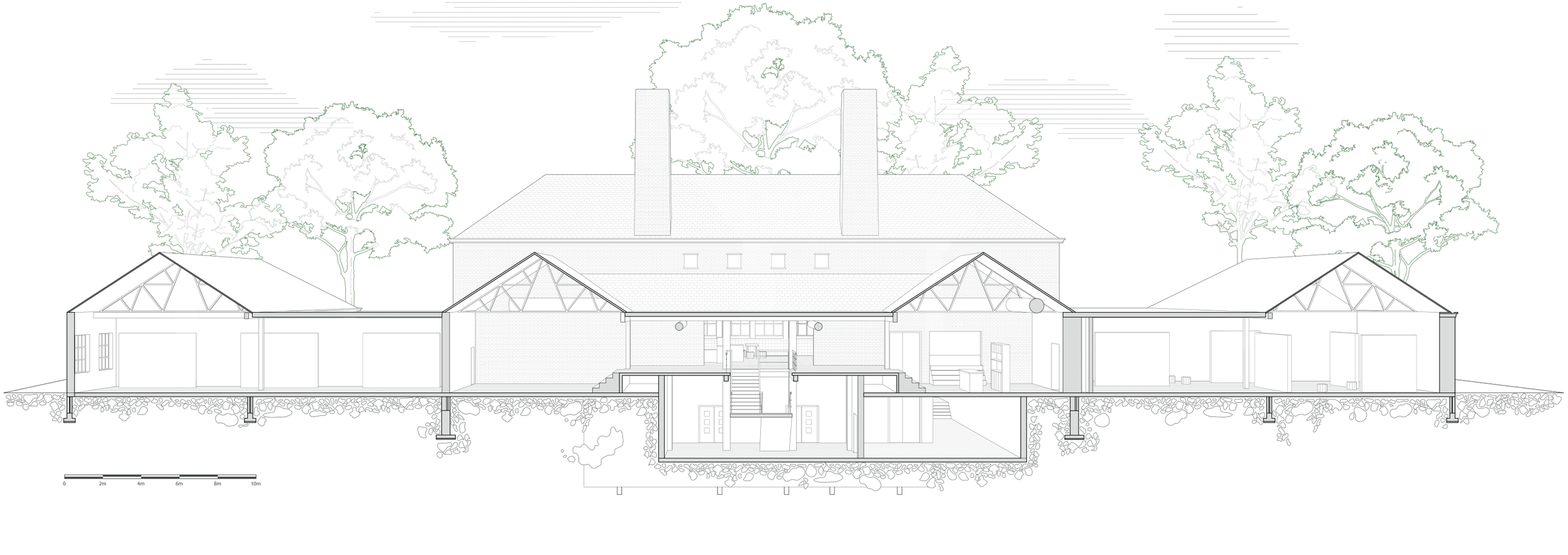
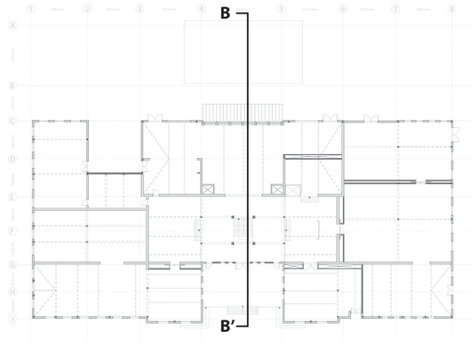
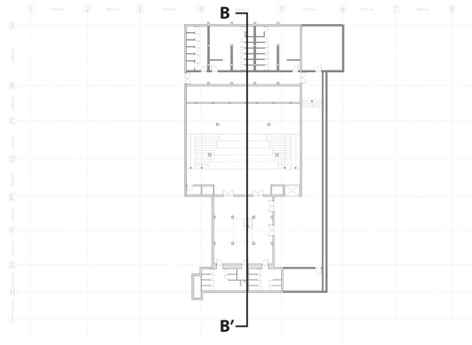


Figure 27: Section drawing AA' 1:100 (scaled)

Section drawing BB' 1:100 (scaled)

Section drawing BB' illustrates how the basement and ground floor function as a single connected space. The central staircase provides a clear view of the functions within the basement. The natural difference in level within the existing basement forms the base for an auditorium with stadium seating, meaning that only minimal interventions are required to transform this space into an auditorium where information sessions and lectures can be held.





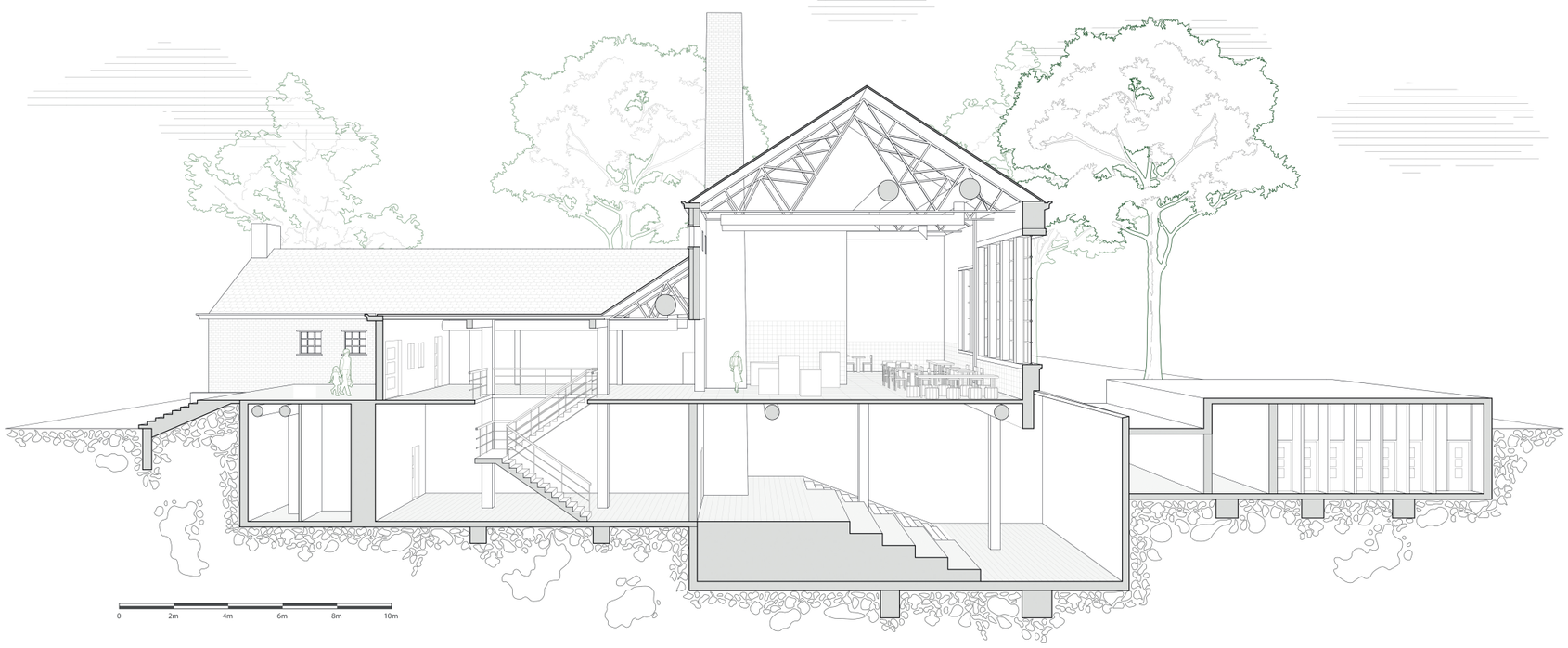


Figure 28: Section drawing BB' 1:100 (scaled)

Figure 29: Impression entrance museum

Front elevation 1:100 (scaled)

The façade of the Kitchenbuilding preserves much of the original appearance and position within the wider ensemble. A key principle of the design is the preservation of the characteristic architectural elements, including the brick façades, the volumes and the chimneys, which serve as landmarks of the former Kitchen Building. The architectural interventions are therefore localised and focused on facilitating a new museum function, ensuring that the building's historic character remains visible.

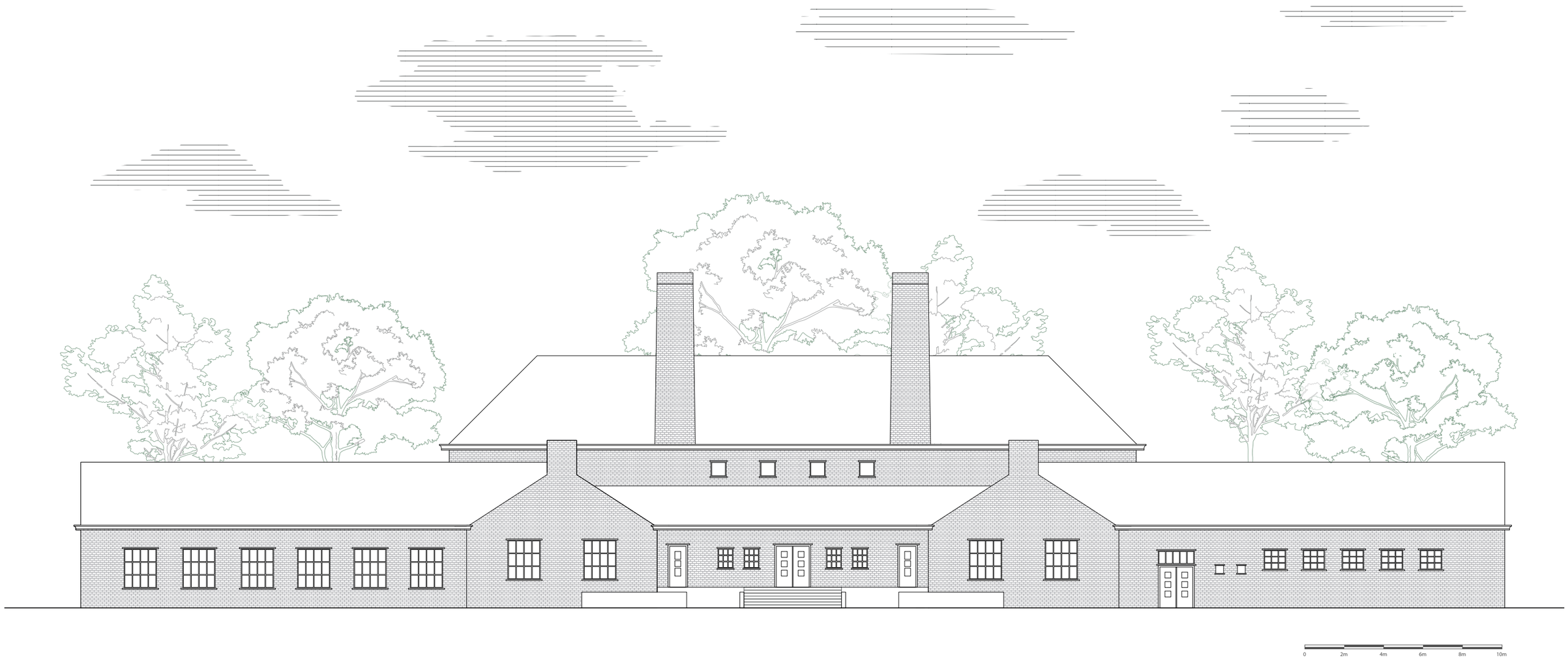


Figure 30: Front elevation 1:100 (scaled)

Back elevation 1:100 (scaled)

At the back of the building, the focus is on preserving the existing shell, which is in line with the results of the mentioned value assessment. New additions are carefully integrated into the existing structure, ensuring that the building's original scale, materials and composition are preserved. Through these local interventions, the Kitchenbuilding remains recognisable as part of the historic barracks site, while at the same time being adapted for a new public function.

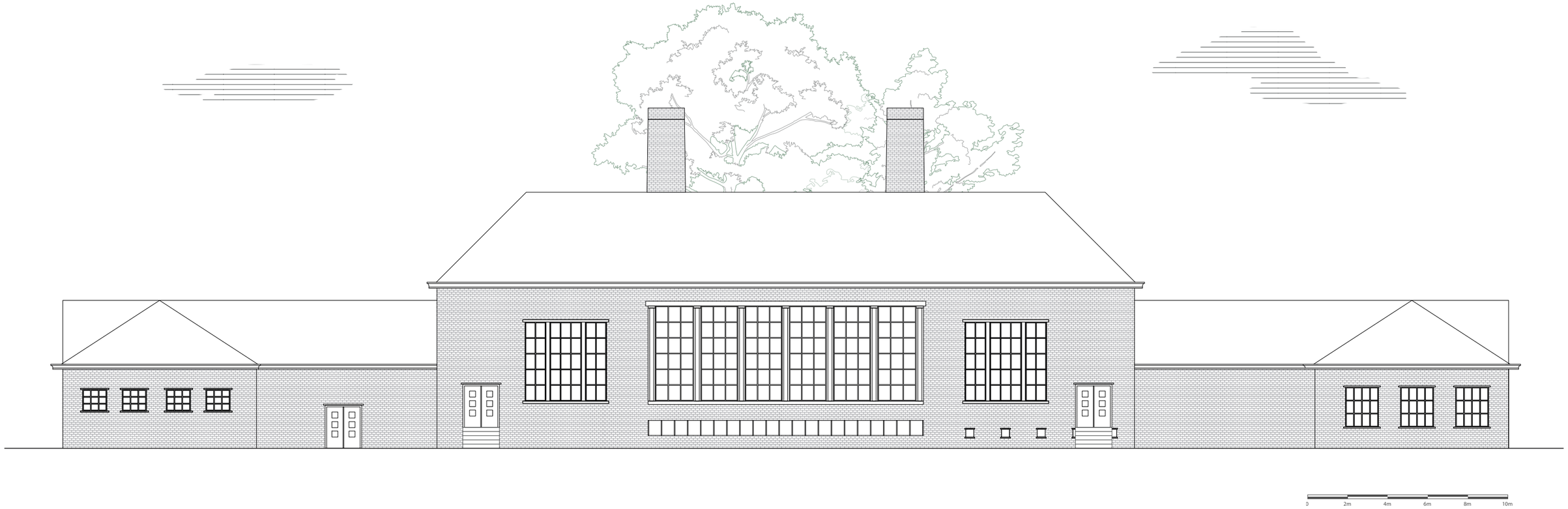


Figure 31: Back elevation 1:100 (scaled)

Section fragment, 1:50

The section drawing illustrates how the transformation of the Kitchenbuilding is realised through a careful balance between preservation and renovation. Where possible, the existing façades, structures and characteristic elements are preserved, allowing the historical identity of the building to remain visible.

As described earlier, the front façade has been moved forward to create space for a spacious entrance hall. Although this façade has been completely rebuilt from a structural perspective, the materiality aligns with the existing through the use of a brick skin. This keeps the appearance of the original Kitchen Building the same, while meeting current requirements for sustainability and comfort.

