Adapted Spaces

A Typological Evolution Between School and Housing

Master's thesis - Delft University of Technology

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Colofon

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Personal fascination

This thesis is part of the Heritage and Architecture studio. The choice was made for this studio due to the personal fascination of existing buildings. During the last year of my bachelor's degree, there was a course called Academic Skills 3 Design Reflection, in which you explain, evaluate, and position your design choices in Design 6. In this course, my interest bloomed in combining old architecture with new. In one of the three papers, the idea of heritage and interventions were researched by looking at interventions that strengthen the architectural connection by focusing on two methods: compatibility and contrast. Furthermore, in MSc 2, a history thesis was chosen for the course with a focus on the heritage of buildings in Bonaire and the evolution of the school, house, and church typologies in three consecutive periods. During this history thesis, I realized the importance of preserving existing buildings since they are linked with the island's history. In addition, in MSc 2, I chose the studio Dwelling: Towards an Inclusive Living Environment, where I had to look at the existing housing block and transform it into functional and inclusive dwellings for all ages. All these fascinations have led me to choose this studio Heritage and Architecture Adapting 20th Century Heritage: Resourceful Housing. These fascinations have sparked my interest in continuing my focus on existing buildings but have also opened my eyes to new ways of preserving heritage, such as the idea of adaptive reuse. The choice of transforming a school building instead of a factory or another function in this thesis derives from the fact that I have never transformed a school building. Additionally, in Design 6, I transformed a yeast factory into a theater, and in the MSc 2 Dwelling studio, the original function was already a housing function. Therefore, in this graduation course, I have chosen to do my research on something I have never done before and focus on the adaptive reuse of a school building.

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Chapter 1: Introduction

The topic surrounding the cultural significance of buildings is starting to become more acknowledged, with the heritage of buildings being a crucial topic since these buildings denote and show glimpses of the past and its time layers (Mısırlısoy & Günce, 2016). More and more buildings are being demolished to make way for new buildings as high-rise structures (Ragheb, 2021). The decision to reuse a heritage building is influenced by many factors, including location, heritage value, architectural qualities, environmental treatments, and market trends. Building preservation is evolving from being just protective to becoming an important component of a holistic plan for sustainable urban growth. Thus, a more effective approach to addressing this shift is adaptive reuse (Ragheb, 2021).

1.1 Adaptive reuse

The internationally recognized reference, the Burra Charter by ICOMOS Australia, defines 'adaptive reuse' as a sub-concept of 'adaptation,' which has been defined as: "Adaptation of a place for a new use... (is called) 'adaptive reuse'", rooted in the Latin terms "ad" (to) and "aptare" (fit) (Australia ICOMOS Burra Charter, 2013). Dr. Johnson's Dictionary (1755) defines adaptation as "the act of fitting one thing to another." In the book 'Building Adaptation' by Douglas (2006), 'adaptive reuse' is further expounded as the conversion of buildings into more effective and efficient uses. "More effective" pertains to satisfying client needs and prolonging a building's usable life, while "more efficient" focuses on improving spatial and technological aspects to align with user requirements. Such conversions can require structural changes to accommodate varying spatial and functional demands (Douglas, 2006).

Designing existing buildings for new functions is a common practice, and throughout history, structurally sound buildings have readily accommodated various uses and needs without significant challenges (Plevoets & Van Cleempoel, 2019). However, these adaptations were often driven by pragmatism rather than heritage preservation, emphasizing the practical and financial motivations behind reuse (Pérez de Arce, 1978; Powell, 1999). Meaning that there is always a reason to reuse.

1.2 Problem statement

The built environment is one of the most pressing issues for sustainable development since the building industry contributes the most to natural resource depletion, the greenhouse effect, and climate change. More than any other sector, the building industry contributes 40% of CO2 emissions (Le et al, 2021; Zimmermann et al, 2020). Therefore, sustainable construction is necessary for future sustainable development. Buildings are long-lasting objects, often meant to last 60 years (Le et al, 2021). According to a study on the improvement of outdated attempts at modernist post-war planning, the age of post-war buildings is causing modernist post-war structures to enter a phase where fundamental questions about their future viability are being asked, (Altrock, 2023). These concerns relate to changing needs for housing, office space, and retail, as well as energy, building services, and infrastructure requirements. Therefore,

nowadays, the fate of modern buildings constructed after 1945 is particularly troublesome, with the risk of them being demolished and replaced by buildings as high-rise buildings (Hartmann, 2022; Ragheb, 2021).

Among existing buildings, school buildings, in general, require renovation due to their age and evolving teaching and learning methods (Le et al, 2021). Besides renovation, existing school buildings facing potential vacancies hold promise for adaptive reuse, especially due to the high-quality interior and exterior layout (Macmillen & Pinch, 2017). However, they also present challenges, such as outdated technology affecting ventilation, thermal fittings, lighting, and acoustics. (Le et al, 2021; Farsäter & Olander, 2019).

When it comes to demolition and rebuilding a new building, studies show that retrofitting, refurbishing, or repurposing a building has a less environmental impact and is mostly the economical choice (Bahadır et al, 2022; Sánchez et al, 2023; Zimmermann et al, 2020)

1.2.1 Demolition of school buildings

Hans Korbee, an advisor of the RVO and an expert in circular construction economy mentions that thousands of schools in the Netherlands need to be sustainably demolished to build a new building in their place (Korbee, 2016). Therefore, post-war schools are becoming scarcer due to them rapidly disappearing by being demolished. Furthermore, In the 'Sectoriale routekaart' for making school buildings more sustainable published by the RVO (Rijksdienst voor Ondernemend Nederland) it is visibly that the schools in the Netherlands have an average of 40 years. This means that post-war schools are the category that is in danger of being demolished now (Rijksdienst voor Ondernemend Nederland, 2021). Just like the post-war churches and other building types, these schools also need protection. Not only because of their architectural-historical significance and financial value but especially because of the inseparable collective memory they hold in many post-war generations (Keminga & Wessel, 2013). The research firm that strives to improve school architecture 'Stichting Mevrouw Meijer'(2019) sees these post-war schools as a great cultural significance and thus worth saving, with great potential to adapt to future use (Keminga, 2020).

1.2.2 Number of students declining and vacancy

Another problem surrounding schools is the decline in the number of students in both primary and secondary schools in the Netherlands. Since 2008 there has been a student decline of 170.000 in primary schools and between 2016 and 2031 there will be a student decline of 130.000 in secondary schools (Rijksoverheid, 2023).

Even cities like Amsterdam predict a shrinkage in the number of students in primary and secondary schools. In the upcoming 5 years, the number of students in primary school will decrease from 60.945 to 58.109 students, and in secondary schools, there will be a total decrease of 5.8%. This decrease is mainly caused by the expected departure of families with children from the city (Gemeente Amsterdam, 2023).

When zooming in, Amsterdam Nieuw-West (figures 1 and 2) also experiences a decrease in the number of students (Gemeente Amsterdam, 2023). Additionally, Rijksoverheid (2023) suggests that merging 2 or more schools can be a way of solving problems caused by student decline. When doing so, one or more schools will be empty and can house a new function, making it possible for an adaptive reuse project. Currently, the Netherlands has a few vacant educational buildings with around 50 in North Holland (figures 3 and 4) (CBS, 2022). In the last known data from 2016 regarding school buildings in Amsterdam Nieuw-West shown in Figure 5, it is visible that 14 schools are closed or have moved, possible meaning that the building is now vacant or has a temporary use (Nio et al, 2016).

Stadsdeel	2020/'21	2021/'22	prognose 2022/'23	telling 2022/'23	verschil
Centrum	3.765	3.650	3.682	3.550	-132
Nieuw-West	12.463	12.275	12.214	12.193	-21
Noord	8.687	8.880	8.800	8.918	118
Oost	10.303	9.767	9.685	9.540	-145
Weesp	1.738	1.822		1.953	
West	8.513	8.390	8.149	8.180	31
Zuid	10.534	10.220	9.989	10.045	56
Zuidoost	6.867	6.665	6.567	6.566	-1
Amsterdam	62.870	61.669	59.086	60.945	-94

Figure 1 - number of students in primary schools in Amsterdam (Gemeente Amsterdam, 2023)

Stadsdeel	2020/'21	2021/'22	prognose 2022/'23	telling 2022/'23	verschil
Centrum	1.109	1.148	1.165	1.174	9
Nieuw-West	7.391	7.760	7.783	8.073	290
Noord	4.709	4.740	4.820	4.800	-20
Oost	7.492	7.632	7.781	7.544	-237
Weesp	1.676	1.677		1.739	
West	2.810	2.731	2.687	2.732	45
Zuid	16.535	16.459	16.531	17.236	705
Zuidoost	2.802	3.173	3.174	3.228	54
Amsterdam	44.524	45.320	43.941	46.526	846

Figure 2 - number of students in secondary schools in Amsterdam (Gemeente Amsterdam, 2023)

1.2.3 Housing shortage

Finally, the last problem is that the Netherlands is dealing with a shortage of housing with almost 400.000 dwellings short. 'The Programma Woningbouw' describes the approach to increase the construction of dwellings to realize 900.000 homes by 2030 whereby 52.500 are expected to be built in Amsterdam by 2025 (Rijksoverheid, 2022, p.5; Gemeente Amsterdam, 2018).

Therefore, the current housing crisis asks for more typologies and room for these houses. By combining the preservation of (post-war) school buildings with the housing crisis problem, a new typology can be created by applying adaptive reuse strategies to transform heritage school buildings into housing.

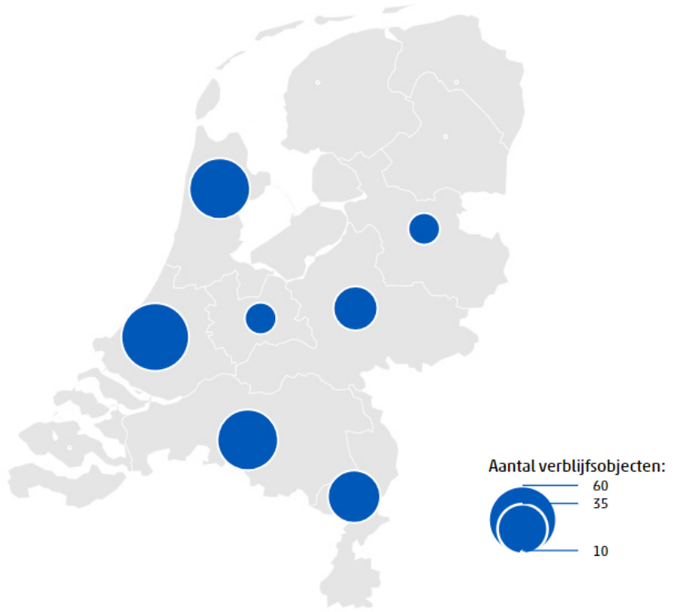


Figure 3 - CBS vacancy of educational building per Provence (CBS, 2022)

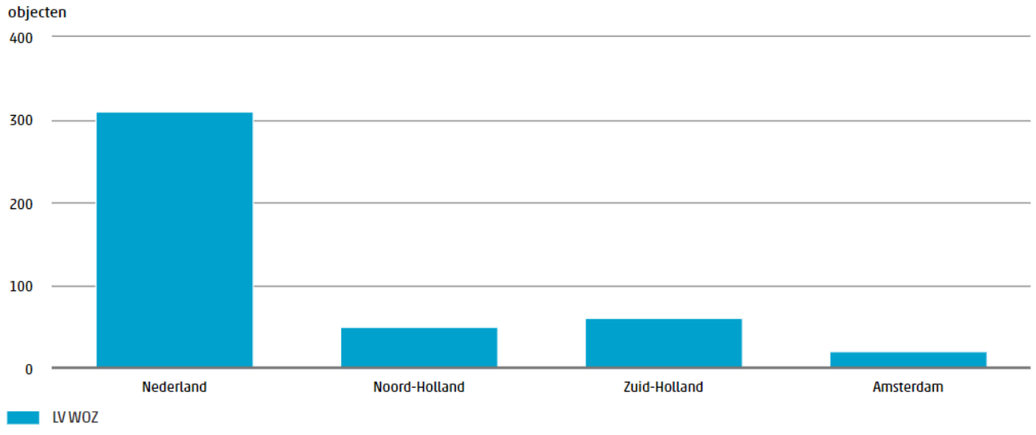


Figure 4 - Vacancy educational buildings in the Netherlands in 2022 (CBS, 2022)

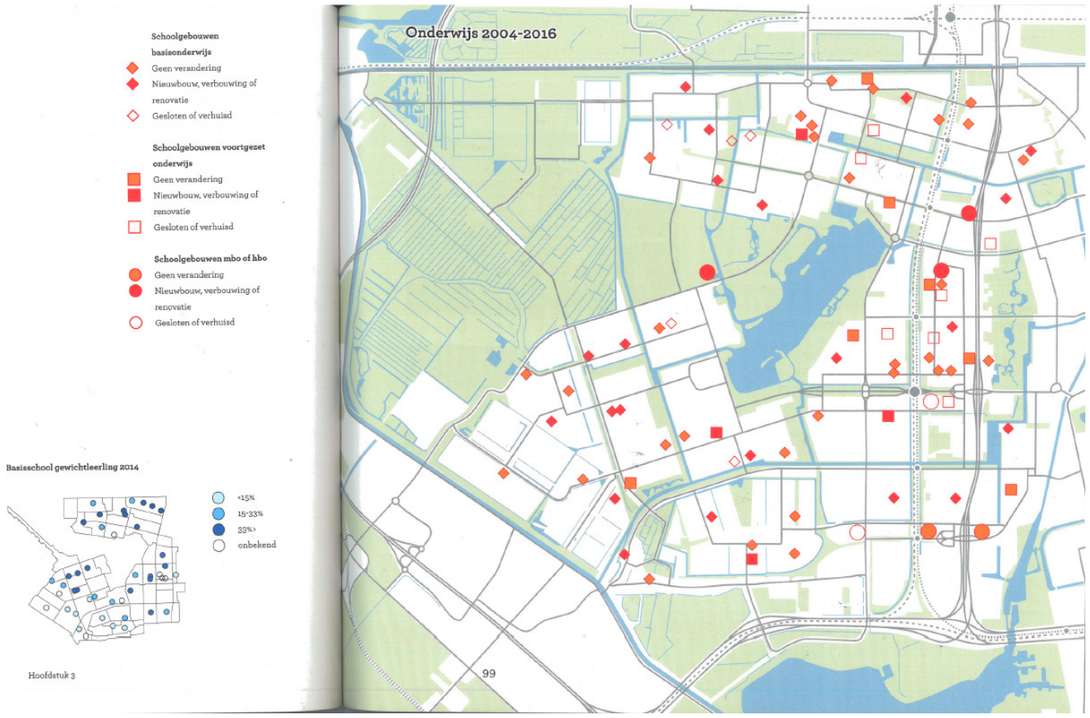


Figure 5 - Education 2004-2016 Amsterdam Nieuw-West (Nio et al., 2016)

1.3 State-of-the-art

So far research surrounding the combination of these problems and the transformation of school buildings is limited. The state-of-the-art will be split into two fields of study: literature on the transformation of (school) buildings and literature on the cultural value of buildings.