The section fragment also shows how existing and new elements are connected. New floor, façade and roof structures make the spatial transformation possible, while the historic building skin is preserved. This creates an atmosphere where the building's history remains visible, while new additions support the transition to a new public function.

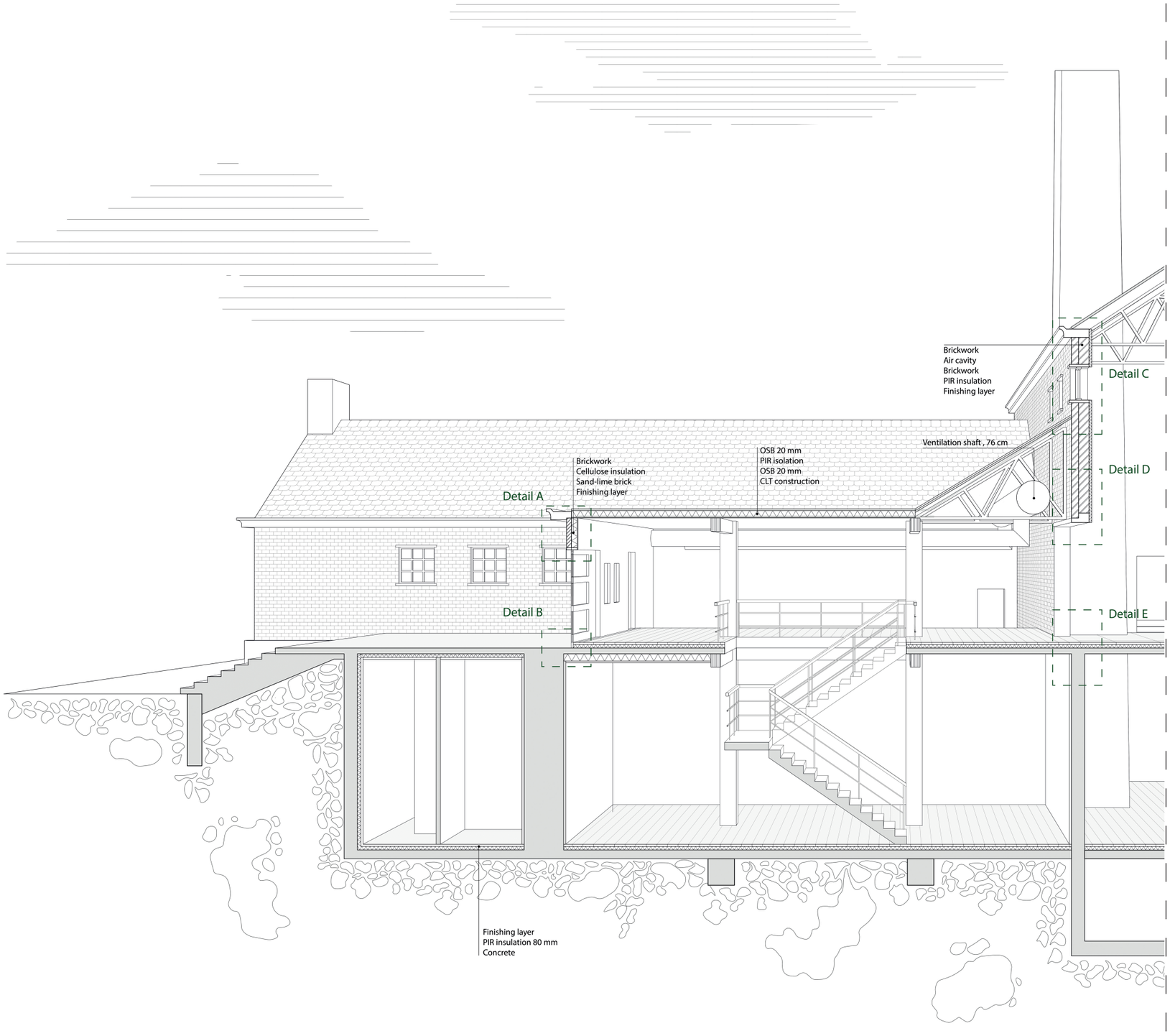


Figure 32: Section fragment 1:50 (scaled)

Detailed drawings

The detailing based on the 1:50 section fragment follows the same principles as the architectural transformation: retain where possible and intervene where necessary. The value assessment revealed that the existing building skin, load-bearing structure and architectural elements are of great value to the building's identity. It was therefore decided to retain these elements as much as possible, including in terms of structural detailing.

The detailed drawings A to E can be divided into two categories. Details A and B show the new entrance façade. This intervention is necessary to create the museum's new reception hall. Details C, D and E focus on the existing building skin and show how the historic façades and roof structures are being preserved, while their thermal performance is being improved.

The five details illustrate how existing and new building elements are connected. The new additions enable the spatial and functional transformation of the building, while the original architecture will remain recognisable to visitors.

Detailed drawing A 1:10 (scaled)

Detail A shows the connection between the new entrance façade and the roof structure of the central hall. Although the structure is newly built, the materials and detailing reflect the appearance of the original Kitchen Building, particularly in the brick façade and roof gutter.

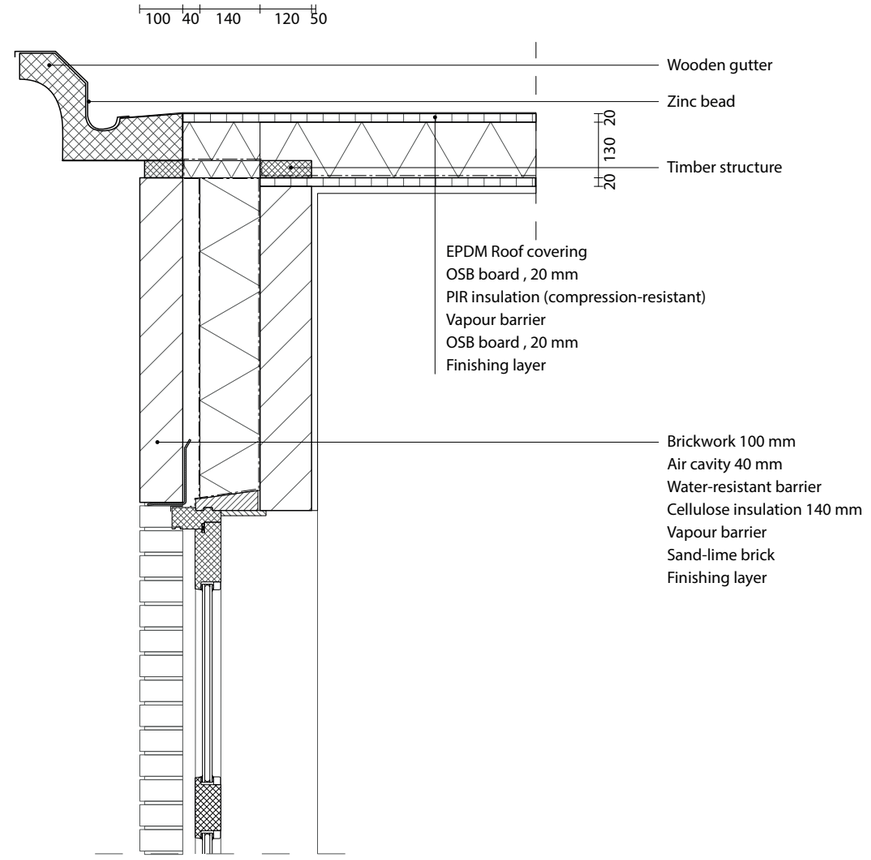


Figure 33: Detailed drawing A 1:10 (scaled)

Detailed drawing B 1:10 (scaled)

Detail B illustrates the transition between the new entrance façade and the existing concrete floor. Terrace tiles on supports provide drainage on the exterior, while the interior is finished with laminate flooring. To improve thermal performance, insulation and underfloor heating have been added above the existing concrete floor, preserving the original structure while meeting the current comfort requirements.

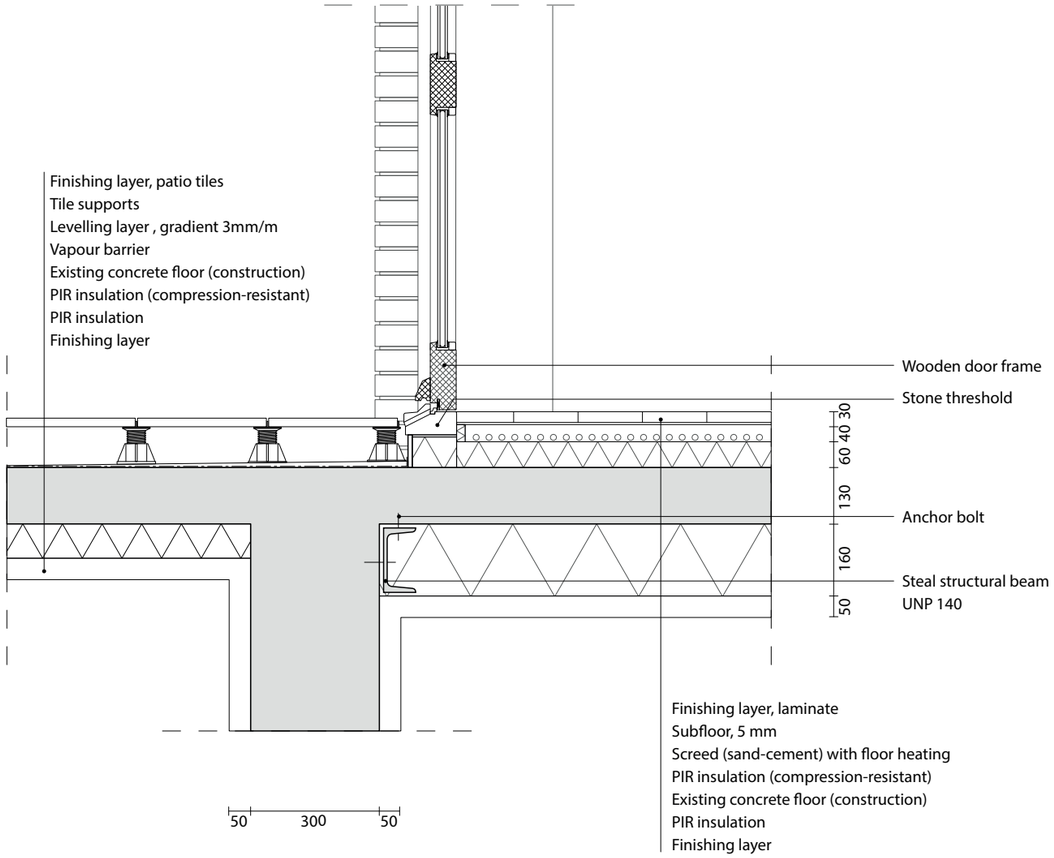


Figure 34: Detailed drawing B 1:10 (scaled)

Detailed drawing C 1:10 (scaled)

Detail C shows the connection between the existing façade, the new window frame and the roof edge. The existing roof structure, roof tiles and roof edge are preserved, while insulation and a vapour barrier are added from the inside to improve thermal performance. New timber window frames with insulating glazing match the original façade composition and contribute to a more comfortable indoor climate.

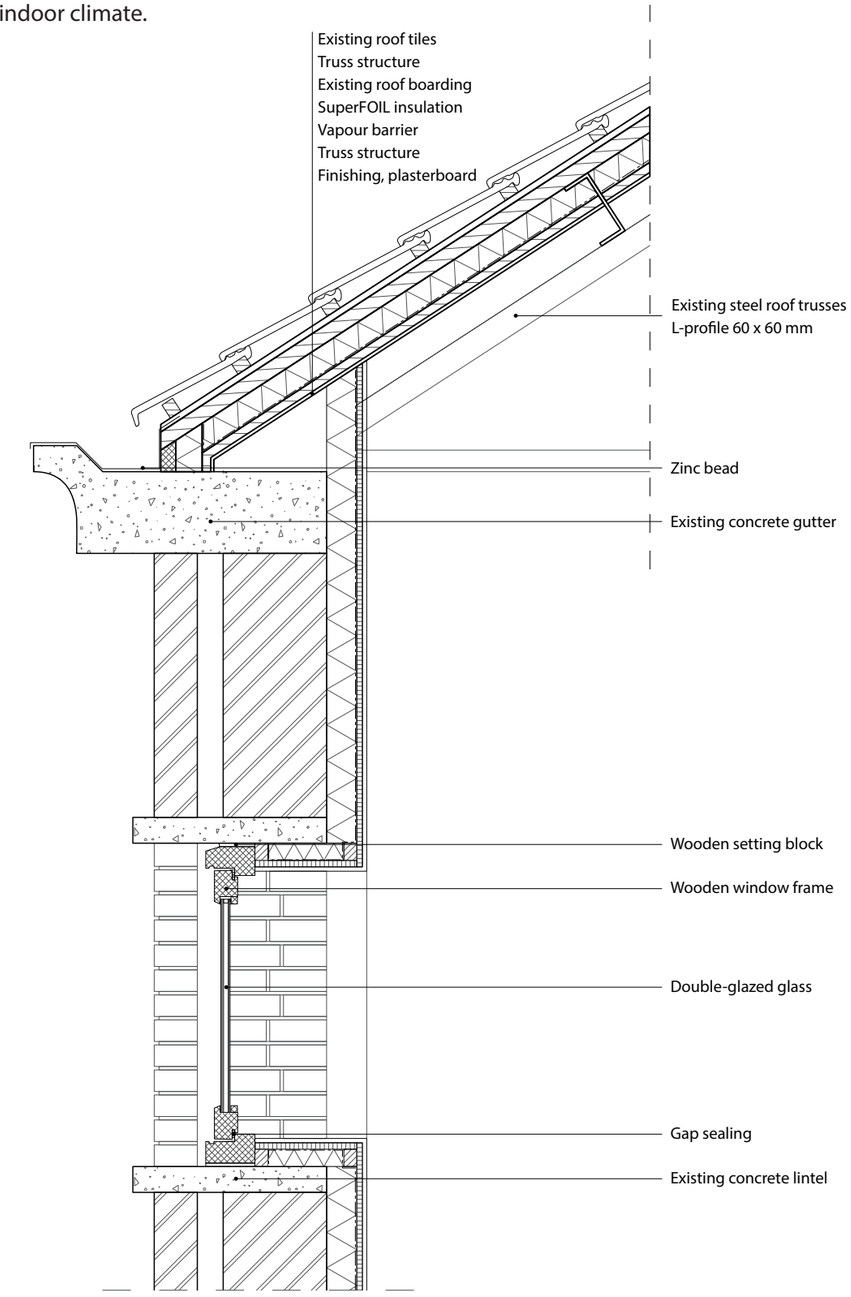


Figure 35: Detailed drawing C 1:10 (scaled)

Detailed drawing D 1:10 (scaled)

As part of the spatial transformation, structural elements of the façade have been demolished in various places to create an open space. Detail D is an example of this. It illustrates how a concrete lintel has been installed as a structural element within the façade structure. The brick wall had been giben additional insulation to ensure an optimal infoor climate

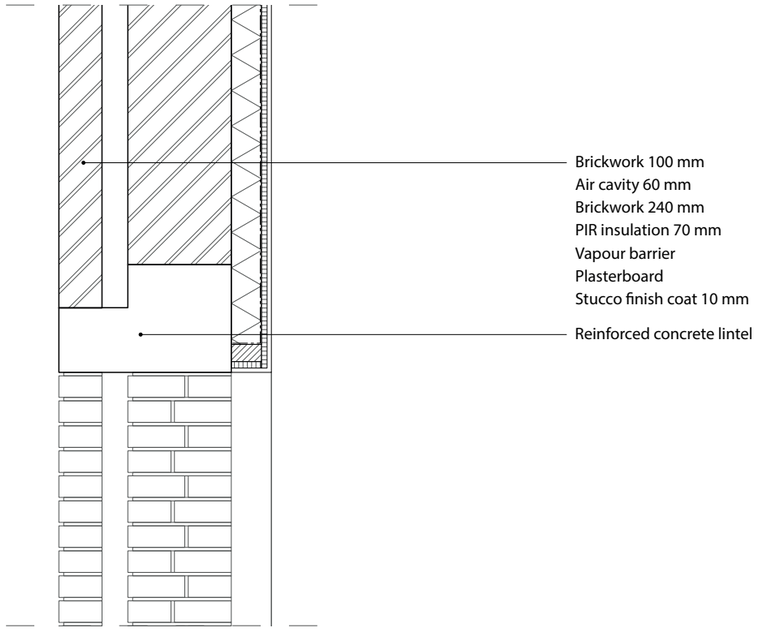


Figure 36: Detailed drawing D 1:10 (scaled)

Detailed drawing E 1:10 (scaled)

Detail E shows the structure of the new floor system and the transition between different floor finishes.

The existing concrete floor is upgraded with insulation, underfloor heating and a new finishing layer. A timber threshold marks the transition between the floor materials and continues into the façade opening, creating a subtle connection between the old and new elements of the building.

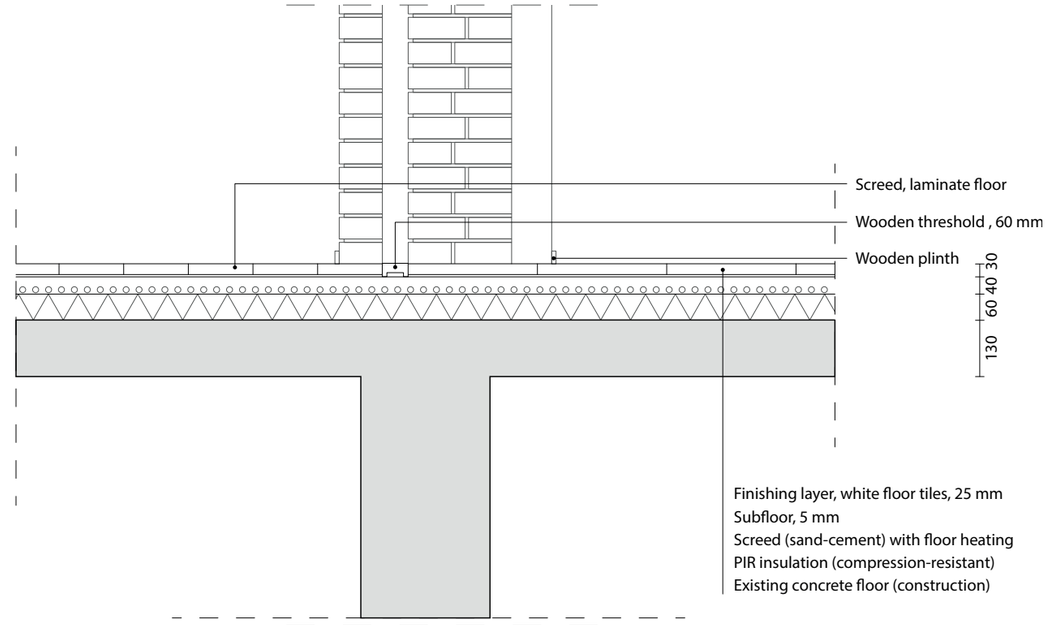


Figure 37: Detailed drawing E 1:10 (scaled)

3.2.3 Indoor Climate Strategy

To make the building suitable as a museum, a sustainable climate control system was chosen, based on thermal energy storage combined with a ground-source heat pump. The various rooms are heated via floor heating.

The design of the ventilation system is based on the climate zoning outlined in the relevant literature (Ankersmit & Stappers, 2020). A difference is made between visitor zones and exhibition spaces. The ventilation shafts are integrated within the existing building structure. The ventilation routes are shown in the floor plans on the following page. The full ventilation calculations and system sizing are included in Appendix V.

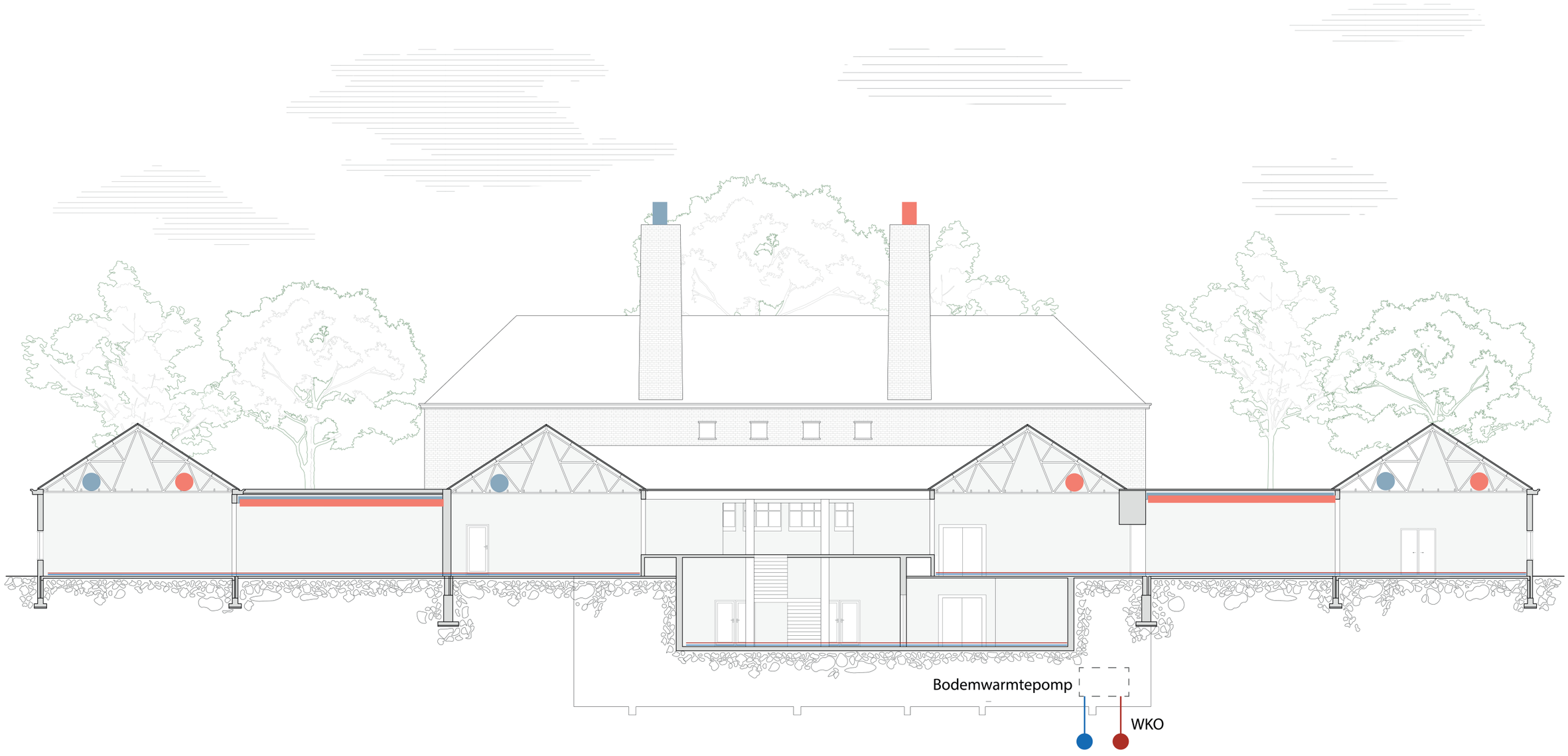


Figure 38: Indoor climate scheme

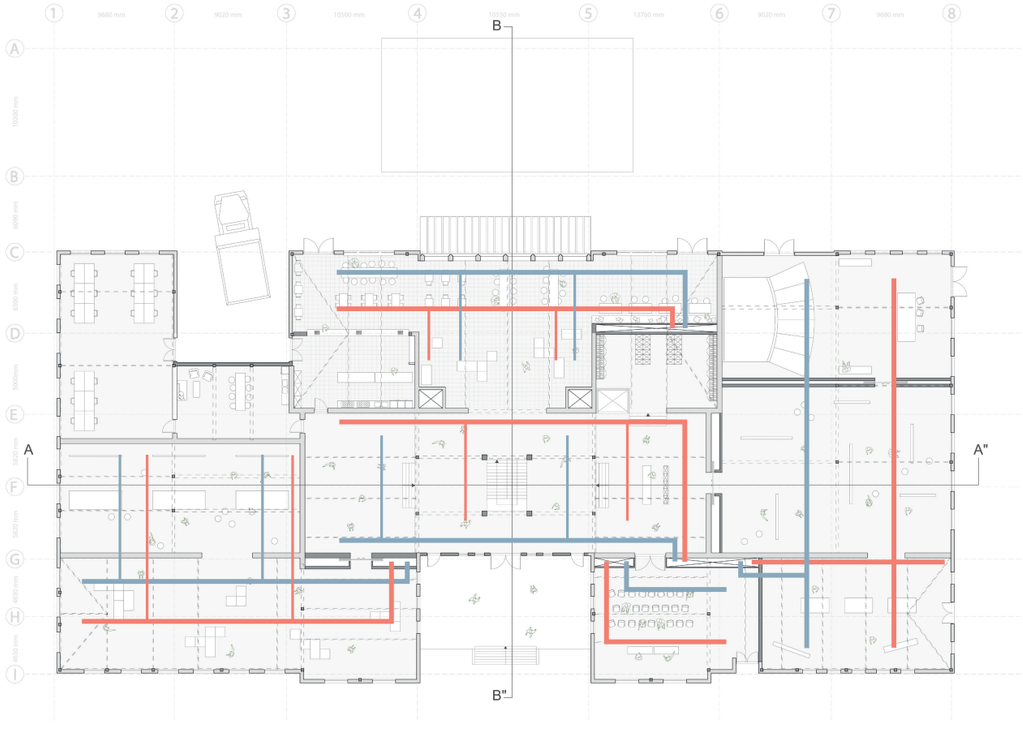


Figure 39: Floorplan ground floor ventilation strategy

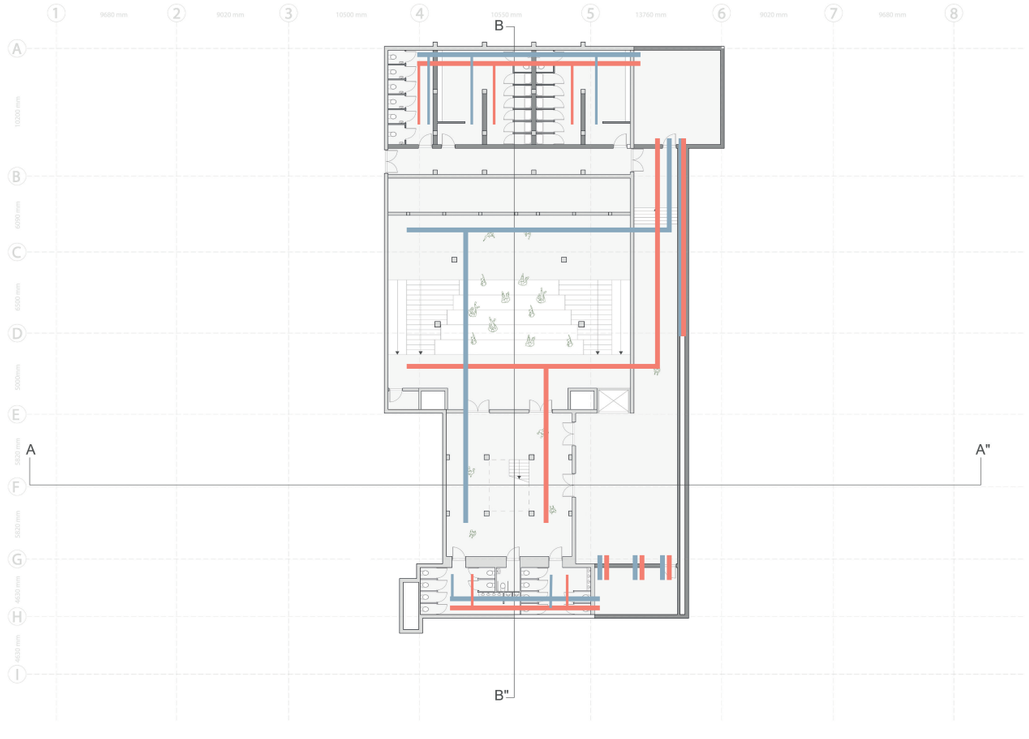


Figure 40: Floorplan basement ventilation strategy

3.2.4 Adaptive Reuse of the building skin

The existing façades will be preserved due to their architectural and historical value as part of the transformation of the Kitchenbuilding. With an Rc value of 0.89 m^2K/W, the current façade structure has limited thermal performance. Additional insulation will therefore be installed, improving the building's comfort and energy performance whilst preserving its original appearance. It is essential to improve the thermal performance of the façades without damaging the historical character of the building. Therefore, the existing outer skin will be preserved, while the inner side of the façade will be fitted with a new insulated structure and a new supporting structure. As the technical condition of the façades varies from site to site, two different insulation strategies have been used in the design.

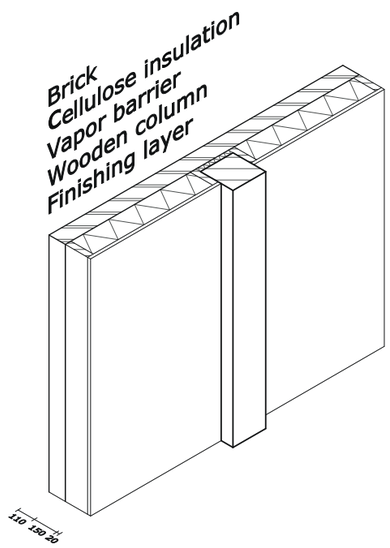


Figure 41: Facade construction option 1

Option 1

This façade system is used on the building's front façades, where the façade has been severely damaged. The cellulose insulation regulates moisture and offers good acoustic and thermal characteristics. Figure 42 shows where this façade system is used.