1.3.1 Existing literature on adaptive reuse

A paper written by two scholars Plevoets and Van Cleempoel (2011) gives an overview of the academic literature on adaptive reuse. This paper compares and classifies theories based on how they handle adaptive reuse. There are three primary approaches that can be distinguished: typological, technical, and strategic (Plevoets & Van Cleempoel, 2011). The first publication on adaptive reuse mentioned by Plevoets and Van Cleempoel (2011) was a book called 'New uses for old buildings' written by Cantacuzino (1975). This book covers various cases but does not go in-depth into the transformation of these cases. Douglas (2006) also covers the adaptation of buildings, but the range of building types discussed is limited.

Furthermore, other sources with emphasis on the typological approach have tackled the reuse of one certain building type, such as religious buildings, (Alavedra & Marin, 2007; Morisset et al, 2006) and industrial buildings (Bordage, 2002; Stratton, 2000). However , when zooming in,

schools are researched to a more limited extent. So far there are no guidelines, overviews, or strategies for transforming a school building into dwellings. One book titled 'De transformatie van het schoolgebouw' by Dam, Komossa, and Spoormans (2011), created in collaboration with Delft University of Technology, documents and classifies twenty school buildings into transformation groups. However, the book is outdated due to it being a publication from 2011, and it provides only one case study on the transformation of a school into housing. Brooker and Stone (2004), Jäger (2010), and Robert (1989) also looked at similar terms regarding adaptive reuse intervention strategies (figure 6).

Moreover, a study published in 2023 focused on a decision-making framework to prioritize existing school buildings in Iran for adaptive reuse. For this research, an Adaptive Reuse Potential (ARP) model, developed by Langston et al. (2007, 2008), was applied in 29 school buildings where enough information was available. However, this study is quite broad and requires a big timeframe (Pourebrahimi et al, 2023).

A book called "Make It Anew" by Hans Ibelings and Diederendirrix architects looks at four approaches to transform a building: Restore, Repurpose, Restructure, and Regenerate.

Design strategies towards adaptive reuse

Robert 1989	Brooker & Stone 2004	Jäger 2010	Dam, Komossa, Spoormans 2011	Ibelings & Diederendirrix 2018
Building within	Insertion	Transformation	Absorption	Restore
Building over	Intervention	Addition	Addition	Repurpose
Building around	Installation	Conversion	Repetition	Restructure
Building alongside			Diversity	Regenerate
Adapting to a new function				
Building in the style of				
Recycling material of vestiges				

Figure 6 - Described strategies towards adaptive reuse mentioned by a few existing literatures

These four approaches are put into two regions created by two axes (figure #) (Ibelings & Diederendirrix, 2018). In this book, 17 cases are analyzed and for each case, the following is mentioned: Client, Transformation Year, Size, Original Architect, Original function, and Construction Year. The method used in this book can be used in this thesis to categorize and classify the selected case studies.

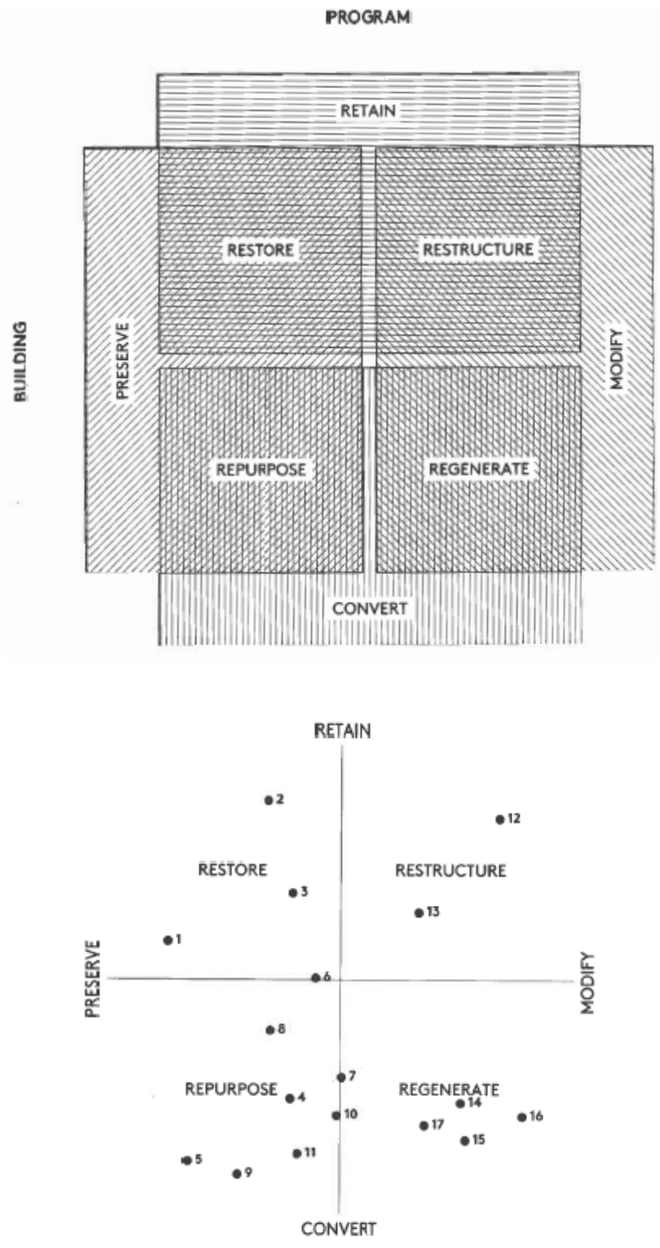


Figure 7 - four approaches to transform a building (Ibelings & Diederendirrix, 2018)

1.3.2 Cultural Value Assessment

At the heart of the field of heritage conservation is the assessment of values in architecture and urbanism, where expert dominated this field, by mainly focusing on historic values. However, there has been a shift. This shift led to the concept of heritage to grow and evolve, leading The Getty Conservation Institute to investigate the inclusion of other disciplines and stakeholders (Mason, 2002; Spoormans & Pereira Roders, 2020).

A recent study by Spoormans & Pereira Roders (2020) on the methods used to assess the architectural values in residential neighborhoods looked at the state-of-the-art and concluded that aesthetical, ecological, and age values were underrepresented. Most methods for assessing values in architecture and urbanism are focused on a limited number of values, stakeholders, and disciplines. Furthermore, some frameworks mention the values, but do not define the framework or concepts (Sagger, Philips, & Haque, 2021; Erikstad, Lindblom, et al, 2008; Spoormans & Pereira Roders, 2020).

Another article written, by Kheirandish, Funk, & Wensveen (2020), also studies different scholars , their disciplines and their lists of values. This study shows the limited disciplines, and the small value scope mentioned by these scholars. Kheirandish, Funk, & Wensveen (2020) mention how scholars such as Weber (1930), Scheler in Smith (1976), Spranger in Hague (1968), and Morris (1956), do not go in detail in the types of values they mention. In contrast, Scott (1965), Williams (1970), and Rokeach (1973) only mention value items without classifying them. Lastly, this study also mentions two frameworks by Schwartz (1992) and Peterson and Seligman (2004) that show value items and in which group they are classified.

Figure 8 - Values framework (Pereira Roders, 2007)

However, a value framework applied by Spoormans & Pereira Roders (2020), is the values framework (figure 8) by Pereira Roders (2007). This framework defines the concepts and the framework itself. The framework of Pereira Roders (2007) is thus seen as a broad and simple classification of most values and seems complete.

The definitions of the values shown in this framework are added in Figure 11, which acts as a guide to identify the primary values of cultural heritage assets (Tarrafa Silva & Pereira Roders, 2012).

1.4 Aims and Objectives

This research aims to gain more understanding of adaptive reuse approaches of various case studies and to then add to the research gap regarding the transformation of school buildings into housing. It is therefore important to obtain knowledge of adaptive reuse projects to fill in this gap. The research question is: 'What architectural interventions can be used to adapt schools into housing while preserving their cultural value, and how does the typology evolve between these two functions?' The following sub-questions must be regarded in order to answer this research question:

- How have previous adaptive reuse projects tackled the transformation of a school building into housing and what architectural interventions can be concluded?
- What design protocols should be followed in creating a new housing typology?
- Which cultural values are important for Rendorpschool?
- Which adaptive reuse strategy is more suitable for Rendorpschool?

Chapter 2: Methodology

This research applies a mixed-method approach.

2.1 Theoretical Framework

2.1.1 Ibeling & Diederendirrix framework

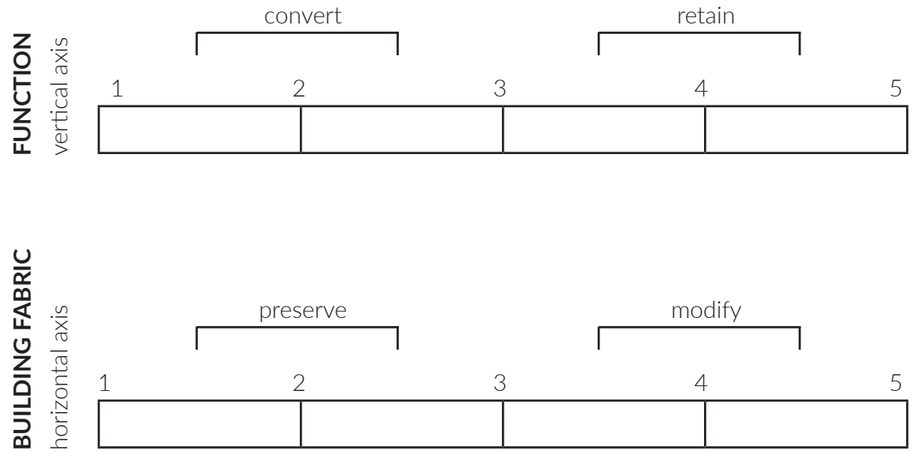
A general comparative case study will be done using the four approaches to transform a building by Hans Ibelings and Diederendirrix (2018). This framework will be used to classify and analyze the research data.

Guidelines given by Ibelings, and Diederenendirrix	Restore	Repurpose	Regenerate	Restructure
function	=	-	-	=
interior building fabric	=	+/-	+/-	+/-!
exterior building fabric	=	=	+/-	+/-!

Legend

+	added
-	removed
=	kept
!	drastically

Figure 9 - the four approaches by Ibelings and Diederendirrix further defined with three identified features



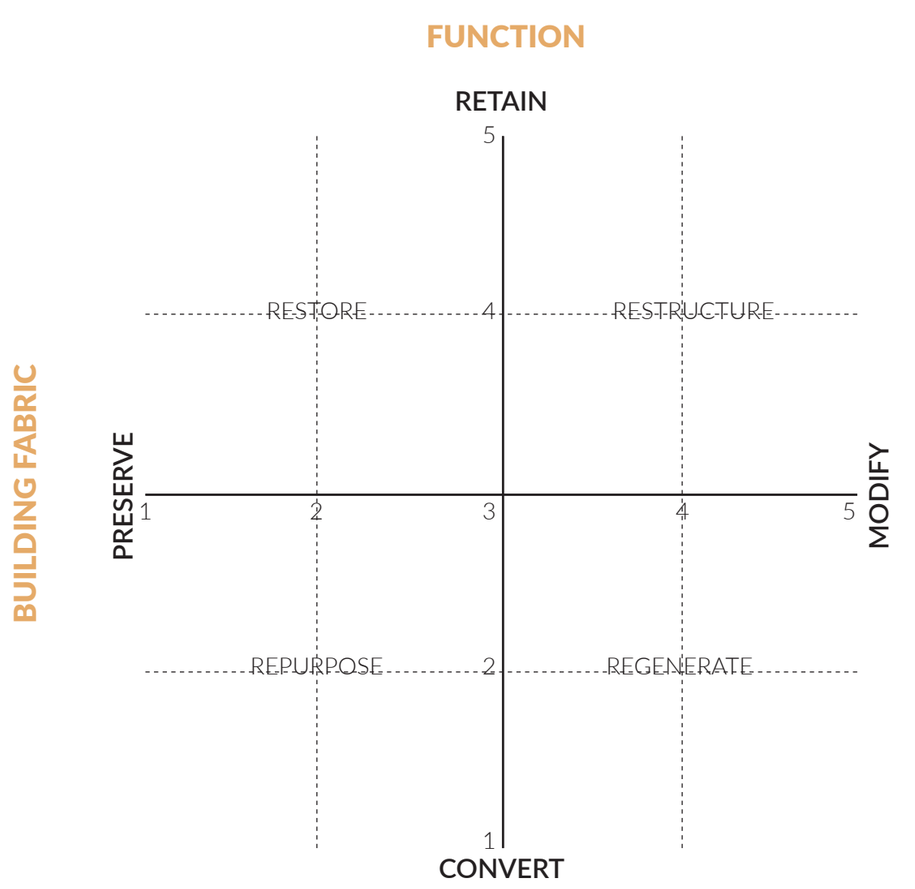


Figure 10 - Developed grid and spectrum system to help position cases on the axes. Adapted from (Ibelings & Diederendirrix, 2018)

Ibelings and Diederenendirrix define the four approaches as the following:

Restoration is defined as retaining or bringing back the integrity of the original building, meaning “preserving” the building fabric and “retaining” the function. When restoring a building a respectful approach is promoted to the existing architecture and the ideas behind it. For Diederendirrix, restoring a building is driven more by engineering than by concept, meaning that it is tangible rather than intangible (Ibelings & Diederendirrix, 2018).

Repurposing a building is seen as the building staying more or less the same while the program and use changes, meaning the “preserving” the building fabric and “converting” the function. Even when the appearance remains intact, repurposing the space often needs spatial interventions (Ibelings & Diederendirrix, 2018).

Regenerate is defined as both the program and the building’s form change, meaning “converting” the function and “modifying” the building fabric. This is especially done with buildings that were tailored to their function and their specific time period, leading these buildings to be more adapted for their next change of use (Ibelings & Diederendirrix, 2018).