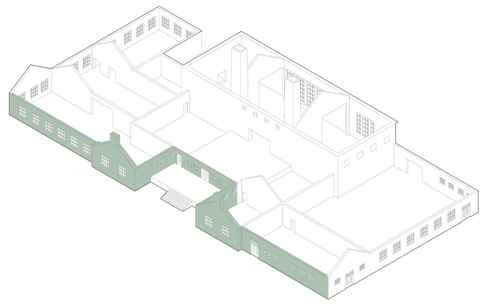


Figure 42: Location of the insulation - option 1

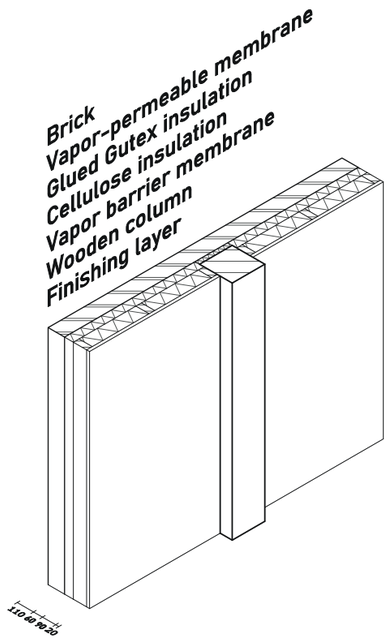


Figure 43: Facade construction option 2

Option 2

This facade package is used on the other facades of the Kitchen Building. The Gutex insulation is mainly used to create a healthy, moisture-regulating indoor climate. It is also highly sustainable and therefore suitable for use as insulation.

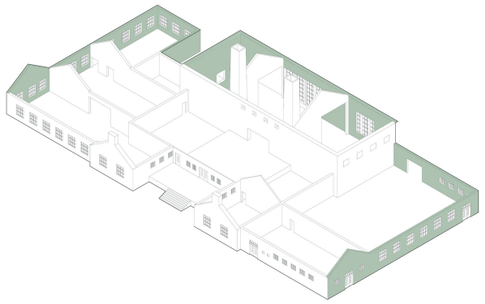


Figure 44: Location of the insulation - option 2

3.2.5 Structural Strategy

The design's structural system combines existing and new structural elements. The existing brickwork forms the primary support structure. In areas where new spatial interventions are being made, an additional timber structure is used, consisting of columns and beams. The axonometric projection in Figure 45 shows how the two systems are combined.

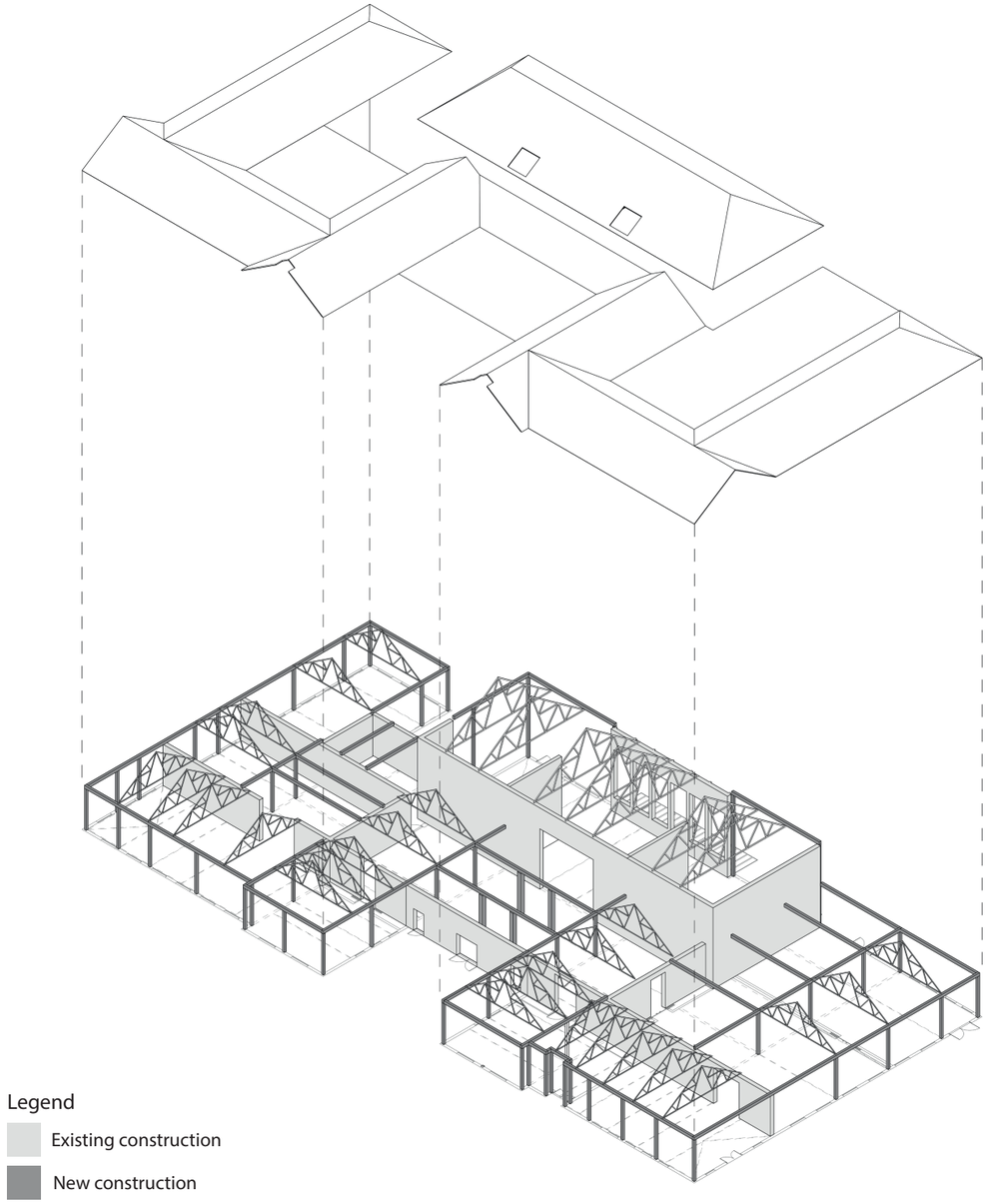


Figure 45: Axonometric drawing construction design

3.2.6 Spatial Experience

By preserving the existing kitchenbuilding and adding new architectural elements, a new layer of history is created in the building. The drawings below show how this layering is translated into the materialisation of the different spaces. While the restaurant reflects the history of the building and the Ministry of Defence by retaining existing materials and structures, the exhibition spaces and experience spaces are given a more modern look. This creates a noticeable contrast between the past and the future, making the building's transformation visible.

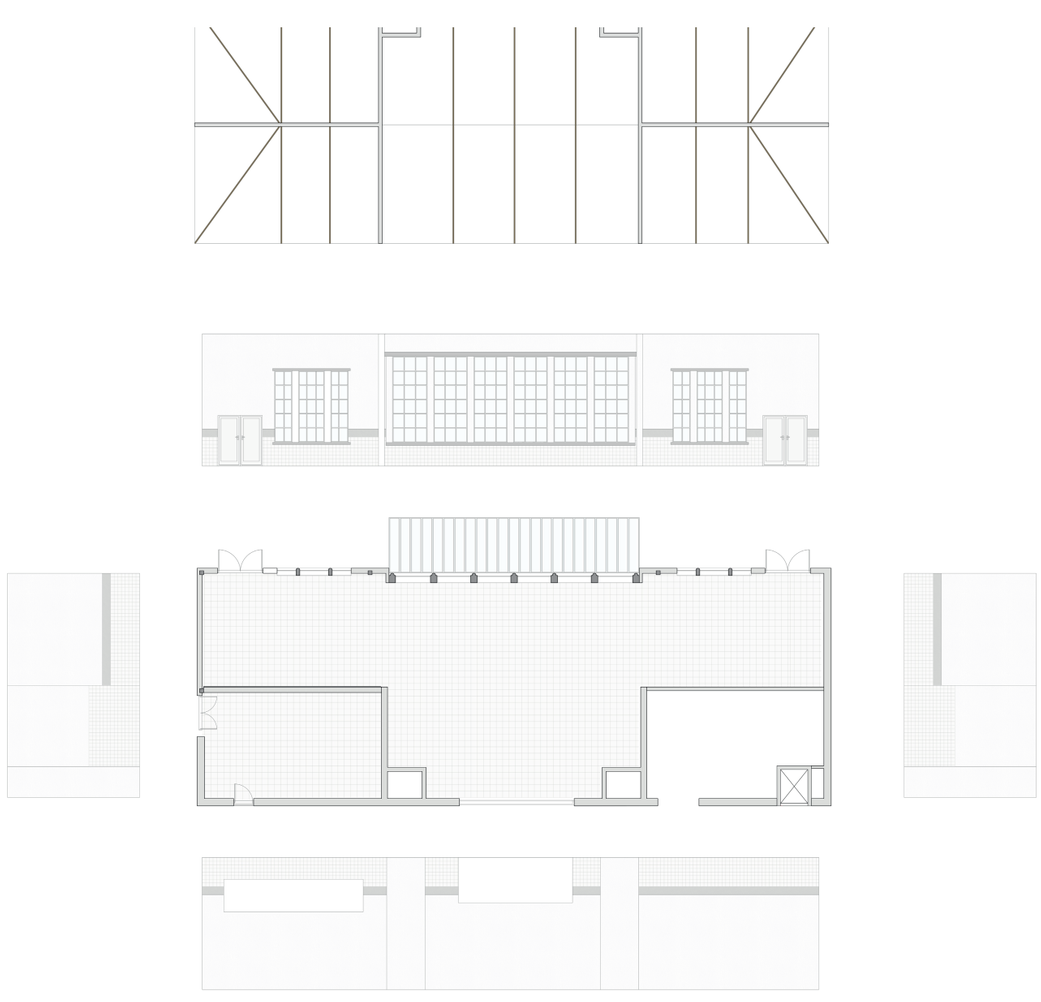


Figure 46: Materialisation of the restaurant and musuem shop

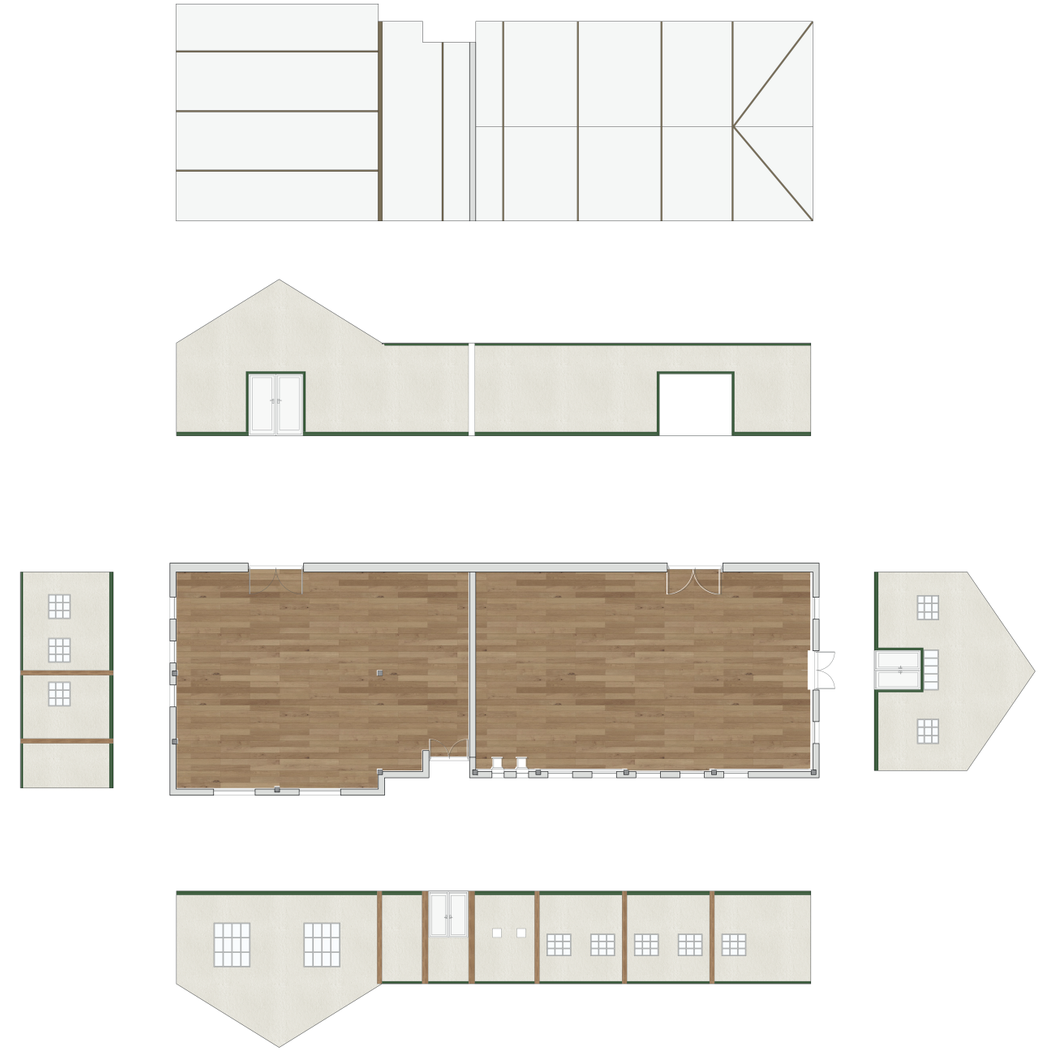


Figure 47: Materialisation of the exhibition area

Figure 48: Impression exhibition space

Figure 49: Impression restaurant and museum shop

Figure 50: Impression digital shooting facility

4. Conclusion and Discussion

4.1 Conclusion 76

4.2 Implications and Recommendations 77

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4.1 Conclusion

The repurposing of military heritage requires a careful balance between preserving cultural and historical values and creating new functions. This graduation project researches how the spatial layout and circulation of a Museum and Information Centre for the Ministry of Defence in an existing military building can contribute to both information provision and recruitment, while respecting the historical value of the building. The research has been applied to the Kitchenbuilding at the Kolonel Palmkazerne in Bussum, where a design has been created that connects the history of the site with a new public function, focused on education, information, recruitment and public engagement.

Research question

The research question posed during the project is as follows:

"How can the spatial layout and routing of a Defence Museum in an existing military building contribute to both public information provision and recruitment, while respecting the historical value of the building?"

Spatial planning and routing

The literature reviewed has shown that spatial layout and visitor routing play a significant role in facilitating both information provision and visitor engagement. The literature review and case studies show that visitors need a clear spatial structure, combined with enough freedom to make their own choices during their museum visit. This has been translated into a design in which a central hall serves as a point of orientation and a meeting area. From this space, the building's different functions are accessible, allowing visitors to determine their own route through the museum.

Information provision and recruitment

The combination of exhibition spaces, interactive functions, educational facilities and an auditorium makes it possible to reach different target groups. Historical exhibitions help to provide information about the history of the Ministry of Defence, while interactive spaces, lectures and information points give visitors an insight into the current organisation and future opportunities at the Ministry of Defence. In doing so, the museum not only informs visitors about Defence, but also contributes to a broader public understanding of the organisation and its role within contemporary society.

The visitor route supports this goal by allowing visitors to move naturally through these different areas, without requiring them to follow a strictly fixed route.

Preserving historical values

In addition, the report shows that a new public function can be integrated without affecting the historical value of the building. The value assessment reveals that the relationship with the assembly point and the main structure are of significant value and should therefore be preserved.
By applying new local interventions, a balance is created between preservation and renovation, ensuring both the historical identity and the future use of the building.

It can be concluded that the spatial layout and circulation of a museum and information centre for the Ministry of Defence can make a significant contribution to both information provision and recruitment. A central meeting space, combined with a route that combines orientation and freedom of choice, offers visitors the chance to get to know the Ministry of Defence in an accessible way. By combining this new function with the preservation of the historical values of the Kitchenbuilding, a design that brings together the past, present and future is created. In this way, this project shows that military heritage can be successfully repurposed for a public function without losing the historical relevance. At the same time, it creates a place where history, education, information provision and public engagement are brought together. This not only contributes to the preservation of military heritage, but also strengthens the relationship between Defence and society by increasing public understanding of the organisation and its role within a changing geopolitical context.

4.2 Implications and Recommendations

The conclusion demonstrates how the spatial layout and visitor flow of a Defence Museum and Information Centre can contribute to the provision of information, recruitment and the preservation of military heritage. At the same time, it is important to critically reflect on the assumptions made, the limitations of the research and the possible alternatives within the design process.

Assumptions and limitations

Although the design responds to the research question, different assumptions were made during the research and design process that have influenced the results. The Programme of Requirements, discussed at the beginning of the report, was based on literature, reference projects and design choices, but was not tested for future users. As a result, further assumptions were made regarding the required spaces and visitor numbers. In addition, the ventilation and climate calculations provide insight into the technical feasibility of the design; this will be reviewed further at a later stage for a final installation design.

Routing and user research

The routing and spatial layout are also based mainly on literature reviews and case studies. Design principles taken from the literature have been applied in the design, but the proposed routing has not been tested with actual visitors. This means it cannot be determined with certainty how different target groups will actually use and experience the building. Further research could focus on testing visitor flows, for example through simulations, interviews or user research.

Alternative design strategies

This project is based on a design strategy that aims to preserve the existing building as much as possible, with new local interventions. This approach is in line with the results of the value assessment and the principles of repurposing. At the same time, a more radical transformation could also have been chosen, replacing larger sections of the interior or the structure to create more design freedom. A comparison of different transformation strategies can offer interesting insights when comparing them with each other.

Relevance for future research

Despite these limitations, the project demonstrates that the combination of literature review, case studies, value assessment and design-oriented research forms a valuable method for the repurposing of military heritage. The design for the transformation of the Kitchenbuilding can be further adapted for similar military buildings that are given a public function in the future.

Furthermore, the research shows that the repurposing of military heritage can be more than just the preservation of a historic building. By combining heritage with information provision, education and social engagement, a new layer of importance can be added to existing locations. In the case of the Kitchenbuilding, this results in a design in which the military history remains visible, while at the same time offering space for current social themes and future developments within the Ministry of Defence. In this way, the project contributes not only to the discussion on the repurposing of heritage, but also to the question of how historic buildings can play an active role inside contemporary society.

4.3 Reflection

This final section of the graduation report reflects onthe graduation process from a personal perspective.

Design approach

Looking back on the graduation process, I approached this project differently from how I was used to. In previous design projects, the focus had been on the design itself from the beginning: formulating a design brief, developing a concept and working towards a final result. In this project, on the other hand, the focus was initially on understanding the existing building. Questions such as: *Where is the building located? What is the relationship with the surrounding area? Which parts are of cultural-historical value?* formed the starting point for the research.

In the beginning, I had to make a switch from designing straight away to analysing and understanding first. As a result, design choices were not based only on intuition, but could later be supported and defended on the strength of research. Looking back, this approach formed a solid starting point for the rest of the design process and helped in developing a clear design strategy for the Kitchenbuilding.

Personal involvement

The decision to focus the design on the Ministry of Defence was a personal choice for me. Because of my work with this organisation, I found it interesting to link a design challenge to a societal issue that I experience closely. From my own experience, I was aware that the Ministry of Defence faces challenges in various areas relating to personnel, capacity and public visibility.

This background helped me to approach certain design decisions from a different perspective. It gave me the opportunity to view the project not only as a designer, but also from the perspective of a future user and the organisation itself. As a result, the design felt personally relevant to me and I developed a strong sense of engagement with the subject.

Balance between space and exhibition

Although the graduation project generally went smoothly, I found that designing a museum also presented a specific challenge. I was frequently asked what exhibitions would be held there and which objects would be on display. This sometimes led to confusion about the question of whether I actually had to design an exhibition, or create the spatial conditions for an exhibition.

As the process continued, I began to approach this differently. Instead of designing a specific exhibition, I focused on designing spaces for future exhibitions. This shifted the focus to the materialisation, atmosphere and finish of the different spaces. What began as a point of uncertainty in the design process eventually grew into a key part of the project. It was working out the materials, details and spatial experience that proved to be an aspect where my interest and strength as a designer lie.

Looking back on the project as a whole, I am grateful for the freedom I was given to develop a design based on my own interests and skills. The project has not only taught me new design skills, but more importantly, a different way of looking at existing buildings. I have learnt how important it is to understand a building first before making design decisions, and how research, analysis and design can strengthen each other. I will carry this integrated approach to architecture forward into future projects, and for me it is one of the most important lessons from this graduation project.

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5. Appendices

5.1 Appendix I: Planning

Figure A1, on the next page, provides an overview of the design and research approach followed during the graduation project. The schedule shows how the various phases, from literature review and analysis to design development and detailing, followed on from one each other. This provides insight into the design process and the connection between research, design decisions and technical detailing.

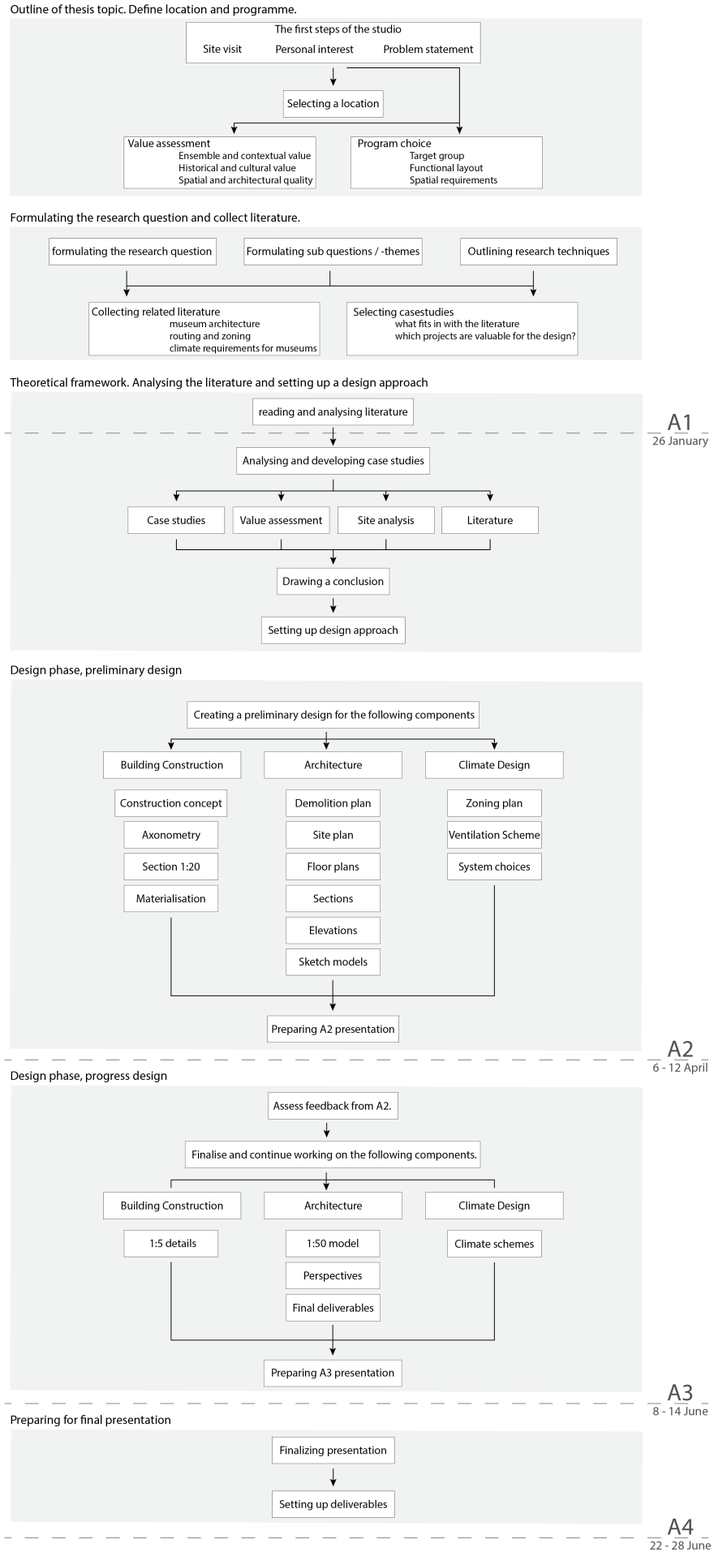

Figure A1: Project schedule

5.2 Appendix II: Value Assessment

The full value assessment is shown in Figure B1. It illustrates how the valuation of the Kitchen Building was structured and assessed.

	SOCIAL	ECONOMIC	POLITICAL	HISTORIC	AESTHETICAL	SCIENTIFIC	AGE	ECOLOGICAL
SURROUNDINGS / SETTING [+]	De betrekkelijke afgesloten periode van de kazerne ten opzichte van de rest van de omgeving	No specific defects or extra costs in the direct outside space surrounding building 13		De kazerne ligt gelegen langs de A1 en dichtbij de Nieuwe Hollandsche Waterlinie. Vroeger was dit belangrijk in tijden van dreiging. 	Objecten vormen een ensemble, waarbij repetitie, uniformiteit, zchtlijnen en klassieke, hiërarchische ordening van gebouwen belangrijke elementen vormen.		Door vele toevoegingen is elke Boostkazerne anders, hierdoor heeft elke kazerne zijn eigen karakter.	De kazerne is gesitueerd in een groen gebied.
SITE	Het keukengebouw is vanwege zichtbaarheid en fucntie van hoge waarde. Doordat in dit gedeelte van het plangebied slechts beperkte verwijzingen zijn naar de legerplaats, zijn deze elementen juist daardoor cultuurhistorisch waardevol.	Extra costs to be expected for remedation of asbestos and toxic materials in basement		Het keukengebouw diende als 'afsluiter' van de appelplaats. Er was geen poortgebouw aanwezig op de kazerne. Daarnaast vormen het exercitieterrein, paden en wegen zijn allen cultuurhistorische elementehet een essentieel onderdeel van het grotere ensemble op de kolonel Palmkazerne. De overige gebouwen vertellen het verhaal van WOII, maar behoren niet tot de eerste opzet van Boost. Spiegelhorst is niet representatief voor eigen stijl en niet zeldzaam. Ook staat het los van het ensemble	Onsamenhangend gebouw. Doet niet recht aan zijn centrale positie ten opzichte van de appélplaats. 	Ensemble staat in een streng orthoginale structuur.	Technical state of basement is well. No damage > high rest-of-life, but present chemicals bring risks.	De groene structuur is een kenmerk van het stuw-wallenlandschap van het Gooi. Het Gebed zonder End vormt een beeldbepalende lijn in het plangebied. Chemical substances + asbestos =environmental stress & health risk
SKIN (exterior)		. - facade masonry okay - concrete not - timber frames okay - steel frames rusted - roof tiles are gone		De stalen kozijnen vergroten de historische leefbaarheid en is kenmerkend voor de bouwmethodiek van het tweede kwart van de 20e eeuw. De westgevel die grenst aan de keukenruimte heeft nog de originele stalen kozijnen.	Sobere uitstraling en weinig aandacht aan detaillering, decoratie of ordamentiek. Detaillering van het Keukengebouw sluit aan op die van de legeringsgebouwen. informatiewaarde en de representativiteit voor de nieuwe zakelijke stijl		Casco-masonry and roof have high rest-of-life value as long as concrete frames get treated.	leaking gutters / bad connections > moist infiltration & energy loss.
STRUCTURE		Gehele keldercomplex in constructief opgetrokken in gewapend beton, een monoliet van balken, wanden en vloeren. Hierdoor is het sterk, waterbestendig, goedkoop en ook brandveilig. Stalen fundering.					casco is in a good condition. Longer technical livespan is possible	bearing structure is positive
SPACE PLAN		Light seperation walls have been removed. No structural problems		Het gebouw bestaat uit twee plannen. De kelder is volgens het principe van Boost. Herbers heeft in de jaren 40 het keukengedeelte naar achteren verplaatst en een ander ontwerp bedacht voor het Keukengebouw.			Technical state is mostly cosmetic, no big threats to rest-of-life	
SURFACES (interior) [+		Ceilings partially destroyed due to leakages. Kitchen is technically usable			Naoorlogse toevoegingen aan het interieur		low rest-of-life this is normal since they are short-life layers	
SERVICES		. - electrics - climate installations - fire safety - plumbing functional but old		De twee schoorstenen en het gehele keldercomplex zijn als eerste gebouwd en zorgden voor centrale verwarming op de kazerne. Het biedt een herinnering aan de voormalige centrale keukenfunctie.			. - Near end-of-life - replacement nearly impossible to avoid	installations are very energy inefficient.
STUFF		Toevoegingen "systeemplafonds, kleurgebruik en afwerkingen" : slecht gekozen en slecht onderhouden Keukenapparatuur functioneert nog, maar behoort niet meer in de huidige situatie.	De bestaande keukenapparatuur wordt verkocht aan Defensie, voor verder gebruik.					reuse of kitchen equipment is possible
SPIRIT of PLACE [+]	opleiden van militaire (koks)			Het gebouw vertelt iets over de wijze waarop kort voor en na WOII werd gekeken naar kazernecomplexen waarbij functiescheiding centraal stond. Kampementen al ver voor 1930. De overname van de Nazies.				Het heulvelachtige en zandige karakter van het plangebied Crailo is door de eeuwen heen ongerept gebleven

Figure B1: Matrix value assessment

5.3 Appendix III: Case studies

5.3.1 Red Star Line Museum, Antwerp

The Red Star Line Museum in Antwerp is located in the former shipping and control buildings of the historic Red Star Line shipping company, which transported millions of European emigrants to North America between 1873 and 1934. The complex served as a departure point for migrants and consisted of a carefully organised system of waiting areas, medical checks, administrative procedures and logistical flow.