When it comes to restructuring, programs stay the same, meaning that their use has not changed, this translates to the function of the building “remaining” the same and the building fabric being “modified”. Restructuring a building goes far beyond refurbishment and re-cladding, the building is drastically updated. Furthermore, restructuring can also imply the reorganization of programs (Ibelings & Diederendirrix, 2018).

However, besides the definitions by Ibelings and Diederendirrix to classify the cases, no other way is explained how a case is considered to be positioned in the axes. Ibelings and Diederendirrix position the cases on first thought rather than scientifically in the axes. Therefore, cases overlap, and positioning the cases in the way of Ibelings and Diederenderrix seems subjective.

Ibelings and Diederendirrix position the cases on first thought rather than scientifically in the axes. Therefore, cases overlap, and positioning them in their way seems subjective. To start, the definitions are further defined in Figure 9. When using the Ibelings & Diederendirrix (2018) guidelines to classify the cases based on four approaches, it is discovered that three key features can be extracted from these four approaches: function, interior building fabric, and exterior building fabric. Furthermore, to further define these four approaches, the interior and exterior interventions, and function changes will be shown with a +, -, and =. + for added, - for removed, and = for kept.

To make the research objective rather than subjective a grid and spectrum system is designed to help position and classify the research cases (figure 10).

2.1.2 black/yellow/red analyses

By further analyzing a case the “black/yellow/red” method will be used to show the adaptations of the building. This color code used in applications for building permissions, was then used to facilitate communication between countries. The colors are used to differentiate the remaining parts of a building – black, for demolition – yellow, and for new construction- red (Boesch et al,

		Secondary Values	References
Primary values	Social	Spiritual	beliefs, myths, religions (organized or not), legends, stories, testimonial of past generations;
		Emotional, individual	memory and personal life experiences;
		Emotional, collective	notions related with cultural identity, motivation and pride, sense of “place attachment” and communal value.
		Allegorical	objects/places representative of some social hierarchy/status;
	Economic	Use	the function and utility of the asset, original or attributed;
		Non-use	the asset’s expired function, which has it value on the past, and should be remained by its existence (of materials), option (to make some use of it or not) and bequest value (for future generations);
		Entertainment	the role that might be have for contemporaneous market, mainly for tourism industry;
		Allegorical	oriented to publicizing financially property;
	Political	Educational	the education role that heritage assets may play, using it for political targets (e. g. birth-nations myths, glorification of political leaders, etc.);
		Management	made part of strategies and policies (past or present);
		Entertainment	it is part of strategies for dissemination of cultural awareness, explored for political targets;
		Symbolic	emblematic, power, authority and prosperous perceptions stem from the heritage asset;
	Historic	Educational	heritage asset as a potential to gain knowledge about the past in the future through;
		Historic-artistic	quality of an object to be part of a few or unique testimonial of historic stylistic or artistic movements, which are now part of the history;
		Historic-conceptual	quality of an object to be part of a few or unique testimonial that retains conceptual signs (architectural, urban planning, etc.), which are now part of history;
		Symbolic	fact that the object has been part/related with an important event in the past;
		Archaeological	connected with Ancient civilizations;
	Aesthetical	Artistic	original product of creativity and imagination;
		Notable	product of a creator, holding his signature;
		Conceptual	integral materialization of conceptual intentions (imply a conceptual background);
		Evidential	authentic exemplar of a decade, part of the History of Art or Architecture;
	Scientific	Workmanship	original result of human labour, craftsmanship;
		Technological	skillfulness on techniques and materials, representing an outstanding quality of work;
		Conceptual	integral materialization of conceptual intentions (imply a conceptual background);
	Age	Workmanship	craftsmanship value oriented towards the production period;
		Maturity	piece of memory, reflecting the passage/lives of past generations;
		Existential	marks of the time passage (patine) presents on the forms, components and materials;
	Ecological	Spiritual	harmony between the building and its environment (natural and artificial);
		Essential	identification of ecological ideologies on its design and construction;
		Existential	manufactured resources which can either be reused, reprocessed or recycled;

Figure 11 - The definitions of the cultural values framework of Pereira Roders (Tarrafa Silva & Pereira Roders, 2012)

2022).

2.1.3 Values Framework by Pereira Roders (2007)

In this research the value framework by Pereira Roders (2007) shown in Figure 8 will be applied. This framework is seen as a broad and simple classification of most values. The definitions of the values shown in this framework are added in Figure 11, which acts as a guide to identify the primary values of cultural heritage assets of the chosen research case and the Rendorpschool (Tarrafa Silva & Pereira Roders, 2012). During the research the values written in the sources will be highlighted with the given colors by Pereira Roders (2007), and any additional important information, beyond the values and attributes mentioned, will be highlighted in a light-yellow color.

2.2 Case Study, Methods, Sources, and Scope

For question one a general comparative case study will be done using the four approaches to transform a building by Hans Ibelings & Diederendirrix (2018). This framework will be used to classify and analyze the research data. The following criteria will be used to make the decision: 19 school buildings in the Netherlands are selected by using websites like: gebouwdin.amsterdam.nl, herbestemming.nl, and architecture firm websites. To ensure that the strategies discovered are not confined to a single region, cases from various parts of the nation are chosen (Appendix 1). The cases need to be post-war adaptive reuse projects with a new dwelling function. The chosen projects are of varied sizes. The data collected will be the following: Picture, Name, Construction Year, Transformation Year, Size, Location, Original Floorplan, and New Floorplan. When it comes to ethics, the authorship will be mentioned of the firms who made the adaptive reuse design will be mentioned.

The Interventions used in the redesigns will be identified using primary sources, by looking at the difference between the original and new floor plans. Additionally, cases with no data on either the original or the new floorplans are filtered out. The cases will be grouped based on their strategies and interventions. An overview is built for each instance, based on the interventions in each case study and the before and after these transformations. This enables the creation of a general overview of all interventions.

The number of groups established will dictate the extent of the analysis. Within each group, one case will be deliberately chosen, and a more comprehensive quantitative vs qualitative analysis will be conducted using the “black/yellow/red” method, with a specific focus on the kept, removed, and added aspects of the volume of the building linked to the function, interior and exterior building fabric. To do this analysis a reproduction in the form of a 3D modeling will be done of the chosen research case(s). Consequently, a more detailed transformation overview is generated, and the effects across all features become visible.
Furthermore, to be able to answer the second question a literature study will be done on the existing design protocols in the Netherlands to link to the reasoning of certain interventions. For this part, the Bouwbesluit of 2012 will be used as a source. Finally, various unique and new design interventions overviews will be created.

These new design intervention overviews will be tested out on the design case, Rendorpschool located in Amsterdam Nieuw-West.

Prior research will be done on the Rendorpschool. Fieldwork and research with (architectural) drawings from the archives will be done. For the selected design case the cultural value will be assessed using the values framework by Pereira Roders (2007) by using the monumental description documents provided by the municipality of Amsterdam.
Together with the cultural value assessment by Pereira Roders (2007), the design interventions overviews will shape and help answer the last question regarding the choice of an adaptive reuse strategy for the creation of a housing typology in a school building.

Chapter 3: General research on 10 cases

3.1 Research Cases Amsterdam

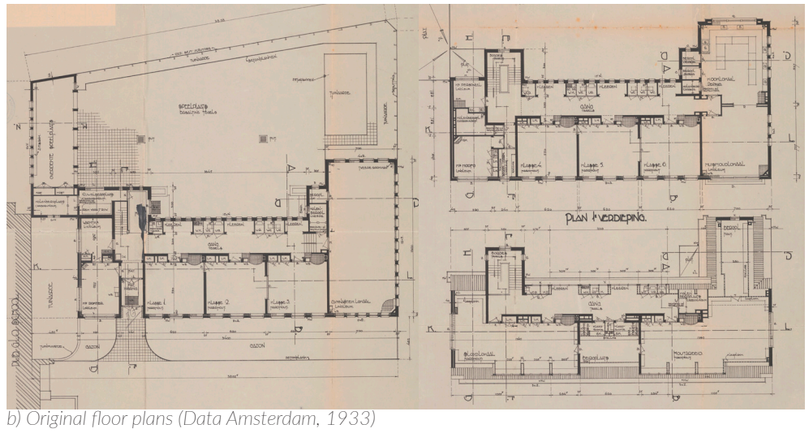
Figure 12 - Locations of the 10 cases in Amsterdam

3.2 Case 1: Jan Ligthartschool

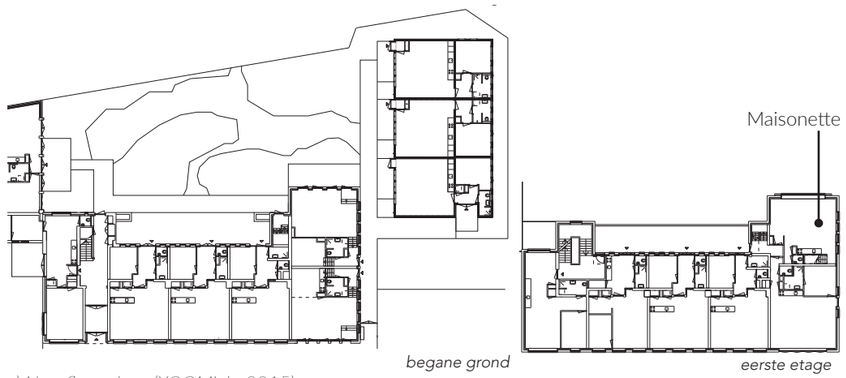
Address: Kraaipanstraat 54-56, Amsterdam Oost
Construction year: 1933
Transformation year: 2015/2016

Transformation architect: XOOMlab
Monument status: monument worthy Order 2
Housing type: 19 dwellings various types

a) Research case (Luuk Kramer, 2017)



b) Original floor plans (Data Amsterdam, 1933)



c) New floor plans (XOOMlab, 2015)

Figure 13 - Case 1

About the case:

This building was the former Jan Lighthartschool built in 1933 by "Publieke Werken" from the municipality of Amsterdam as a school for special education. The buildings are located near a quiet square in the Kraaipanstraat. This street, like the Transvaal neighborhood, was build according to Berlage's urban design plans. Many houses in this Neighborhood were built in the Amsterdam School, with elements like special corners and detailing. This adaptive reuse project has mid-priced rental homes. This building was transformed by repurposing which took less than 2 years. The homes on the ground floor are accessible from the communal courtyard garden on the former schoolyard and on the first floor the dwellings are accessible by a wide balcony gallery. In this project the atmosphere of the old school rooms has been left intact as possible. (XOOMlab, 2017; Gemeente Amsterdam, 2017).

All homes are unique with ranging areas from 49 to 78 m2. In the former bicycle shed there is a one-bedroom garden apartment, a maisonette in the cooking room, a one-bedroom patio apartment in the janitor's quarters, and one-bedroom dwellings in the classrooms and in the vacant attic. Finally, the wooden school in the courtyard, now a municipal monument, has been transformed into three dwellings (XOOMlab, 2017; Gemeente Amsterdam, 2017).

Findings:

Function:

- education spaces
- sanitary spaces
+ 2 maisonettes
+ 14 apartments (2 rooms)
= stairs circulation for apartments

Interior:

+ staircase for maisonette
+ interior walls for creating bathroom, toilet, and bedroom
- removing some interior walls to create bigger spaces for example apartment on the right of building south
- removing interior walls from old toilets and wardrobes.
= keeping the small elements such as the monkey-bars in the old gym classroom

Exterior:

+ gallery 1st floor
+ addition for three dwellings
+ new entrances

Legend

+ added
- removed
= kept
! drastically

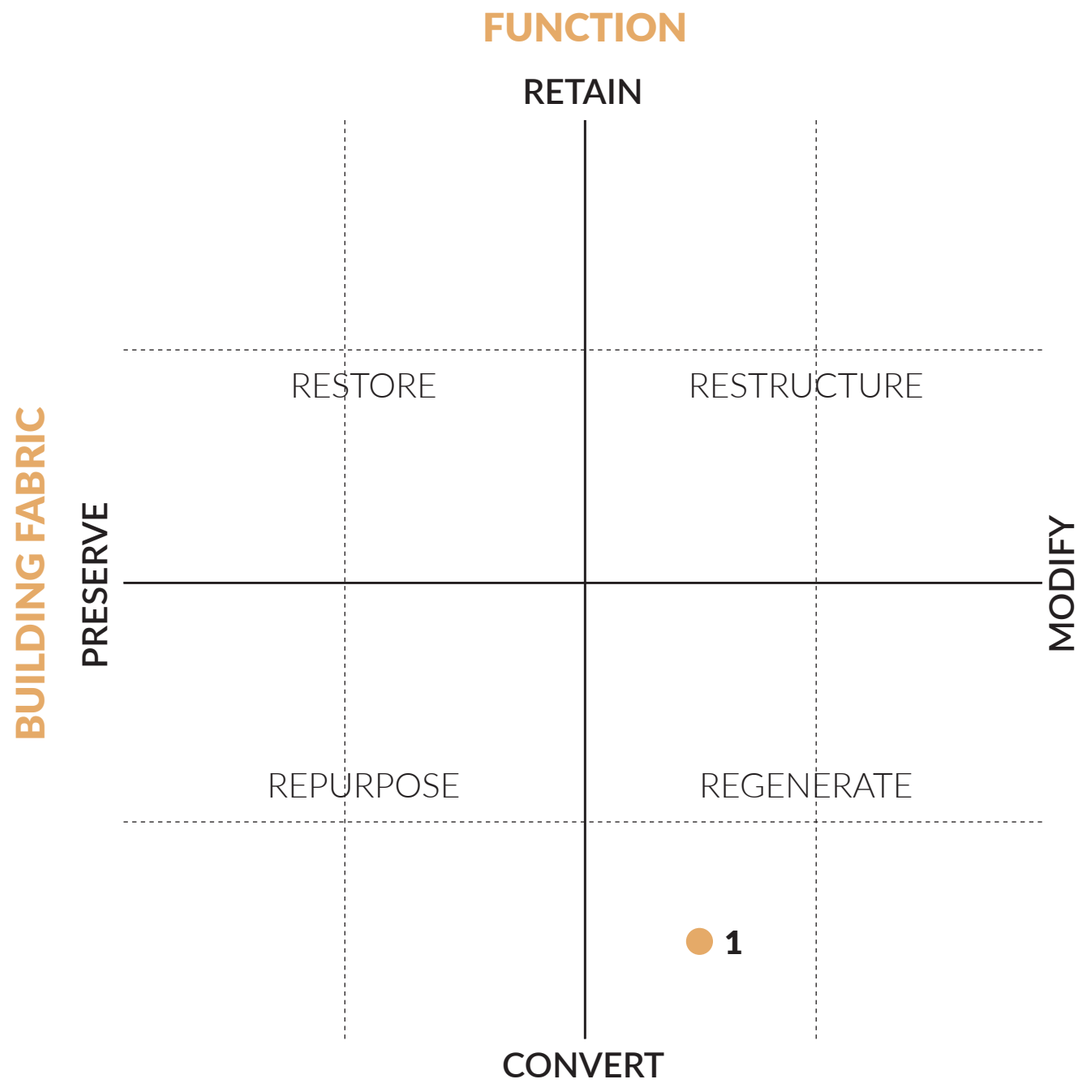
Guidelines given by Ibelings, and Diederenendirrix	**Category: Regenerate**	Restore	Repurpose	Regenerate	Restructure
function	-	=	-	-	=
interior building fabric	+/-	=	+/-	+/-	+/-!
exterior building fabric	+	=	=	+/-	+/-!