The transformation of this industrial building into a museum, designed by Bold Architects, is based on the preservation and reuse of the existing buildings, while emphasising the original condition of the building as much as possible. The current museum route is designed so that visitors literally walk through the story of migration, creating a strong relationship between space, movement and narrative.

Routing

The visitor route at the Red Star Line Museum can be linked to the previously mentioned work by Tzortzi. The museum is designed in such a way that visitors follow a fixed route that spatially represents the historical migration process. The building's original functional layout, which focused on control, waiting times and flow, forms the starting point for the museum's route. Figure C1 shows the museum's route, making it clear that visitors have little freedom to choose their own path. The choice of this type of route can therefore be linked to the chronological narrative the museum wants to tell its visitors.

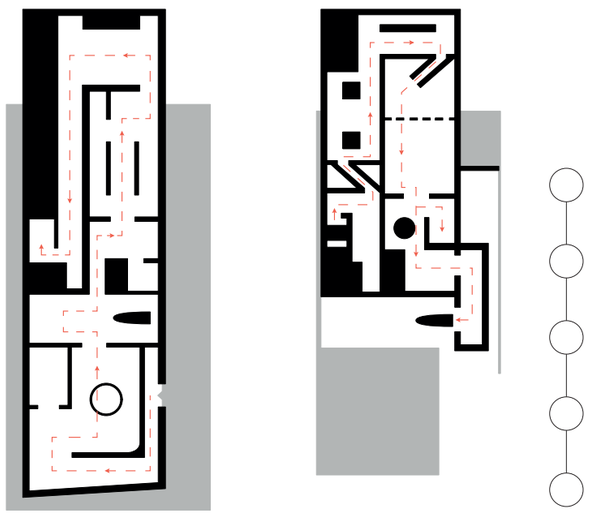

Figure C1: Routing Red Star Line Museum, Antwerp

Figure C2: Scheme linear routing of the Red Star Line Musuem

5.3.2 National Maritime Museum, Amsterdam

The National Maritime Museum is located in Amsterdam, in the former 's Lands Sea Warehouse. A renovation took place in 2007, focusing on improving the visitor experience while preserving the monumental qualities of the building. Additions such as a covered patio and new public facilities made it more accessible to a wider audience. The transformation focused not only on exhibiting collections, but also on creating a pleasant environment for visitors.

Spatial Planning

Based on the Performance Heptagram from the publication Metamorphosis (Roos et al., n.d.), the focus is on the aspects of audience, social context and mise-en-scène. The central courtyard serves as a key meeting space where visitors gather

Warm-up and cool-down zones

The entrance, foyer and central interior space can be seen as warm-up zones, where attention is given to the transition between everyday life and the museum experience. The restaurant, café and museum shop are clear spaces that serve as cool-down zones. This is a place for socialising and where the first memories of the museum are formed.

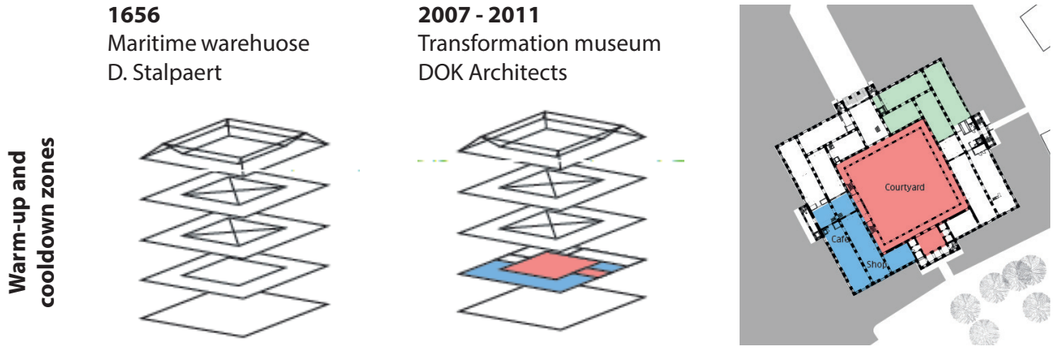

Figure C2: Warm-up and cooldown zones National Maritime Museum, Amsterdam (Roos et al., 1905)

5.3.3 National Military Museum, Soesterberg

The National Military Museum in Soesterberg was established following the merge of the former Army Museum in Delft and the Military Air Force Museum in Soesterberg. The museum presents the history of the Ministry of Defence and now focuses on two branches of the armed forces: the Royal Netherlands Air Force and the Royal Netherlands Military Police.

Routing

From a routing perspective, the museum aligns with Tzortzi's theory, which focuses on finding a balance between orientation and freedom of choice. Visitors enter a large central space. From this hall, there are various exhibitions to visit, separated by large military objects that serve as landmarks along the route. This creates a layout where visitors can make their own choices between different exhibition areas. This combination of viewpoints, landmarks and multiple possible routes contributes to an accessible and clear museum experience.

Figure C3 illustrates what the possible routes through the museum might look like. Although there are many more possibilities for options and choices, this demonstrates that visitors have significant freedom in selecting a route, meaning that the museum experience will be unique for everyone.

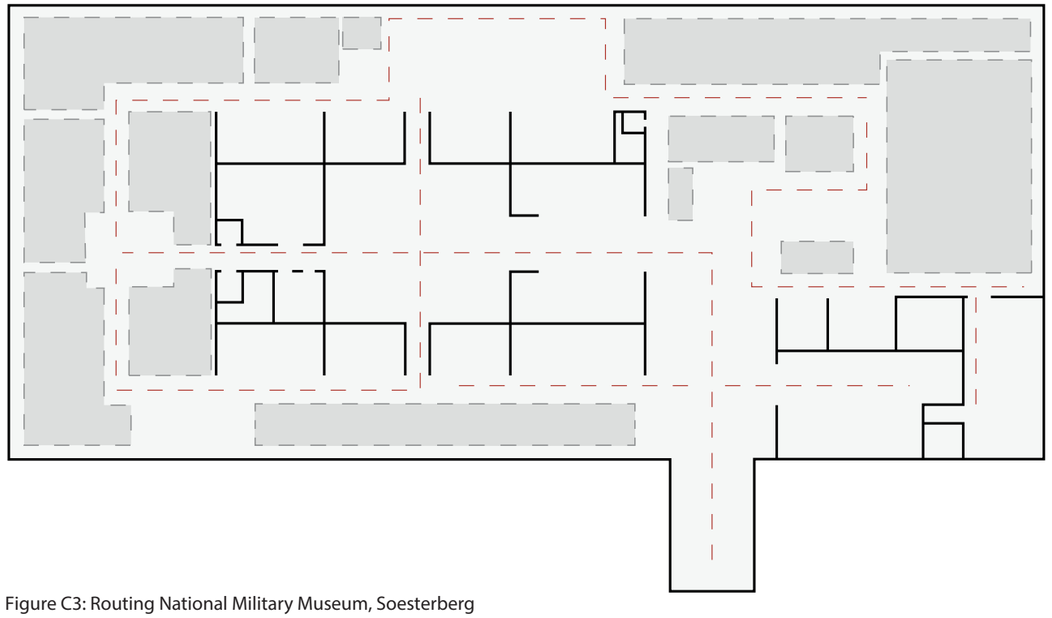

Figure C3: Routing National Military Museum, Soesterberg

5.4 Appendix IV - Literature to Design Translation

5.4.1 Warm-up and cooldown zones

The importance of the warm-up and cooldown zones has been discussed previously in the publication Metamorphosis (Roos et al., n.d.). In this design, these two zones have been taken into account and serve as key elements within the building. Figure D1 shows the ground floor plan. As mentioned earlier, the entrance façade is brought forward partly. This creates a large central hall that serves as the entrance to the museum and information centre. The entrance, situated as the central focal point of the building, thus functions partly as a warm-up zone. Visitors enter this space first and decide from there which way they would like to go. The restaurant and museum shop, located behind the central hall, can be seen as cooldown zones. Visitors create their first memories of their visit within these spaces and can chat with one another about their experiences.

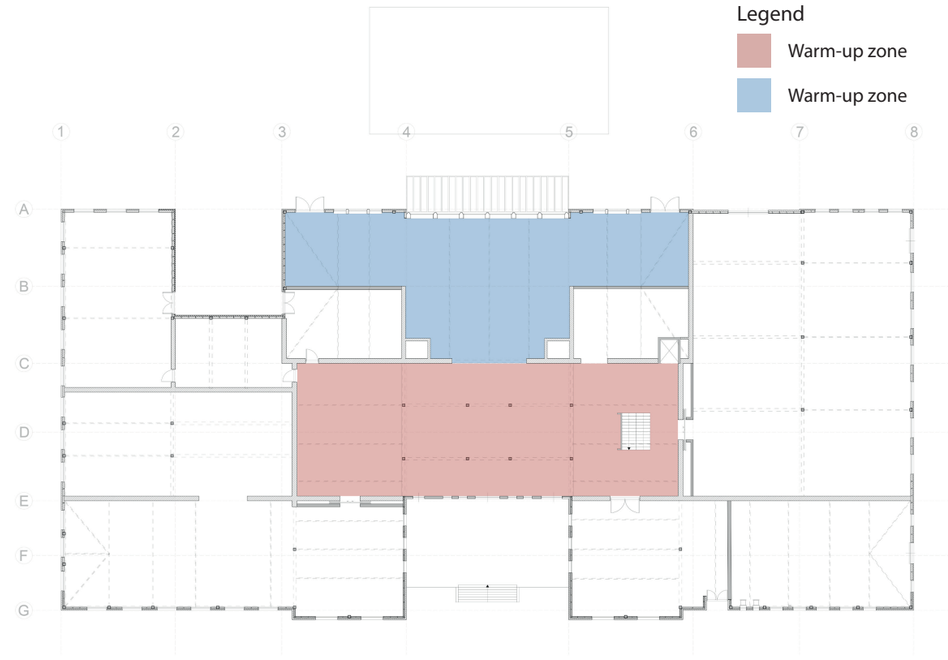

Figure D1: Warm-up and cool-down zones Kitchenbuilding

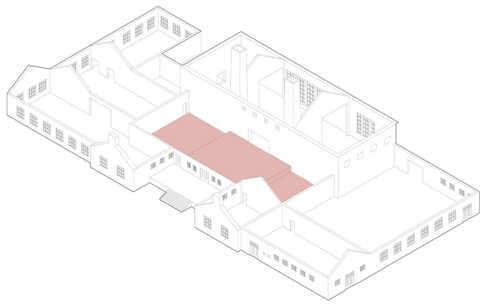

Figure D2: Warm-up zone Kitchenbuilding

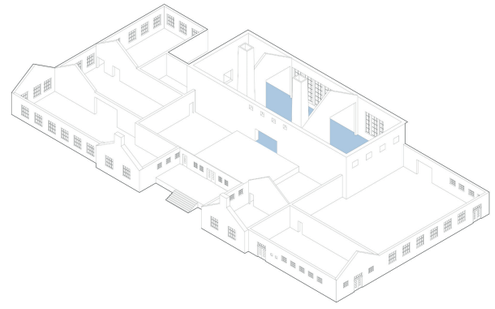

Figure D3: cooldown zone Kitchenbuilding

5.4.2 Movement and routing through the building

The routing strategy is based on literature by Tzortzi, which focuses on finding the right balance between guidance and freedom of choice. Rather than guiding visitors through the museum along a single fixed route, the design allows them to choose their own path, allowing them to experience the building and the exhibitions in different ways.

When entering, visitors arrive in a central entrance hall, which serves as a gathering space. From this area, the museum's main functions are visible and accessible. From here, visitors can choose their own route. The exhibition spaces are positioned on either side of the building, giving visitors a lot of freedom to choose how and by which route they explore the museum. This layout is in line with the aim of actively introducing visitors to both the history and the future of the Ministry of Defence.

Figure D4 shows a diagram of the routing on the ground floor of the building, based on the literature reviewed (Tzortzi & The Bartlett School of Graduate Studies, UCL, 2007). The central hall forms the central point of the building, offering visitors many possibilities to choose their own route.

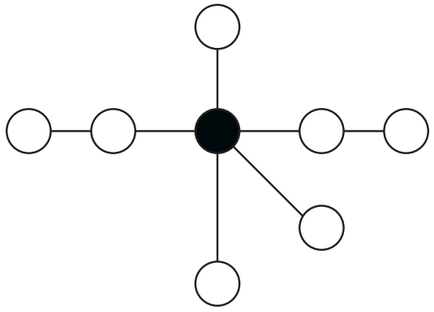

Figure D4: Routing scheme

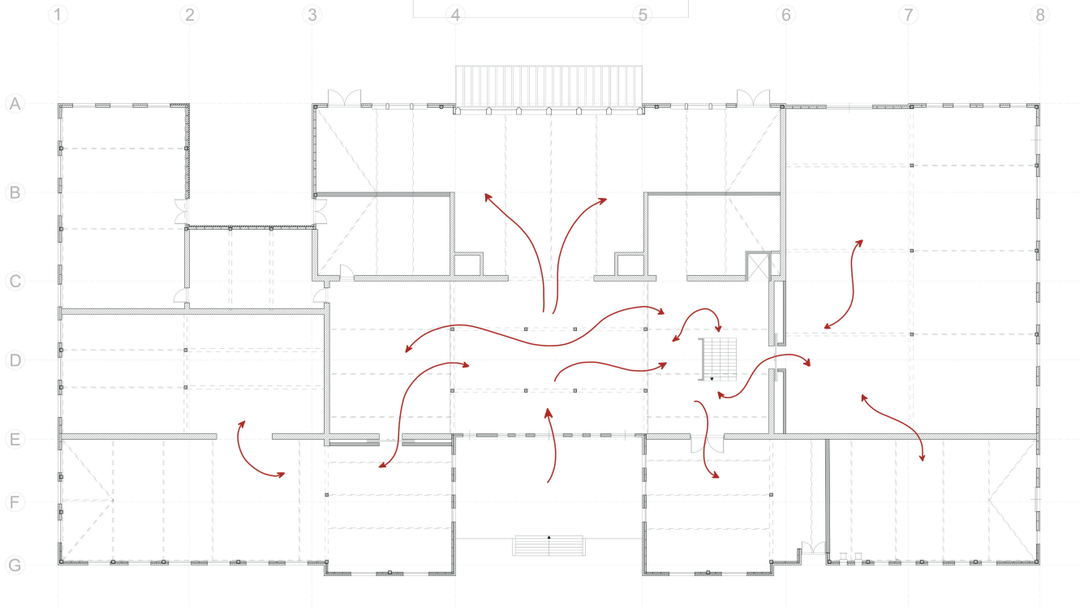

Figure D5: Routing ground floor

5.4.3 Spatial Planning

The museum performance heptagram (Roos et al., n.d.) describes the different spatial qualities that contribute to the overall museum experience. Four aspects are central to the transformation of the Kitchenbuilding into a museum: access, audience, social context and collective representation.

Access

The aspect of access is reflected in the new entrance hall, which serves as the museum's central orientation point. From here, various functions are visible and accessible.

Audience

Audience is reflected in the museum's routing. Visitors are not limited to a single fixed route, but can decide for themselves how they move through the museum.

Social context

Social context plays a key role as the basis of the design. The restaurant and auditorium offer visitors the opportunity to meet and exchange knowledge.

Collective representation

Collective representation is reflected in the museum's content and exhibition spaces. Through the combination of exhibition spaces, educational functions and recruitment activities, the museum displays not only the history of the Ministry of Defence, but also the current role and future vision of the organisation. This creates a museum that connects military history with current social issues.

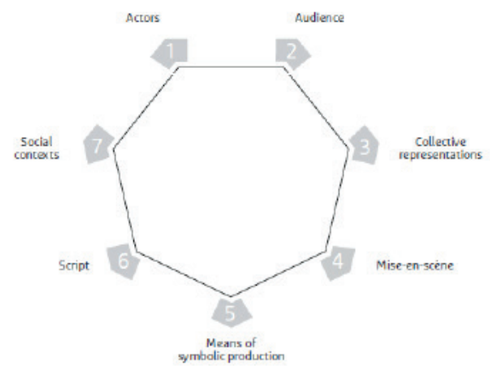

Figure D6: The museum performance heptagram (Roos et al., 1905)

5.4.4 Climate zoning

Based on the literature by Ankersmit & Stappers (2020), a distinction is made between different climate zones within a museum. Functions with similar climate requirements can be grouped together to create a more efficient climate control system. Figure D7 shows how the different functions within the programme are divided into people, collection and mixed zones. This diagram is inspired by the literature 'Het binnenklimaat in het programma van eisen en erfgoedinstellingen' (Ankersmit & Stappers, 2020).

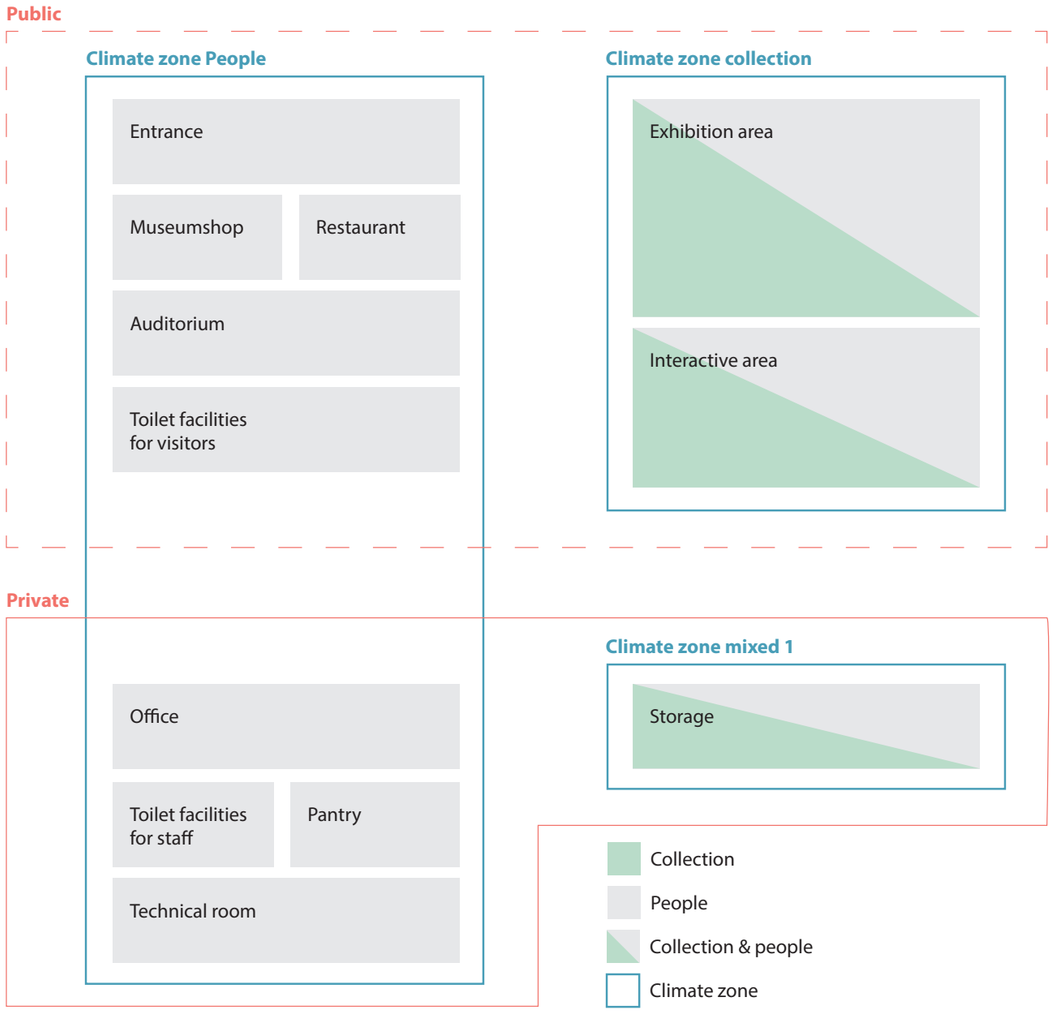

Figure D7: Climate zoning strategy

The floor plans below show the different zones within the building. Public areas such as the entrance, museum shop and restaurant are located in the people zone, where comfort is the priority. The exhibition spaces form the collection zone, where a stable indoor climate is essential for the preservation of object.

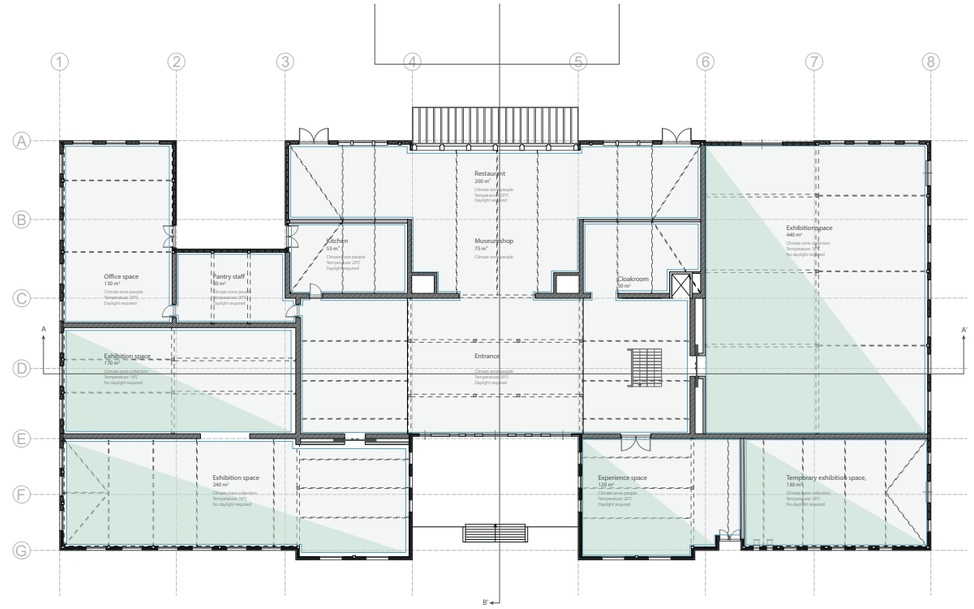

Figure D8: Climate zoning floor plans

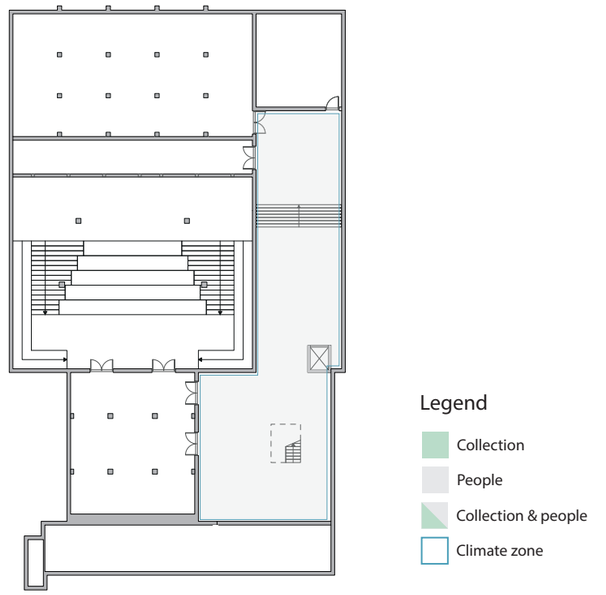

Figure D9: Climate zoning floor plans

5.5 Appendix V - Ventilation System Design

To further develop the ventilation design, the required ventilation requirements, shaft dimensions and air handling units have been specified for all spaces. The results of these calculations form the base for the dimensioning of the ventilation system and have been applied in the final design. This chapter provides a technical explanation of the different climate zones and ventilation systems.

5.5.1 Airflow calculations

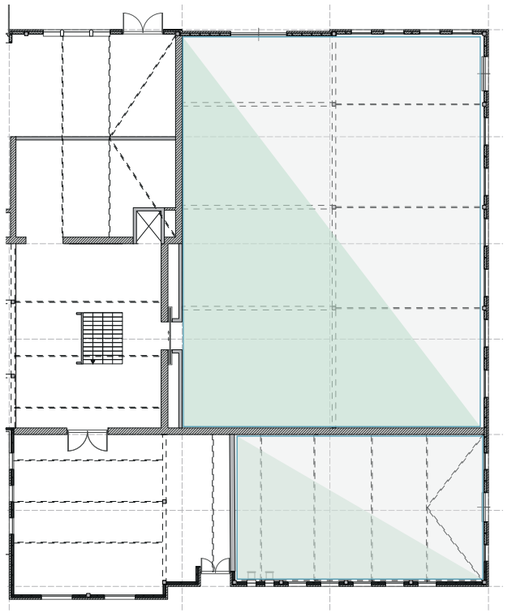

Figure E1: Climate zone 1

Climate zone 1, exhibition space

150 persons
v = 3 m/s
Ventilation = 25m^3 per person
Totaal = 150 * 25 = 3750 m^3/h

A = V / (3600 * v)
= 3750 / (3600 * 3) = 0,35 m^3

r = √(0,35 / π) = 0,33 m
d = 2 * 0,33 = 0,66 m = 66 cm

The height of the ventilation ducts in climate zone 1 must be at least 66 cm.

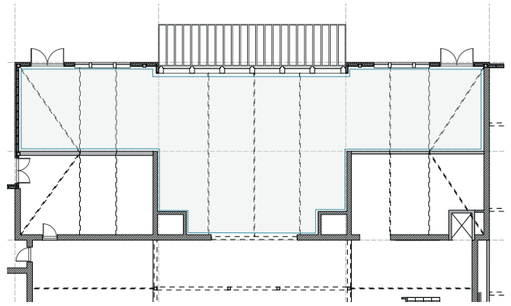

Figure E2: Climate zone 2

Climate zone 2, restaurant and museumshop

150 personen
v = 3 m/s
Ventilatie = 25m^3 per persoon
Totaal ventilatie = 150 * 25 = 3750 m^3/h

A = V / (3600 * v)
= 3750 / (3600 * 3) = 0,35 m^3

r = √(0,35 / π) = 0,33 m
d = 2 * 0,33 = 0,66 m = 66 cm

The height of the ventilation ducts in climate zone 2 must be at least 66 cm.

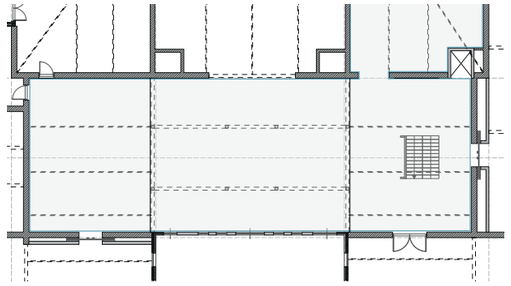

Figure E3: Climate zone 3

Climate zone 3, entrance

200 persons
v = 3 m/s
Ventilatie = 25m^3 per person
Totaal ventilatie = 200 * 25 = 5000 m^3/h

A = V / (3600 * v)
= 5000 / (3600 * 3) = 0,46 m^3

r = √(0,46 / π) = 0,38 m
d = 2 * 0,38 = 0,76 m = 76 cm

The height of the ventilation ducts in climate zone 3 must be at least 76 cm.

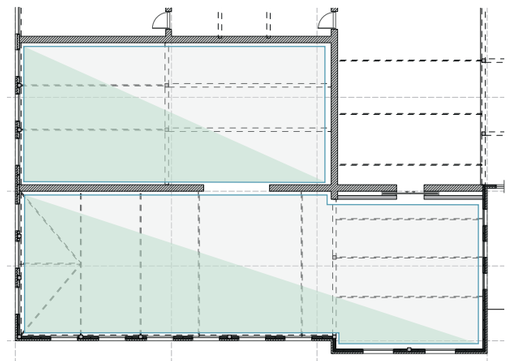

Figure E4: Climate zone 4

Climate zone 4, exhibition space

100 persons
v = 3 m/s
Ventilatie = 25m^3 per person
Totaal ventilatie = 100 * 25 = 2500 m^3/h

A = V / (3600 * v)
= 2500 / (3600 * 3) = 0,23 m^3

r = √(0,23 / π) = 0,27 m
d = 2 * 0,38 = 0,54 m = 54 cm

The height of the ventilation ducts in climate zone 4 must be at least 54 cm.

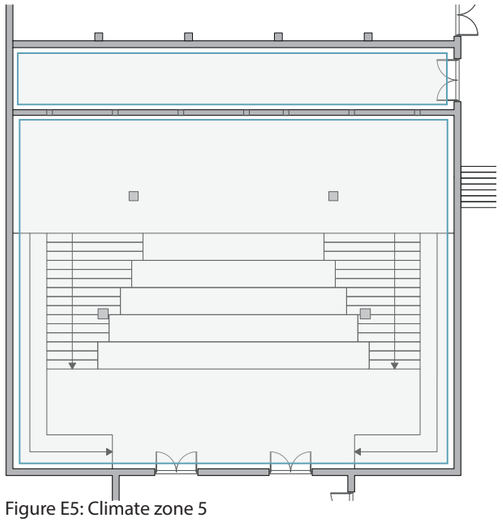

Figure E5: Climate zone 5

Climate zone 5, auditorium

100 persons
v = 3 m/s
Ventilatie = 25m^3 per person
Totaal ventilatie = 100 * 25 = 2500 m^3/h

A = V / (3600 * v)
= 2500 / (3600 * 3) = 0,23 m^3

r = √(0,23 / π) = 0,27 m
d = 2 * 0,27 = 0,54 m = 54 cm

The height of the ventilation ducts in climate zone 5 must be at least 54 cm.