a) Category case 1. Source: own work

b) grid position case 1

Category:

Regenerate, because of the building getting a new purpose and the back facade changing a bit by adding the gallery. Since the gallery is the only major difference on the facade the location on the axes of this building is close to repurpose.



c) Result classification case 1

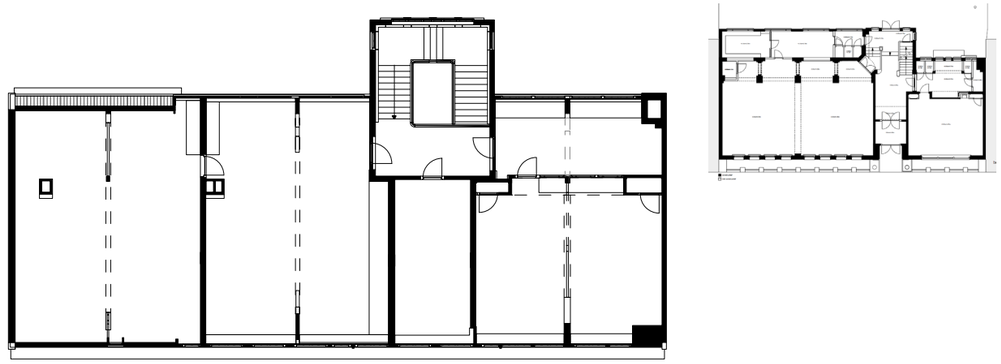
Figure 14 - Results case 1

3.3 Case 2: Lokaal Zuid FV 10

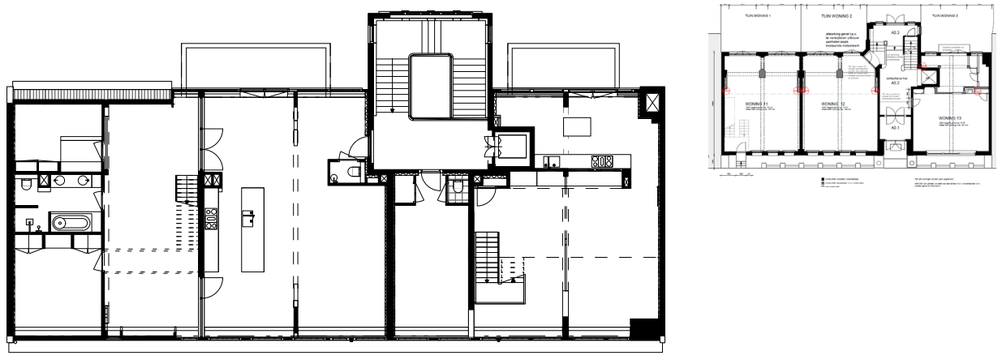
Address: Floris Versterstraat 10, Amsterdam Zuid
Construction year: 1931
Transformation year: 2013/2014

Transformation architect: Hund Falk Architecten
Monument status: municipal monument Order 1
Housing type: 7 dwellings various types

Research case (Hund Falk Architecten, 2012)



Original floor plans 3rd floor (left) and ground floor (right) (Hund Falk Architecten, 2012)



New floor plans 3rd floor (left) and ground floor (right) (Hund Falk Architecten, 2012)

Figure 15 - Case 2

About the case:

Lokaal Zuid FV 10 was originally built in 1931 as the Calvijnschool, later as the public primary school Nicolaas Maes. The former school building at Floris Versterstraat 10 was designed by architect Op 't Land in an early Amsterdam School style. Originally there were 7 classrooms, a crafts-room, and a gym. Behind the school there is a protestants chapel with the name Pro Rege (Amsterdam op de kaart, 2023).

Lokaal Zuid FV 10 is part of a transformation project called "Lokaal Zuid" where three school buildings have been restored and transformed. In front of this old school building there is another old school building located at Floris Versterstraat 11, which also forms a special feature in the urban setting of the Hoofddorpplein neighborhood. This transformation project has produced 7 dwellings with various dwelling types and sizes that range from apartments to ground floor maisonettes. The dwellings are delivered as shell construction meaning that the buyers must fill in the space. To match the shell with the interior design, the residents were involved in the process from the sketch design onwards. The whole building is adapted to high sustainability criteria and all technical aspects have been integrated into the design in such a way that the building's striking character has been optimally preserved (Hund Falk Architecten, 2012; Gemeente Amsterdam, 2012).

Findings:

Function:

- educational spaces
- sanitary spaces
+ 3 maisonettes
+ 4 apartments
= stairs circulation for apartments

Interior:

+ elevator
+ staircase for maisonettes
+ interior walls for creating bathroom, toilet, and bedroom
- removing some interior walls to create openings for doors

Exterior:

+ new building entrance along the street
+ big balconies on the backside

Sustainability:

+ insulation
+ double glazing
+ PV-panels
+ Ventilation with heat recovery

Legend

+ added
- removed
= kept
! drastically

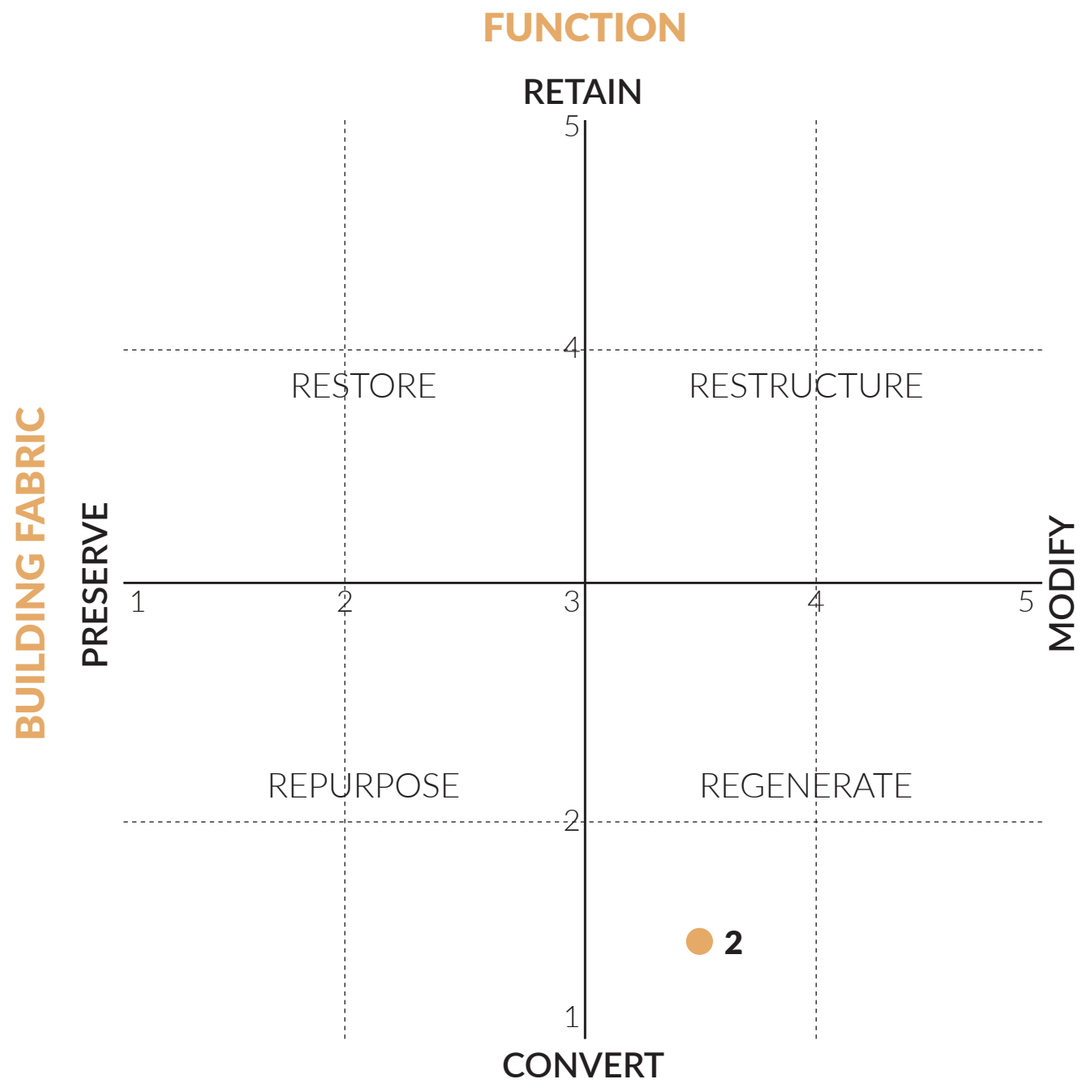
Guidelines given by Ibelings, and Diederenendirrix	Category: **Regenerate**	Restore	Repurpose	Regenerate	Restructure
function	-	=	-	-	=
interior building fabric	+/-	=	+/-	+/-	+/-!
exterior building fabric	+	=	=	+/-	+/-!

a) Category case 2.

b) grid position case 2.

Category:

Regenerate, because of the facade changing by adding balconies and entrances. Furthermore, the facade is not drastically modified more.



c) Result classification case 2.

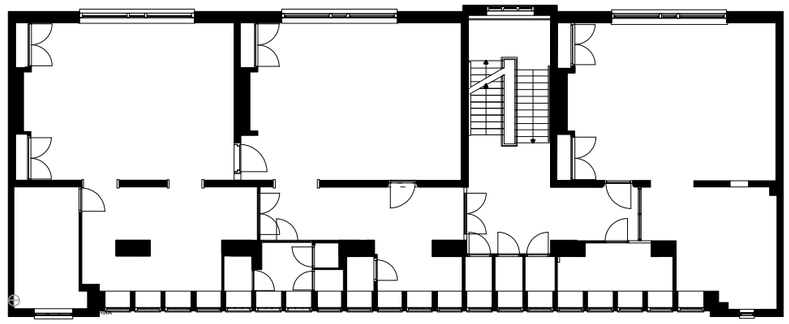
Figure 16 - Results case 2.

3.4 Case 3: Lokaal Zuid FV 11

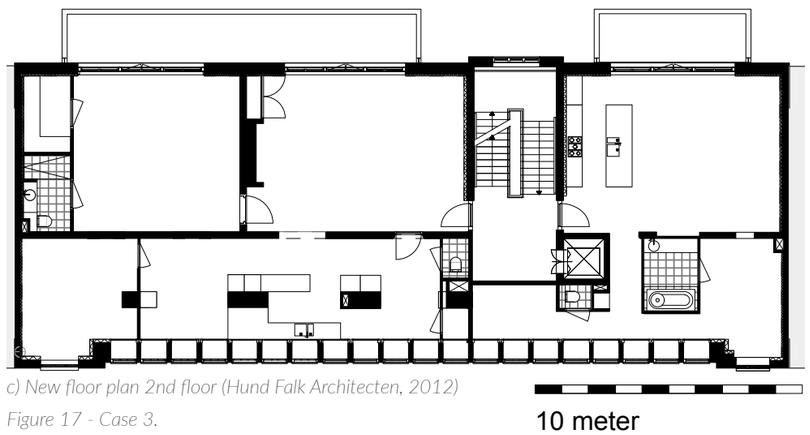
Address: Floris Versterstraat 11, Amsterdam Zuid
Construction year: 1931
Transformation year: 2013/2014

Transformation architect: Hund Falk Architecten
Monument status: monument worthy Order 2
Housing type: 10 dwellings various types

a) Research case (Amsterdam Op Kaart, 2021)



b) Original floor plan 2nd floor (Hund Falk Architecten, 2012)



c) New floor plan 2nd floor (Hund Falk Architecten, 2012)

Figure 17 - Case 3.

About the case:

Lokaal Zuid FV 11 was originally a school for reformed primary education with a gym. The former school was designed by architect G.A. Roobol in an early Amsterdam school style and was built in 1931. The school got the name Pro Rege meaning “for the king”. After it housed another school Willem van Boeijenschool till around 2010 (Amsterdam op de kaart, 2021).

Lokaal Zuid FV 11 is also part of the transformation project in Hoofddorpplein neighborhood in Amsterdam Zuid. It is visible from the small windows in the front that the classrooms were orientated towards the back. Just like Lokaal Zuid FV 10, this transformation project has produced 7 dwellings with various dwelling types and sizes that range from apartments to ground floor maisonettes. The houses have been realized as much as possible within the existing main structure while retaining the interior and exterior detailing. The dwellings are delivered as shell construction meaning that the buyers must fill in the space. To match the shell with the interior design, the residents were involved in the process from the sketch design onwards (Hund Falk Architecten, 2012).

The whole building is adapted to high sustainability criteria and all technical aspects have been integrated into the design in such a way that the building’s striking character has been optimally preserved (Hund Falk Architecten, 2012; Gemeente Amsterdam, 2012).

Findings:

Function:

- education spaces
- sanitary spaces
+ 3 maisonettes
+ 4 apartments
= stairs circulation for apartments

Interior:

+ elevator
+ staircase for maisonettes
+ interior walls for creating bathroom, toilet, and bedroom
- removing some interior walls to create openings for doors

Exterior:

+ new entrances street side
+ roof patio
+ balconies on back side

Sustainability:

+ insulation
+ double glazing
+ PV-panels
+ Ventilation with heat recovery

Legend

+ added
- removed
= kept
! drastically

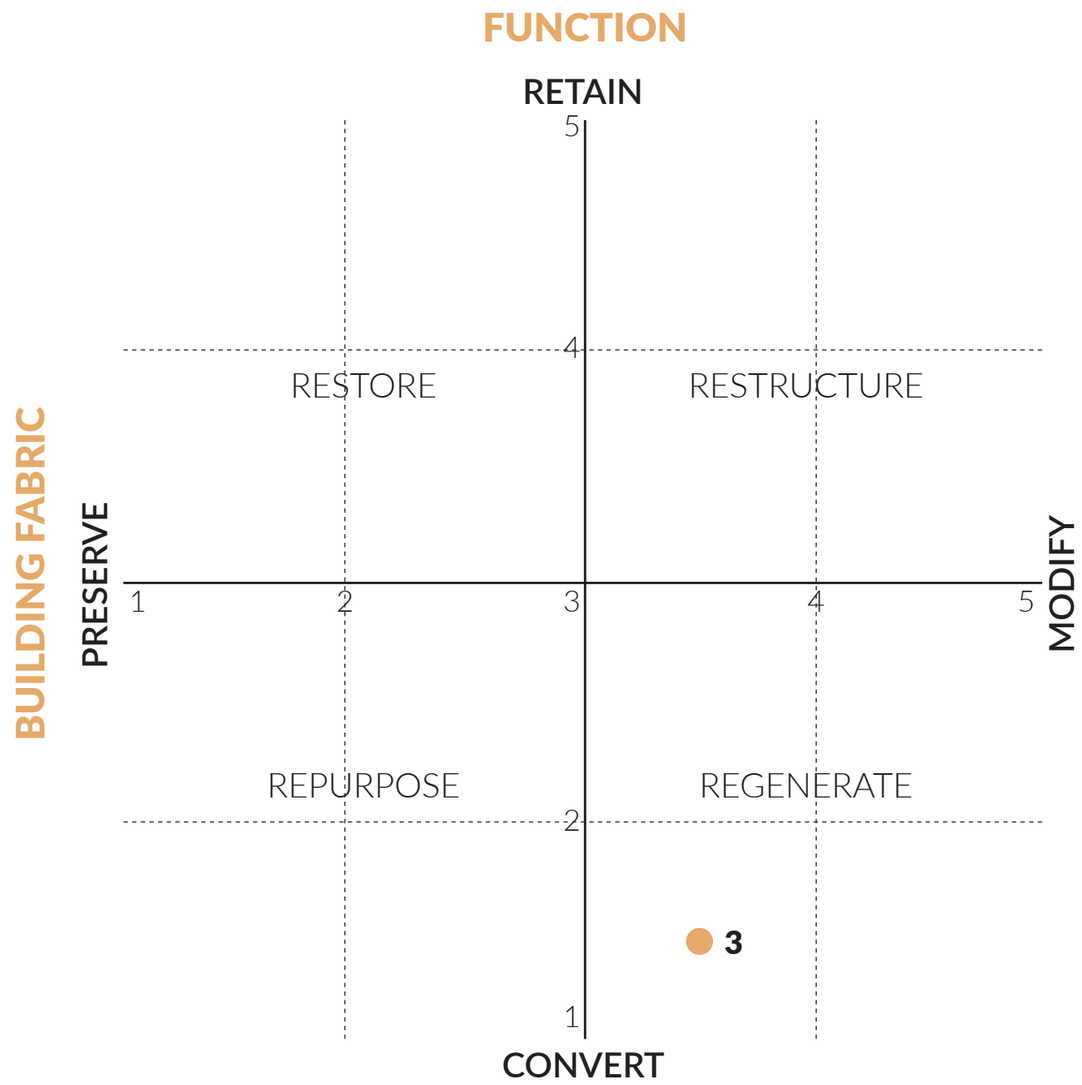
Guidelines given by Ibelings, and Diederenendirrix	Category: **Regenerate**	Restore	Repurpose	Regenerate	Restructure
function	-	=	-	-	=
interior building fabric	+/-	=	+/-	+/-	+/-!
exterior building fabric	+	=	=	+/-	+/-!

a) Category case 3.

b) grid position case 3.

Category:

Regenerate, because of the facade changing by adding balconies and entrances. Furthermore, the facade is not drastically modified more.



c) Result classification case 3.

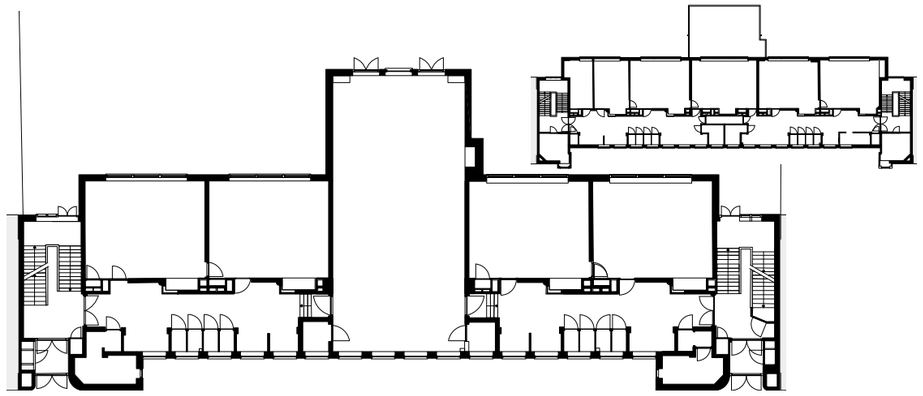
Figure 18 - Results case 3.

3.5 Case 4: Lokaal Zuid BB

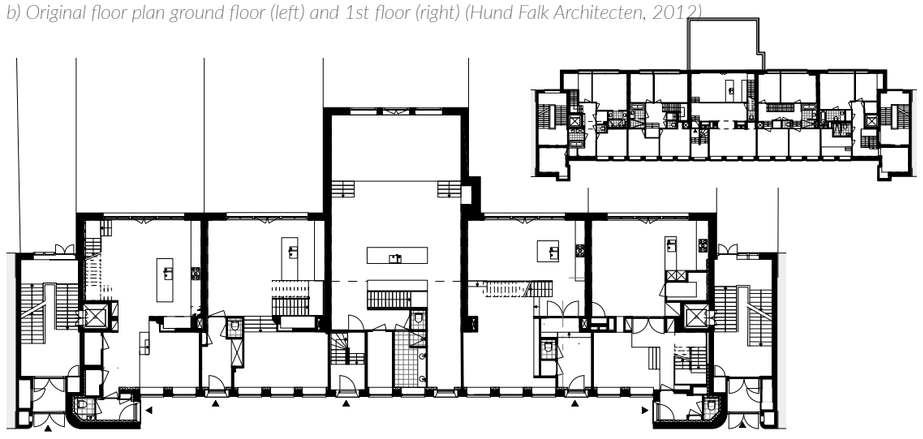
Address: Bennenbroekstraat 11, Amsterdam Zuid
Construction year: 1930
Transformation year: 2013/2014

Transformation architect: Hund Falk Architecten
Monument status: Order 3
Housing type: 10 dwellings various types

a) Research case (Hund Falk Architecten, 2012)



b) Original floor plan ground floor (left) and 1st floor (right) (Hund Falk Architecten, 2012)



c) New floor plan ground floor (left) and 1st floor (right) (Hund Falk Architecten, 2012)
Figure 19 - Case 4

About the case:

Lokaal Zuid BB is also part of the transformation project in the Hoofddorpplein neighborhood. The former school building in Benneboekstraat was built around 1930 in a sober Amsterdam School style, commissioned by the Public Works Department. Just like the previous two cases this project also consists of various dwelling types. This transformation project has produced 10 dwellings with various dwelling types and sizes that range from apartments to ground floor maisonettes. The houses have been realized as much as possible within the existing main structure while retaining the interior and exterior detailing (Gemeente Amsterdam, 2012).

Just like the other adaptive reuse projects mentioned before, the dwellings are delivered as shell construction meaning that the buyers must fill in the space. To match the shell with the interior design, the residents were involved in the process from the sketch design onwards (Hund Falk Architecten, 2012).

The whole building is adapted to high sustainability criteria and all technical aspects have been integrated into the design in such a way that the building's striking character has been optimally preserved (Hund Falk Architecten, 2012; Gemeente Amsterdam, 2012).

Findings:

Function:
- education spaces
- sanitary spaces
+ 5 maisonettes
+ 5 apartments
= stairs circulation for apartments

Interior:
+ extension of the two existing stairwells to the top floor
+ elevator
+ staircase for maisonettes
+ interior walls for creating bathroom, toilet, and bedroom
- removing some interior walls to create openings for doors

Exterior:
+ new entrances on the exterior facing the street
+ balconies backside
+ dormer windows
+ roof patio

Sustainability:
+ insulation
+ double glazing
+ PV-panels
+ Ventilation with heat recovery

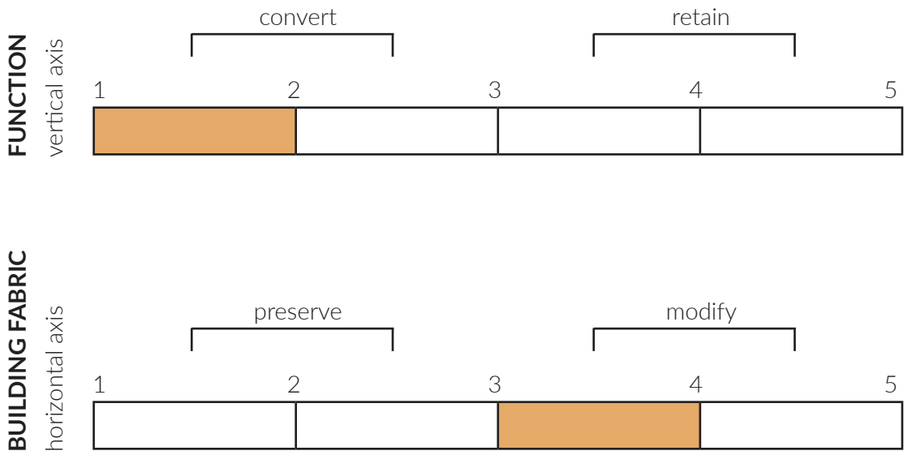
d) original and new facades (Hund Falk Architecten, 2013)

Legend

+ added
- removed
= kept
! drastically

Guidelines given by Ibelings, and Diederenendirrix	**Category: Regenerate**	Restore	Repurpose	Regenerate	Restructure
function	-	=	-	-	=
interior building fabric	+/-	=	+/-	+/-	+/-!
exterior building fabric	+	=	=	+/-	+/-!

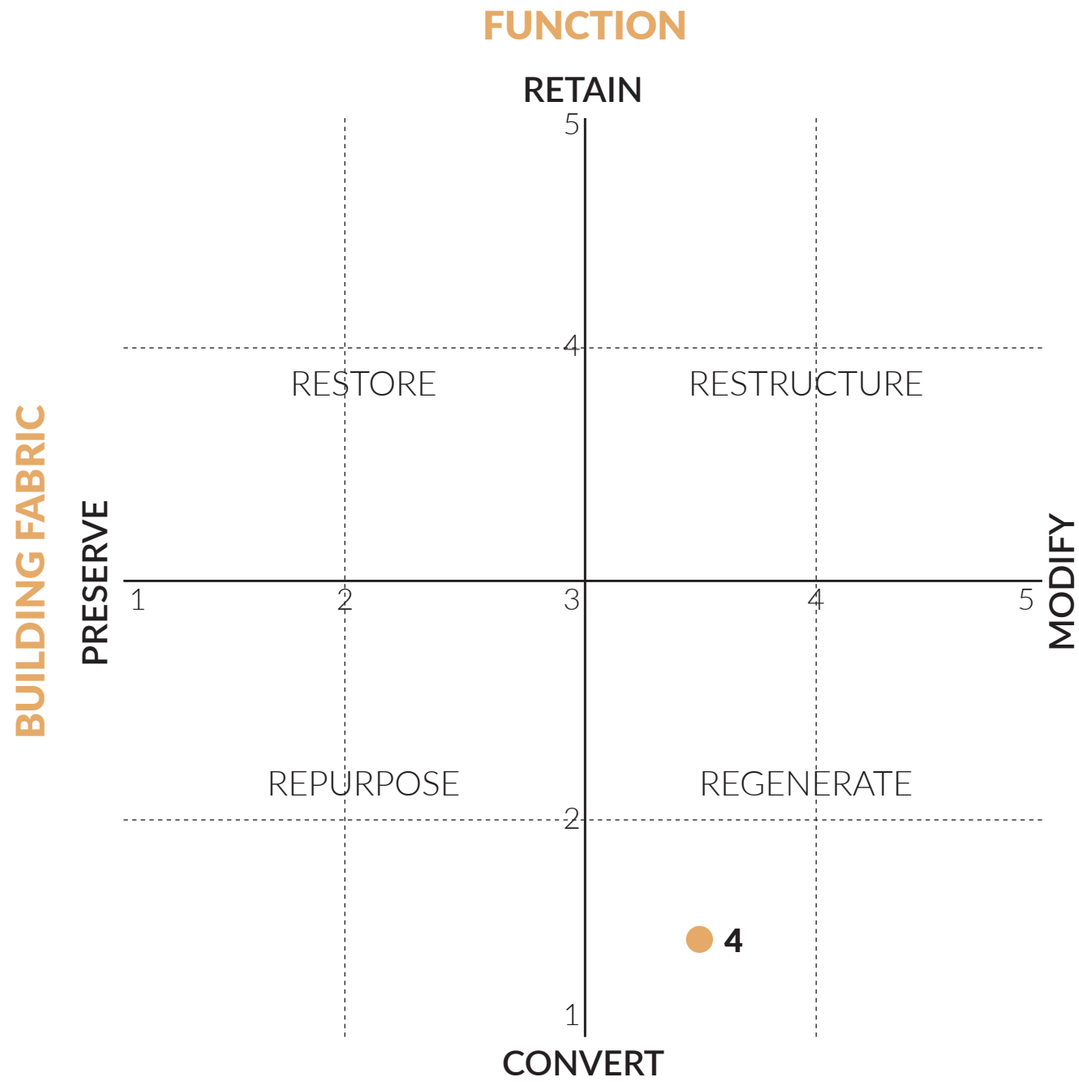
a) Category case 4.



b) grid position case 4.

Category:

Regenerate, because of the facade being modified by carving new openings for dormer windows and balconies being created. It differs from the other Lokaal Zuid projects, because the openings created here were not here before, while the other ones had window openings that got extended down to add doors.



c) Result classification case 4.