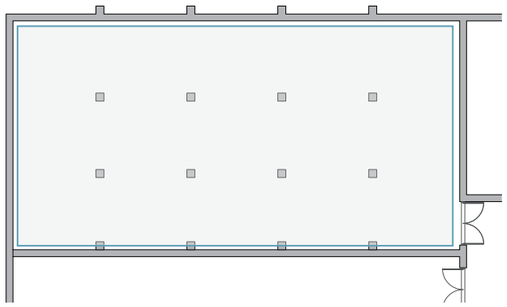

Figure E6: Climate zone 6

Climate zone 6, changing room

40 persons
v = 3 m/s
Ventilatie = 25m^2 per person
Totaal ventilatie = 40 * 25 = 1000 m^3/h

A = V / (3600 * v)
= 1000 / (3600 * 3) = 0,09 m^3

r = √(0,09 / π) = 0,17 m
d = 2 * 0,17 = 0,34 m = 34 cm

The height of the ventilation ducts in climate zone 6 must be at least 34 cm.

5.5.2 Air Handling Unit Sizing

Technische gegevens per RotorLine-model met condensatiewiel (volgens ErP-eisen)

Gegevens	Eenheid	Model 10	14	17	21	24	28	31	35
Max. luchthoeveelheid (ErP)	(m³/h)	3.200	6.500	11.000	16.200	22.000	29.200	35.500	44.000

Afmetingen en gewichten per RotorLine-model

Gegeven	Eenheid	Model 10	14	17	21	24	28	31	35
L: Lengte*	(mm)	2.100	2.450	2.450	2.800	3.150	3.150	3.150	3.500
B: Breedte*	(mm)	1.050	1.400	1.750	2.100	2.450	2.800	3.150	3.500
H: Hoogte**	(mm)	1.050	1.400	1.750	2.100	2.450	2.800	3.150	3.500
Gewicht	(kg)	600	900	1.200	1.700	2.200	2.600	3.000	3.700

Figure E7: Technical specifications for the RotorLine model air handling unit (RotorLine, n.d.)

The building uses NedAir's Rotorline air handling units (RotorLine, n.d.). The various climate zones are linked to different air handling units, so that the different functions can also be used separately from each other. The diagram below shows which zones are linked to the various air handling units.

LBK 1: climate zone 1 (3750 m^3/h)
climate zone 4 (2500 m^3/h)
total 6250 m^3/h
] RotorLine model 14

LBK 2: climate zone 2 (4500 m^3/h)
climate zone 3 (5000 m^3/h)
total 9500 m^3/h
] RotorLine model 17

LBK 3: climate zone 5 (2500 m^3/h)
climate zone 6 (2000 m^3/h)
total 4500 m^3/h
] RotorLine model 14

LBK 4: climate zone 6 (1000 m^3/h)
] RotorLine model 10

5.6 Appendix VI - Data Management Checklist

Instruction

This checklist is relevant for all graduation projects of the Master AUBS. The form is intended to highlight common aspects of graduation projects that require particular attention with regard to planning the research and data management. Relevant information and supplementary sources regarding each question are provided below each question.

With this checklist, the faculty wants to avoid that students unexpectedly find themselves in complex and stressful situations, in which ethical or privacy matters and/or other laws and regulations become an issue. In projects involving humans, certain types of data processing increase the risks to the human participants: planning such projects requires additional evaluations and advice from university staff before ethical approval can be received and the project can begin. In the case of a graduation project, obtaining additional advice or permits may delay the project with an extra education period or semester. To avoid this, it is recommended that students set up a graduation project with a low level of risk. Therefore, all students have to check their risk, by completing this checklist before their A1.

The first section of the checklist (A) should be completed by all students, together with their supervisor, during the planning of the graduation project, before the A1. It does not need to be submitted to anyone for review or approval. Please consider questions 1 to 3 carefully in relation to the intended graduation project, and answer with ‘yes’ or ‘no’.

The second section of the checklist (B) should only be completed if the graduation project involves working with data from human participants. In that case, the student and their supervisor must apply for and receive ethical approval from the Human Research Ethics Committee (HREC) before the project can begin (see the paragraph ‘Explanation and follow-up’ after the questions). The student can submit the application to the HREC, but the supervisor is responsible for making sure that the project is compliant with relevant privacy regulations and ethical policies.

Section A. General considerations	yes	no
1. Is the graduation project conducted as part of an internship (at a company), or as part of a research project at TU Delft? If a student’s graduation project is conducted at a company or as part of a research project at the university, questions of data ownership and intellectual property rights need to be addressed in a written graduation or internship agreement before the project begins. Students and their supervisor should consult the Intellectual Property Rights of Students webpage. Additional information can also be found in the Extended Personal Research Data Workflow.		✓
2. Does the project involve conducting (part of) the research outside the Netherlands? Students who intend to travel abroad (even to other EU countries) for study, exchange, research, internship, or graduation project purposes need to follow the Travel Safety Protocol. This includes attending a mandatory Travel Safety Training Session: see the Disclaimer.		✓
3. Will the research involve processing data from humans, such as running a survey, conducting interviews or workshops, collecting data through social media or internet forums, or re-using existing datasets about humans provided by a third party? (If ‘yes’, see follow-up questions 4 to 13 in Checklist B.) Students who work with data from human participants must complete the next section and apply for and receive ethical approval from the Human Research Ethics Committee (HREC) before conducting the research.		✓

Section B. Extended risk factors (only if question 3 has been answered with 'yes'.)	yes	no
4. Will the project involve participants who may be considered vulnerable, such as the elderly, refugees or asylum seekers, ethnic minorities, patients, or people with disabilities? Participants who may suffer very adverse consequences (for instance, due to discrimination) if their personal data became publicly available can be considered vulnerable.		✓
5. Will the project involve participants who cannot themselves give informed consent for taking part in the project, but for whom consent must be obtained from a legal guardian? Participants who cannot give informed consent can include, for instance, children or participants with intellectual disabilities, mental disorders, or dementia. Such participants are also considered vulnerable in the context of the General Data Protection Regulation (GDPR).		✓
6. Will the project involve processing any of the special categories of personal data below? - Race - Ethnicity - Criminal offence data - Political opinion - Union membership - Religious or philosophical beliefs - Sex life and/or sexual orientation - Health data (including measurements such as heart rate) - Biometric or genetic data (including fingerprints, iris scanning, facial recognition) The General Data Protection Regulation (GDPR) defines a stricter rules for processing special categories of personal data. If it is necessary to process these data in a project, it is it is important to provide additional safeguards.		✓
7. Will the project involve processing personal data that could be considered sensitive, such as the ones listed below? - Information about a person's income, debts, or other payments - Information about a person's (un-)employment status - Information about a person's performance at school or work - Information about relationship problems or (gambling) addiction - Information about poverty, domestic violence, or youth welfare/social work involvement Some types of personal data are considered sensitive, because they can have a high impact on the privacy of the data subject if other persons gain access to these data. Sensitive personal data should only be processed if necessary: in such cases, additional safeguards need to be put in place.		✓
8. Will the project involve processing video-recordings, or photographs of participants? TU Delft considers photographic and video-materials of research participants to be sensitive personal data. If such data need to be processed, additional safeguards must be put in place.		✓

Section B. Extended risk factors (only if question 3 has been answered with 'yes'.)	yes	no
9. Will the project involve sharing or transferring personal data between multiple partners or collaborating organisations involved, such as between TU Delft and an internship company? According to privacy law, sharing personal data between organisations requires a privacy agreement to be in place: setting this up takes time, and requires support from additional university staff. Furthermore, personal data sharing can potentially expose research participants to different types of risks: these risks must be considered in the ethical application.		✓
10. Will the project involve deception, or covert observation of participants? In some types of research, obtaining informed consent for processing participants' personal data is not an option: for instance, if the research involves deception, or the research is covert (conducted without participants knowing about it). In such situations, the steps to mitigate risks to participants are important, and an alternative legal basis for processing the participant's data needs to be established with the help of additional support staff.		✓
11. Will the project involve working with social media data? Social media data are personal data, but since it is usually not possible to ask for informed consent for processing social media data, another legal basis for processing the participant's data needs to be established. Processing of social media data also involves legal considerations related to terms of use of data from third-party platforms: therefore, research with social media data requires expert support on privacy, ethics, and legal matters.		✓
12. Will the project involve using learning algorithms or other AI to analyse, combine, or otherwise process data from participants? The use of AI in research involves many considerations in terms of data protection, ethics, security, and intellectual property: for more information, see TU Delft's Instructions for use of Generative AI.		✓
13. Will the project involve participants who are based in a country or countries outside of the EU? Students affiliated with TU Delft must comply with Dutch and EU regulations of personal data processing (GDPR). Furthermore, the student and their supervisor must make sure that the research complies with local (privacy) legislations of any foreign destinations. Additional support from an external (local) expert may be required.		✓

Explanation and follow-up

If you have answered 'no' to all questions 4 to 13, your project is likely to be considered low or minimal-risk: see the paragraph 'Projects with minimal or low-risk' on the next page.

If you have answered 'yes' to one or more of the questions 4 to 13, your research likely involves extended or high risks to participants, according to the General Data Protection Regulation (GDPR) and TU Delft's privacy and ethical policies: for information regarding such projects, see the paragraph 'Projects with extended or high-risk' on the next pages.

Projects with minimal or low-risk

If you have answered ‘no’ to questions 4 to 13, your project is likely to be considered low-risk. This does not mean that the project involves no risks at all, but suggests that these risks can likely be addressed by the student and supervisor in the application to the Human Research Ethics Committee (HREC) within the timeline for a graduation project and without need for additional support.

Compiling the HREC application:
An application to the HREC generally involves a Data Management Plan (DMP), a risk-identification and mitigation checklist, and informed consent materials. Master’s students at ABE who intend to compile a HREC application are advised to make use of the following support documents:

- the student guide
- the Example Data Management Plan for MSc projects

The graduation supervisor is responsible for the student’s project and ethical application, and must provide support for compiling the HREC application documents.

Additional support
For low-risk student graduation projects, compiling of the HREC application documents should be done by the student in consultation with the supervisor. The Faculty Data Steward can be contacted for individual questions at datasteward-BK@tudelft.nl: however, the Data Steward does not provide detailed feedback on student DMPs for low-risk HREC applications.

Additional resources
The HREC has guides available for completing the checklist and for compiling informed consent materials. Additionally, the Guide to the Extended Personal Research Data Workflow has been created to help researchers and students who work with human participants comply with both GDPR principles and TU Delft’s policies on Data Management and Human Research Ethics.

Timeline
Minimal or low-risk HREC applications are generally processed faster than extended or high-risk applications (see the paragraph below). Nevertheless, the initial evaluation by the HREC usually takes approximately 2 weeks, and may take longer during busy periods or holiday: see the HREC website for up-to-date information. Additionally, the application may require revisions before final approval is granted. If you do not receive an initial response about your ethical application after 4 weeks from the time of submission, you may follow up with the HREC to enquire about an update.

Projects with extended or high-risk

If you have answered ‘yes’ to one or more of questions 4 to 13, there are potential increased risks related to how data from human participants will be processed in your project. These risks will need to be addressed in consultation with the Data Steward and other relevant support staff before submitting the ethical application to the Human Research Ethics Committee (HREC).

Compiling the HREC application
An application to the HREC generally involves a Data Management Plan (DMP), a risk-identification and mitigation checklist, and informed consent materials. Master’s students at ABE who intend to compile a HREC application are advised to make use of the following support documents:

- the Ethical Approval & Data Management Planning Student Information
- the Example Data Management Plan for MSc projects

The graduation supervisor is responsible for the student’s project and ethical application, and must provide support for compiling the HREC application documents.

Additional support
Once the DMP has been compiled and reviewed by the supervisor, feedback should be requested from the Data Steward via DMPonline. After this, any other necessary support staff will need to be contacted. Crucially, if the project involves one or multiple ways of personal data processing that could result in high-risk to the participants according to the GDPR, the TU Delft Privacy Team must be consulted to establish whether or not a Data Protection Impact Assessment (DPIA) is required.

Additional resources
The HREC has guides available for completing the checklist and for compiling informed consent materials. Additionally, the Guide to the Extended Personal Research Data Workflow has been created to help researchers and students who work with human participants comply with both GDPR principles and TU Delft’s policies on Data Management and Human Research Ethics.

Timeline
It can take a long time to compile a complete research plan and HREC application for projects involving extended risks. DMP feedback from the Data Steward usually takes around 2 weeks, but can take longer during busy periods or holidays. Receiving additional support from other staff, such as the Privacy Team, can take anywhere from a few days to multiple weeks, depending on the project and capacity of university staff. If a DPIA is deemed necessary, it can take anywhere from 4 weeks to several months.

It is important to note that advice from the Privacy Team or other support staff, as well as any additional documents (such as necessary contracts, or a DPIA, if needed) must be in place before the application is submitted to the HREC. The initial evaluation by the HREC can be processed in 2 weeks, but may take longer during busy periods or holidays: see the HREC website for up-to-date information. Additionally, the application may require revisions before final approval is granted. If you do not receive an initial response about your ethical application after 4 weeks from the time of submission, you may follow up with the HREC to enquire about an update.

Considering the limited time available for students conducting their graduation projects, students working with data from human participants are strongly advised to prioritise low-risk research projects. If a student project necessitates processing data in ways that are considered extended or high-risk, both student and supervisor need to be aware of the extended processing times involved in obtaining ethical approval and beginning the graduation project.

6. References

6.1 Literature and Sources 106

6.2 Figures 107

6. References

6.1 Literature and sources

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6.2 Figures

Figure 5: Tzortzi, K. & The Bartlett School of Graduate Studies, UCL. (2007). Museum Building Design and Exhibition Layout: Patterns of Interaction. In Proceedings, 6th International Space Syntax Symposium, İstanbul. http://spacesyntaxistanbul.itu.edu.tr/papers%5Clongpapers%5C072%20-%20Tzortzi.pdf

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Figure D6: Roos, J., Hoebink, D., Kok, A., Susan Lammers, Roos, J., Hoebink, D., Kok, A., Job Roos, Dorus Hoebink, Arjen Kok, Sinem Cerrah, Bart Ankersmit, Renate van Leijen, Maria Peek, Marzia Loddo, Roos, J., Hoebink, D., & Kok, A. (1905). Metamorphosis. In Metamorphosis

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