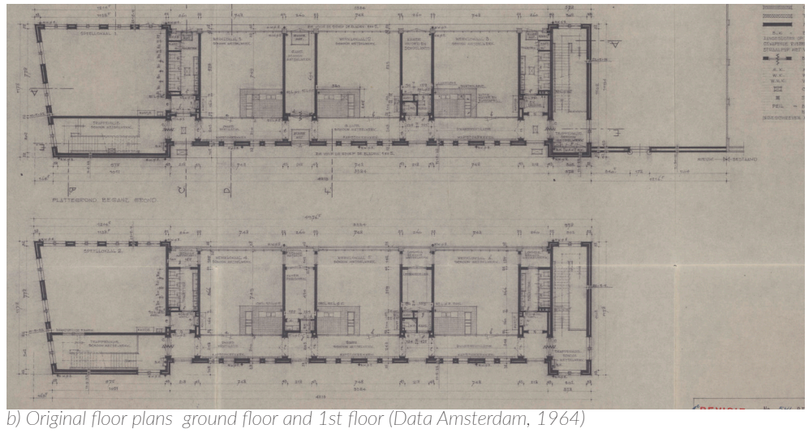
Figure 20 - Results case 4.

3.6 Case 5: Amundsenhofje

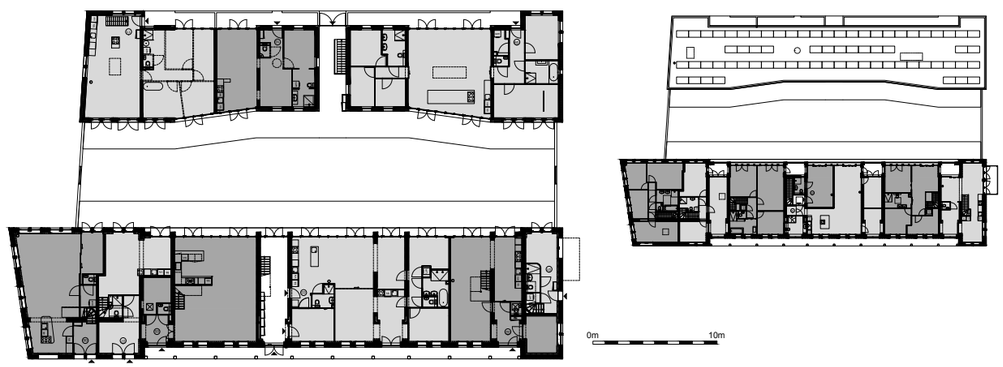
Address: Amundsenweg 1, Amsterdam West
Construction year: 1964
Transformation year: 2014/2015

Transformation architect: Hulshof Architecten
Monument status: Order 1
Housing type: 10 dwellings

a) Research case (Amsterdam Op Kaart, 2023)



b) Original floor plans ground floor and 1st floor (Data Amsterdam, 1964)



c) New floor plans ground floor plans (left) and 1st floor (right) (Hulshof Architecten, 2014)

Figure 21 - Case 5.

About the case:

This building located in the Robert Scott neighborhood was originally a roman-catholic kindergarten built 1964. This school was designed by Evers and Sarlemijn as a corridorschool, with the corridor on the north side and the classrooms on the south next to the playground. Two of the classrooms were for lessons and the other two for playtime. In around 1975 the school became the Alphons Laudyschool for special education. In 2001 the building housed a part of the El Amien Islamic elementary school. After this closed, the building was squatted in 2010 (Amsterdam op de kaart, 2023; Gemeente Amsterdam, 2014).

This building was later transformed in 2014/2015 into seven dwellings in the original envelope of the building and three on the old playground as a self-build project with collective private commissioning. During the transformation, as much as possible has been reused. Individual options for each home were added by the tenant to customize the plan (Hulshof Architecten, 2014).

Findings:

Function:

- education spaces
- sanitary spaces
- circulation space (remove original staircases)

\+ 5 maisonettes
\+ 2 apartments (old building) & 3 apartments (new building)
\+ 1 collective space for 2 dwellings

Interior:

\+ change of main staircase to the center of the building
\+ interior walls for creating bathroom, toilet, and bedroom
\+ adding 6 stairwells for maisonettes
- removing the 2 big stairwells
- removing some interior walls to create openings for doors

Exterior:

\+ sedum vegetation on roofs
\+ addition on old playground of 3 dwellings
= loggia's

Sustainability:

\+ Insulation improvement
\+ Collective heating system
\+ PV and PVT-panels

Legend

+ added
- removed
= kept
! drastically

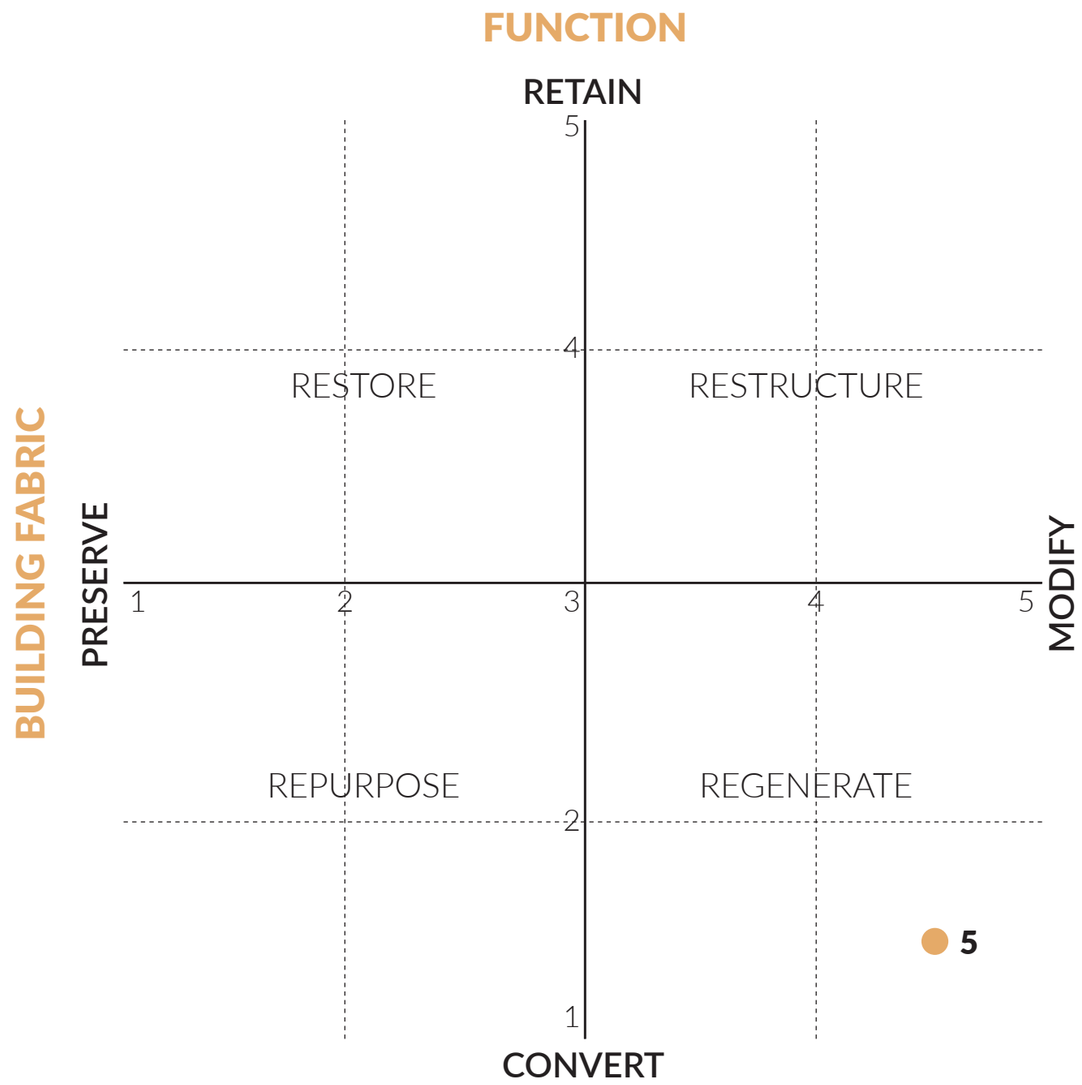
Guidelines given by Ibelings, and Diederenendirrix	Category: **Regenerate**	Restore	Repurpose	Regenerate	Restructure
function	-	=	-	-	=
interior building fabric	+/-	=	+/-	+/-	+/-!
exterior building fabric	+	=	=	+/-	+/-!

a) Category case 5.

b) grid position case 5.

Category:

Regenerate, because the original staircases are removed to build 6 new maisonette staircases instead and an extra building is built parallel to the school which requires a lot of resources.



c) Result classification case 5.

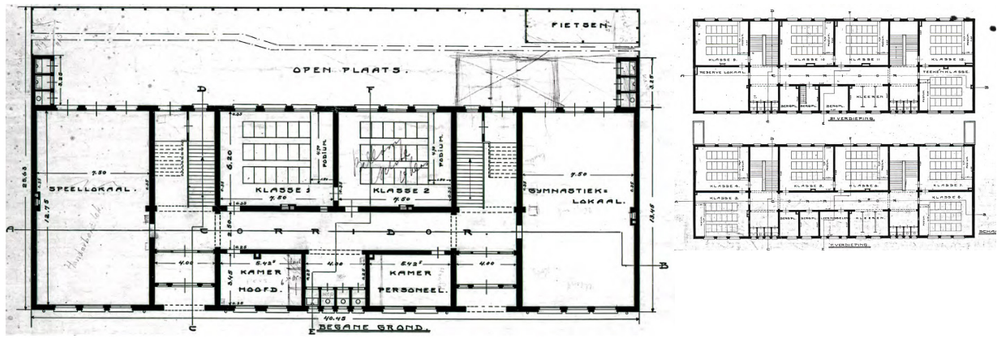
Figure 22 - Results case 5.

3.7 Case 6: Ons Dorp Amsterdam

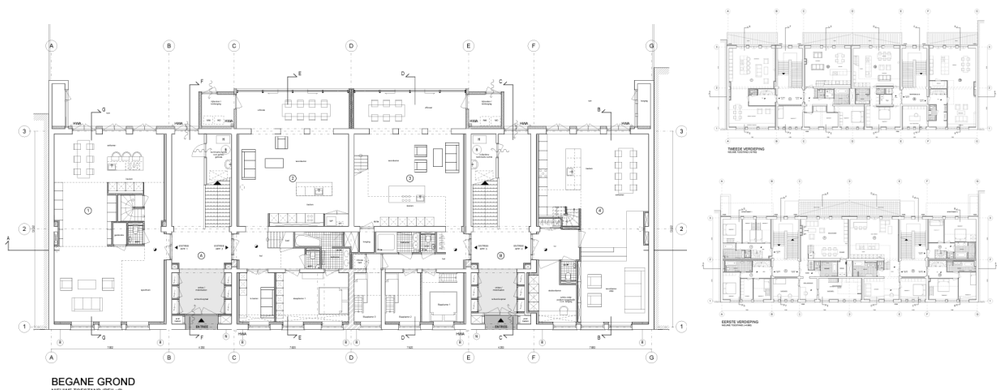
Address: Elisabeth Wolffstraat 50. Amsterdam West
Construction year: 1910
Transformation year: 2014/2015

Transformation architect: CASA Architecten
Monument status: Basic order
Housing type: 10 family dwellings and common room

a) Research case (CASA Architecten, 2014)



b) Original floor plan 2nd floor (Data Amsterdam, 1910)



c) New floor plans ground floor (left) 2nd and 1st floor (right) (CASA Architecten, 2014)

Figure 23 - Case 6.

About the case:

The Elisabeth Wolfstraat 50 building consists of ten completely different owner-occupied family apartments, both in terms of layout and finish. This transformation projects made use of the great height of the old classrooms. By applying a clever thin construction, entresols could be created. The building was delivered as a shell construction where all interventions were discussed by the architects with the entire group. The realized apartments of around 170 m2 are all unique not only in layout, but also in the use of materials (Gemeente Amsterdam, 2014; CASA Architecten, 2014).

On the sides, 4 maisonettes over one and a half floors were made, in the middle there are 4 apartments and on the 2nd floor 2 maisonettes. All houses have a large outdoor space: garden, roof terrace or balcony. The middle houses on the first floor have an extension, on which the houses above have a terrace. The material use of the extensions contrast with the rear facade of the building. Much attention has been paid to sustainability: by applying heat pumps with heat-cold storage in the ground and PV-panels on the roof, the houses are virtually energy-neutral (Gemeente Amsterdam, 2014; CASA Architecten, 2014).

Findings:

Function:

- education spaces
- sanitary spaces
+ 6 entresol maisonettes h≈5
+ 4 entresol apartments h≈ 5m
+ collective technical room
= stairs circulation for apartments

Interior:

+ entresols due to the existing height
+ interior walls for creating bathroom, toilet, and bedroom
- removing some interior walls to create openings for doors
= keeping existing stairwells.

Exterior:

+ balconies
+ extension of middle houses creating a terrace for apartments on top
+ roof patio
+ sedum vegetation roof
= central main entrance of 1960s replaced by two new entrances just like the ones of 1910

Sustainability:

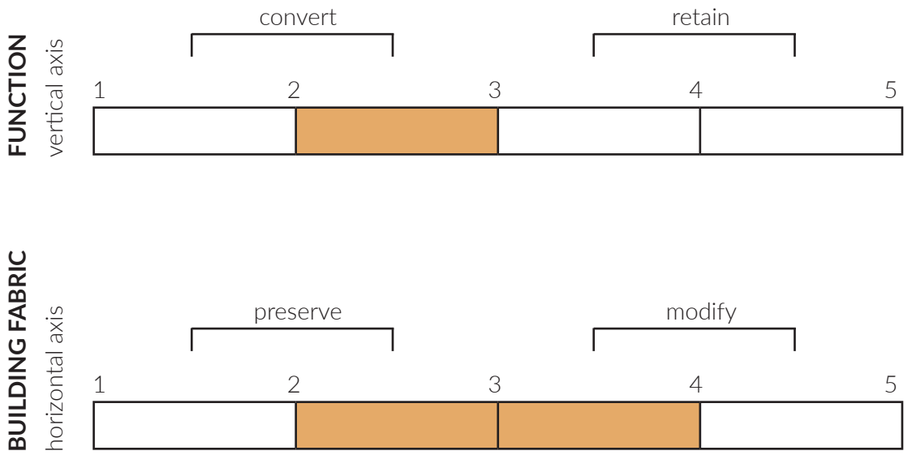
+ heat pumps with heat-cold storage in the ground
+ rear facade insulated on the outside and finished with brick strips to not change facade appearance
+ PV-panels on the roof
+ roof insulation on the outside to keep existing roof construction in sight
+ total window frame replacement recreating original 1910 character
+ triple glass
+ hidden ventilation facilities
+ homes are full-electric

Legend

+ added
- removed
= kept
! drastically

Guidelines given by Ibelings, and Diederenendirrix	Category: **Regenerate/ Repurpose**	Restore	Repurpose	Regenerate	Restructure
function	-	=	-	-	=
interior building fabric	+/-	=	+/-	+/-	+/-!
exterior building fabric	+/=	=	=	+/-	+/-!

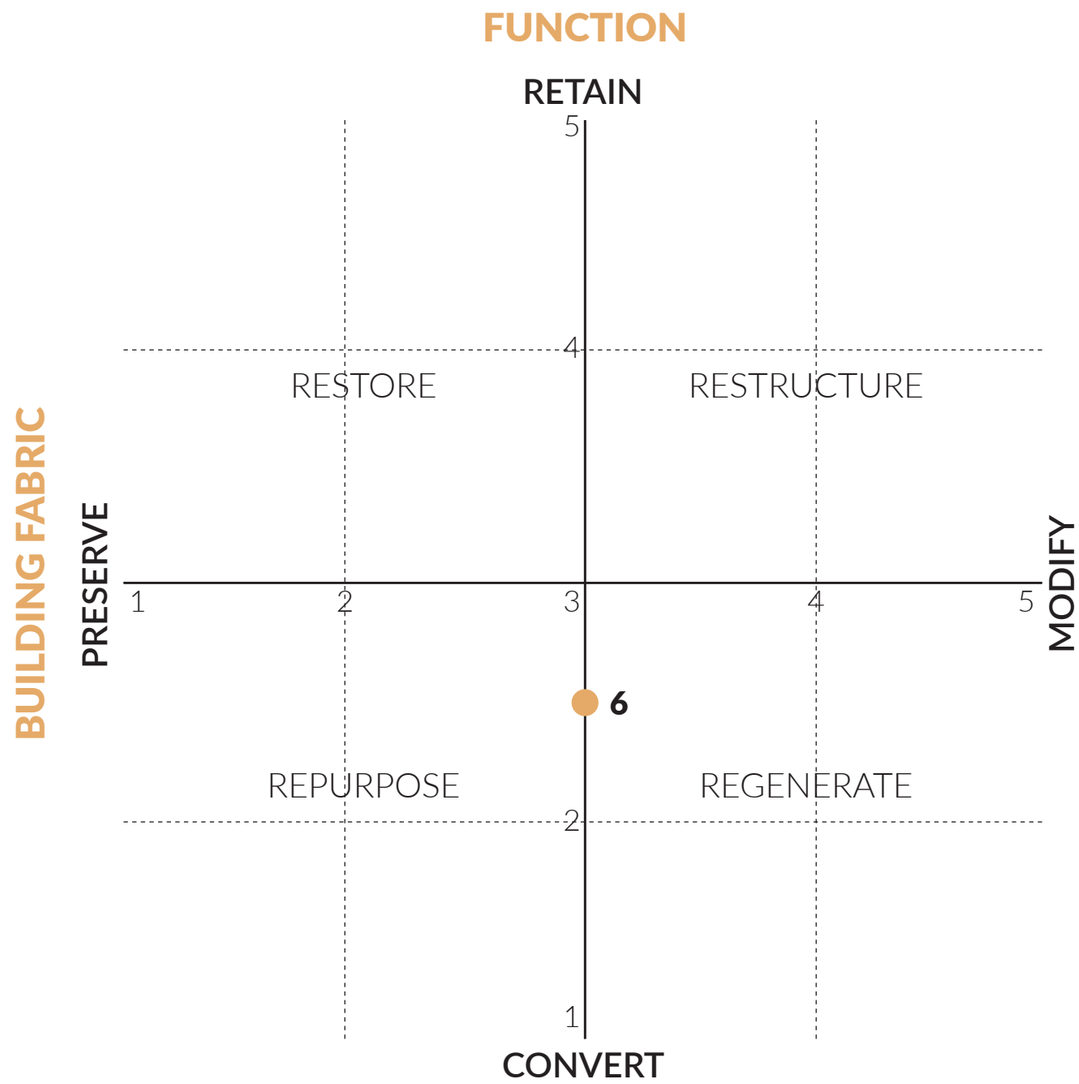
a) Category case 6.



b) grid position case 6.

Category:

Repurpose/Regenerate, in the middle closer to convert because they try to preserve the original design by bringing back the two stairwells, but they also modify by adding an extension and balconies on the back. When it comes to function, it is on position -1 on the grid due to it having a collective room and not only dwellings



c) Result classification case 6.

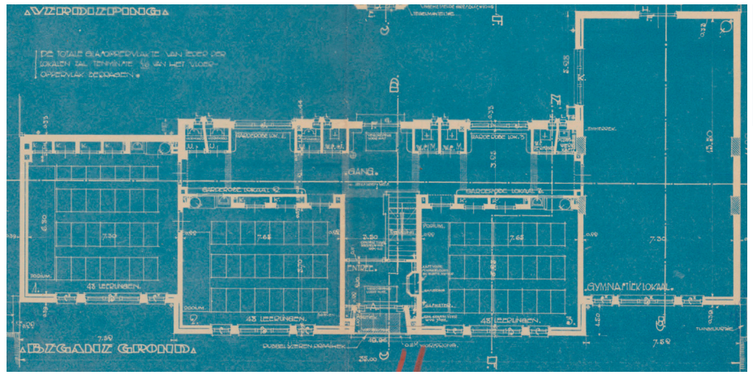
Figure 24 - Results case 6.

3.8 Case 7: Kalkoenstraat

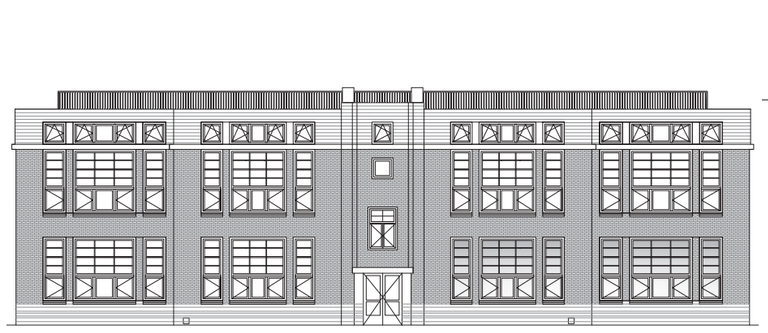
Address: Kalkoenstraat 11, Amsterdam Noord
Construction year: 1923
Transformation year: 2018/2019

Transformation architect: Stadsgezicht
Monument status: Order 3
Housing type: 9 dwellings

a) Research case (Amsterdam op de kaart, 2021)



b) Original floor plans (Data Amsterdam, 1923)



c) New floor plans. Gemeente Amsterdam, 2015)

Figure 25 - Case 7.

About the case:

This building was originally built in 1923 as the Ds. C.P. van Eeghenschool as a Christian elementary school designed by C.B. Posthumus Meyjes jr. Additionally, the architect designed courthouses, office buildings and hospitals with his father. This building in Amsterdam School style shows its characteristic of buildings of the 1930s (Amsterdam op de kaart, 2021).

The building contained four classrooms on the first floor and three classrooms on the ground floor with a gym. When the school became vacant for a bit it was repurposed in 2003 to office spaces and for a while it was also an architecture firm. In 2018/2019 it was transformed into 9 homes while retaining the special features (Gemeente Amsterdam, 2015).

The entrances of the dwellings are accessible from the communal entrance, and they also have their own outdoor space by having a large garden or a spacious roof terrace.

Findings:

Function:

- education spaces
- sanitary spaces
+ 9 apartments
= stairs circulation for apartments

Interior:

+ interior walls for creating bathroom, toilet, and bedroom
- removing some interior walls to create openings for doors
- remove interior walls of old toilets and wardrobes

Exterior:

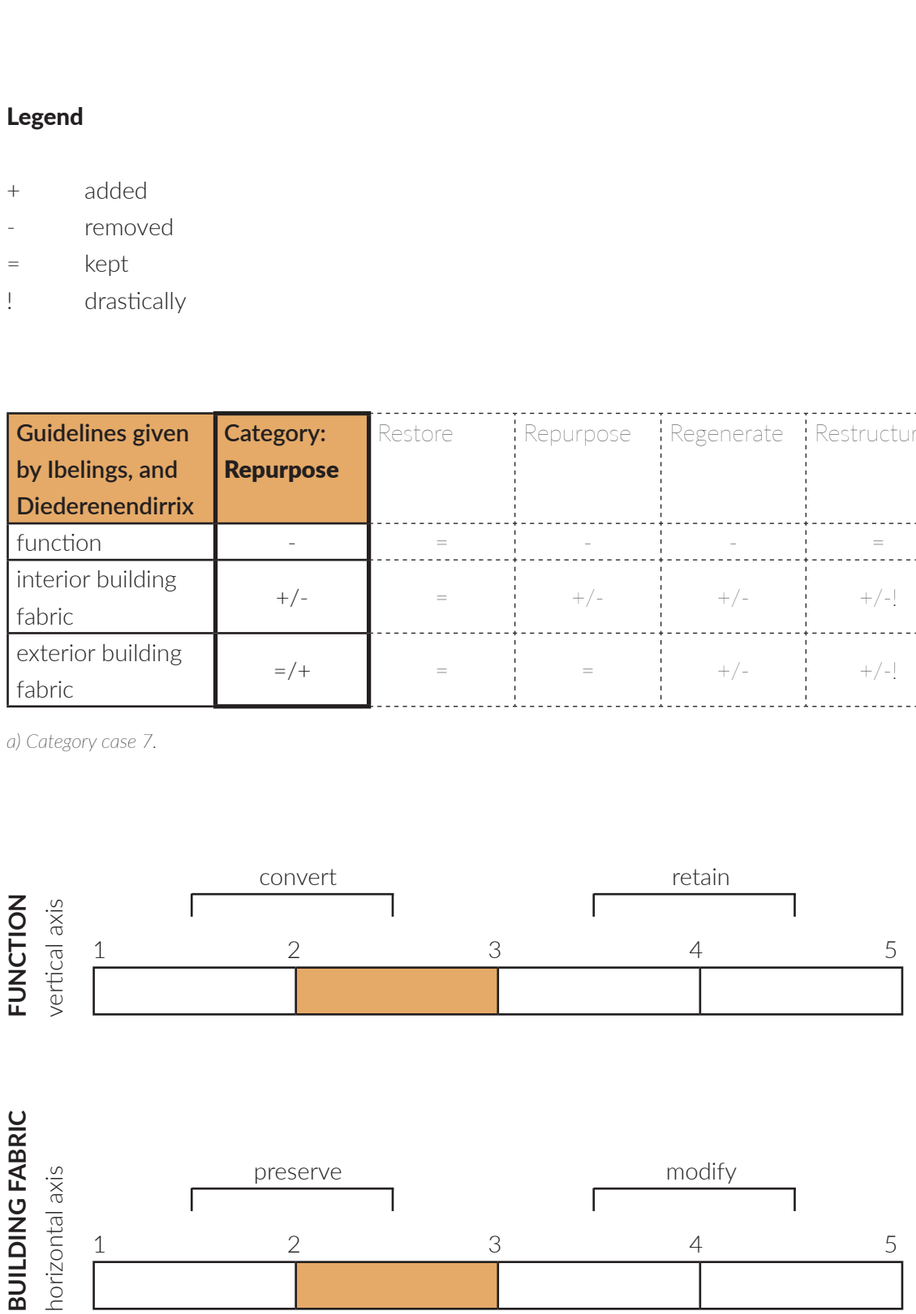
+ roof patio
+ extra windows on top level
+ new entrances created on the back making the facade more open
= facade material

Legend

+ added
- removed
= kept
! drastically

Guidelines given by Ibelings, and Diederenendirrix	Category: **Repurpose**	Restore	Repurpose	Regenerate	Restructure
function	-	=	-	-	=
interior building fabric	+/-	=	+/-	+/-	+/-!
exterior building fabric	=/+	=	=	+/-	+/-!

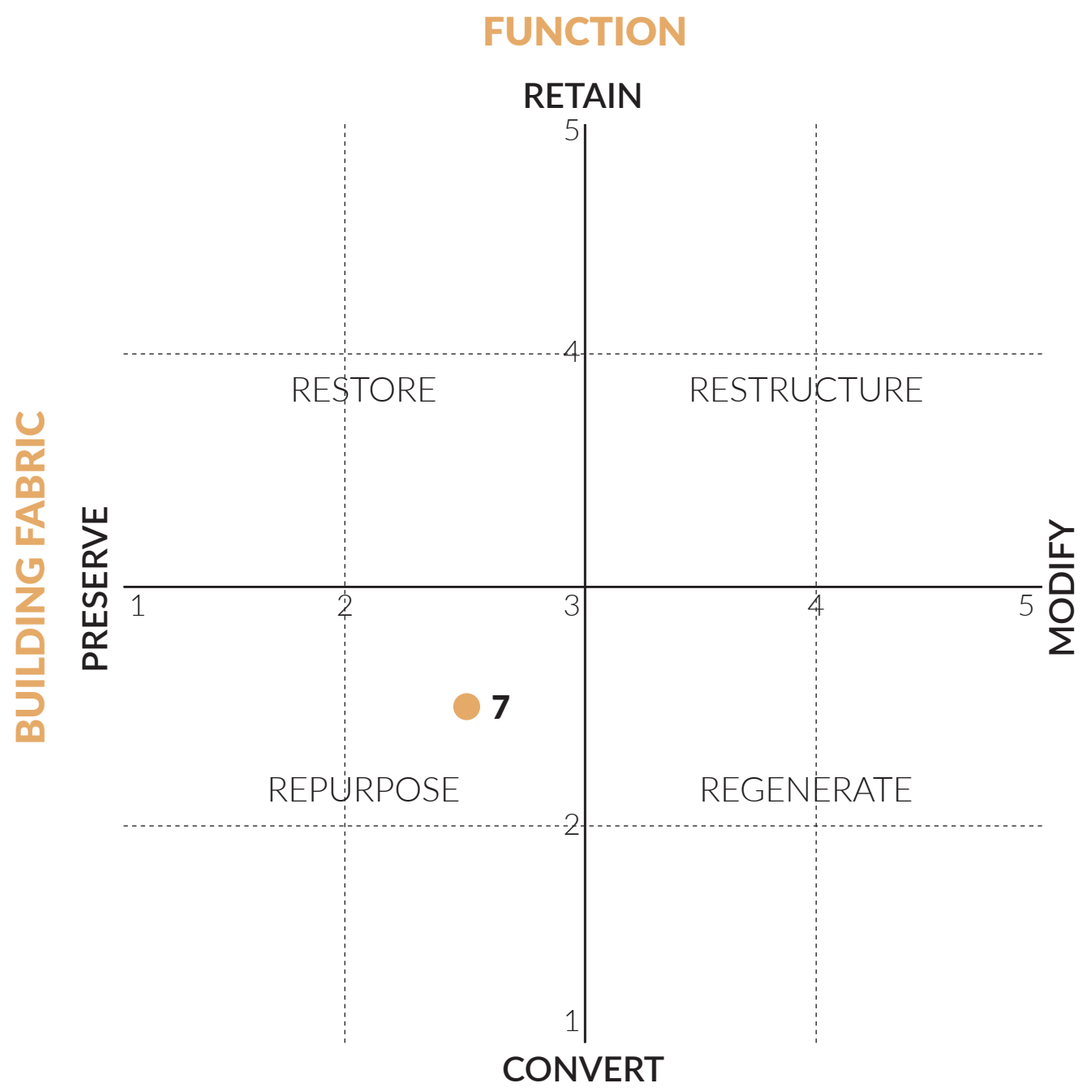
a) Category case 7.



b) grid position case 7.

Category:

Repurpose, because of the obvious of the function changing to housing function and retaining the special features. The only major changes to the facade is the roof terrace that is seen on the top and the new openings on the back.



c) Result classification case 7.

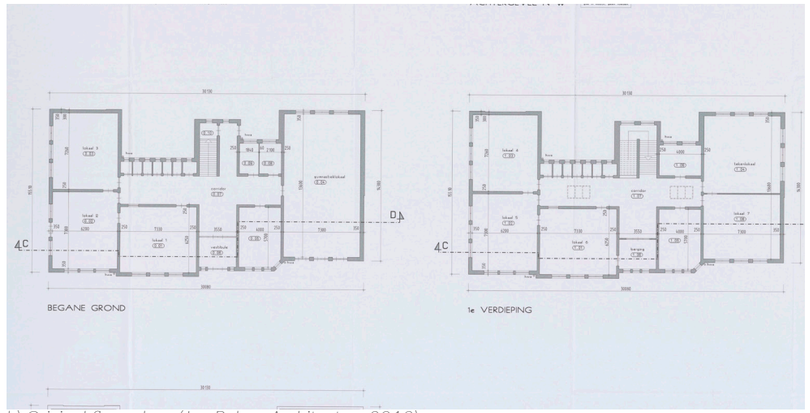
Figure 26 - Results case 7.

3.9 Case 8: Stek Noord 1

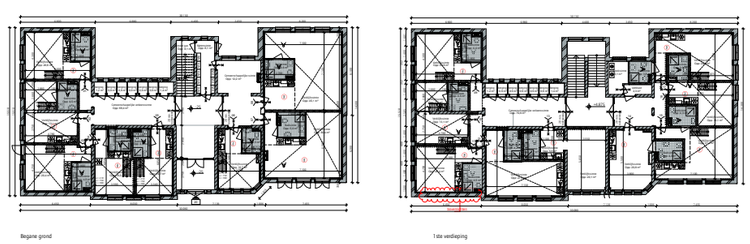
Address: Havikslaan 20, Amsterdam Noord
Construction year: 1914-1916
Transformation year: 2018/2019

Transformation architect: Jan Bakers Architecten
Monument status: Order 1
Housing type: 17 dwellings and common room

a) Research case (Gemeente Amsterdam, 2019)



b) Original floor plans (Jan Bakers Architecten, 2019)



c) New floor plans (Jan Bakers Architecten, 2019)

Figure 27 - Case 8.

About the case:

Between 1914 and 1916 there were three school buildings built based of a design by H.P. Berlage and J.C. van Epen. In 2004 these three schools were given the title of municipal monument. Two of these schools on the Havikslaan 20 and 22 were transformed into 17 dwellings each between 25 and 50 m2. Half of the apartments are rented to young adults between 18 and 28 years and the other half for status holders of the same age group. These apartments are insulated and due to the high ceilings, entresols were created (Gemeente Amsterdam, 2019; Jan Bakers Architecten, 2019).

The facade and some authentic interior detailing were preserved and restored, such as stained-glass windows, existing tiles, paneled doors and stairwells. The surroundings of these buildings are designed as a buffer between the old school buildings and the surrounding buildings. In the green there is a communal vegetable garden for the residents. There is also a common space on the first floor and in the garden around the buildings. The residents are expected to contribute at least one hour a week to the community to promote integration (Gemeente Amsterdam, 2019; Jan Bakers Architecten, 2019).

Findings:

Function:

- educational spaces
- sanitary spaces
+ 17 entresol apartments h≈5m
+ collective spaces
= stairs circulation for apartments

Interior:

+ entresols
+ interior walls for creating bathroom, toilet, and bedroom
- removing some interior walls to create openings for doors
= interior detailing

Exterior:

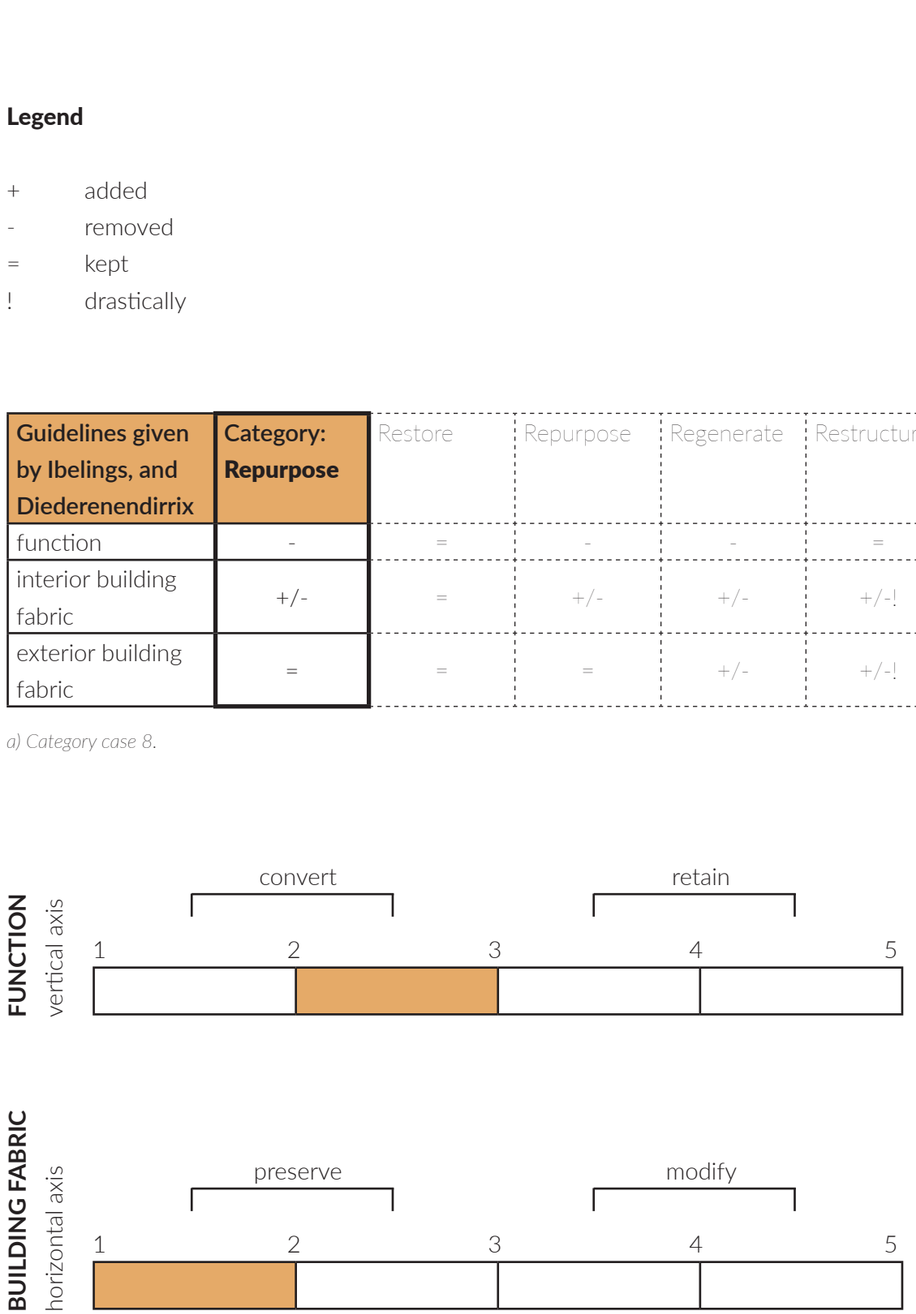
= stained glass windows
= paneled doors
= existing facade tiles

Legend

+ added
- removed
= kept
! drastically

Guidelines given by Ibelings, and Diederenendirrix	Category: **Repurpose**	Restore	Repurpose	Regenerate	Restructure
function	-	=	-	-	=
interior building fabric	+/-	=	+/-	+/-	+/-!
exterior building fabric	=	=	=	+/-	+/-!

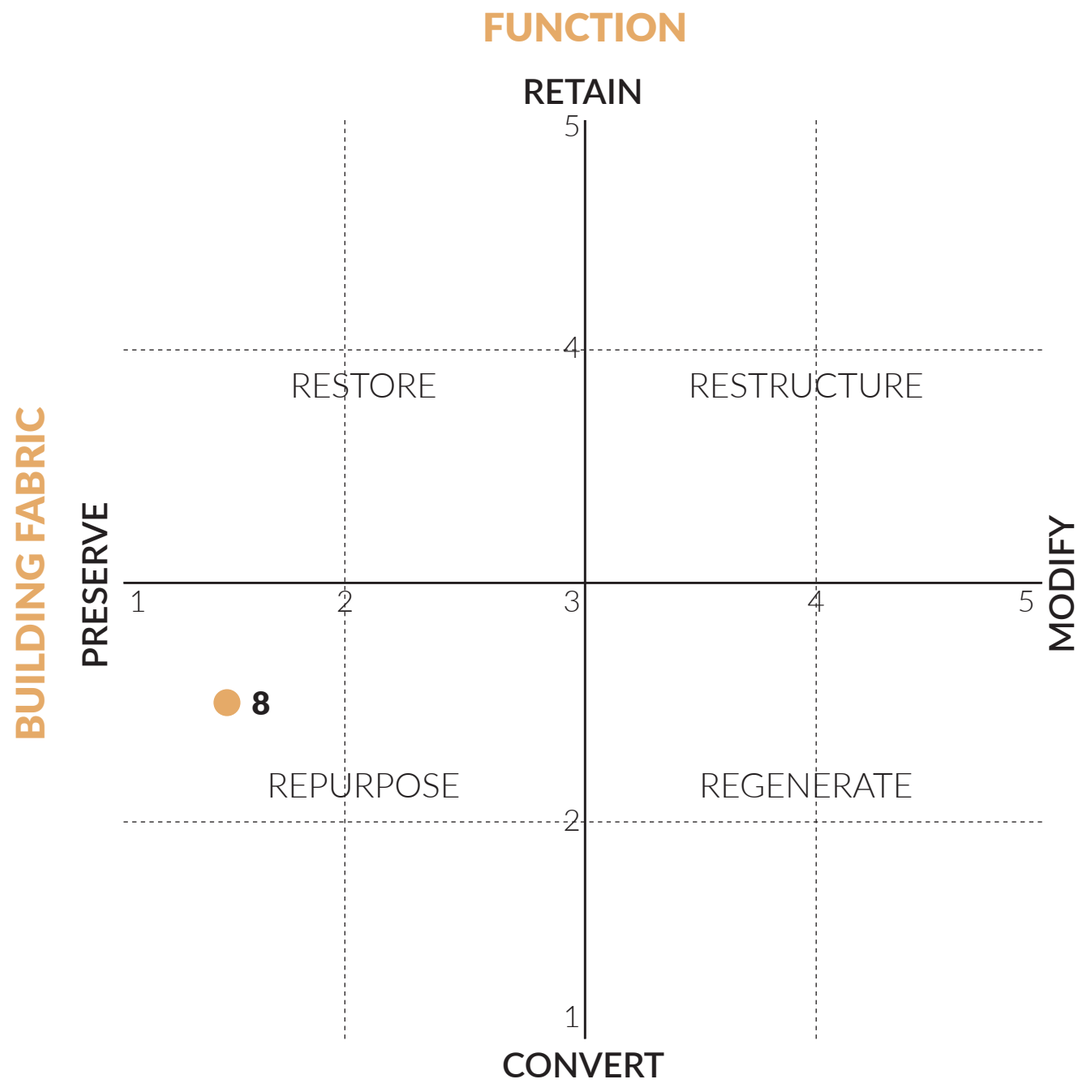
a) Category case 8.



b) grid position case 8.

Category:

Repurpose and closer to retain (restore), because of the function obviously changing and that the facade and interior detailing were restored. And that the function in the building is not just a housing function but that there is a communal part.



c) Result classification case 8.

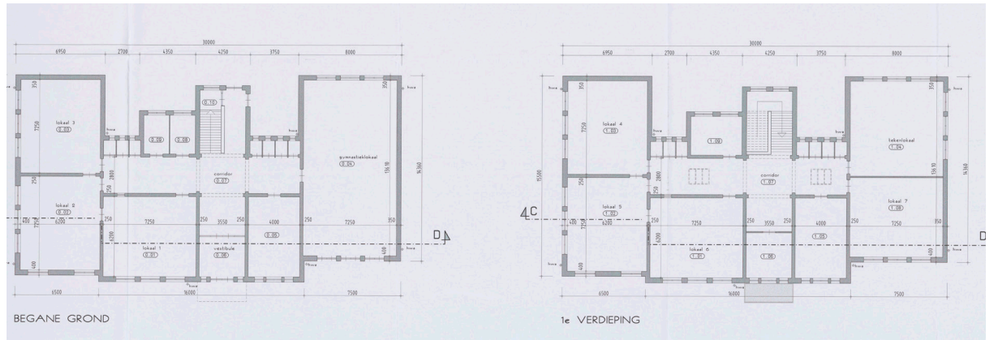
Figure 28 - Results case 8

3.10 Case 9: Stek Noord 2

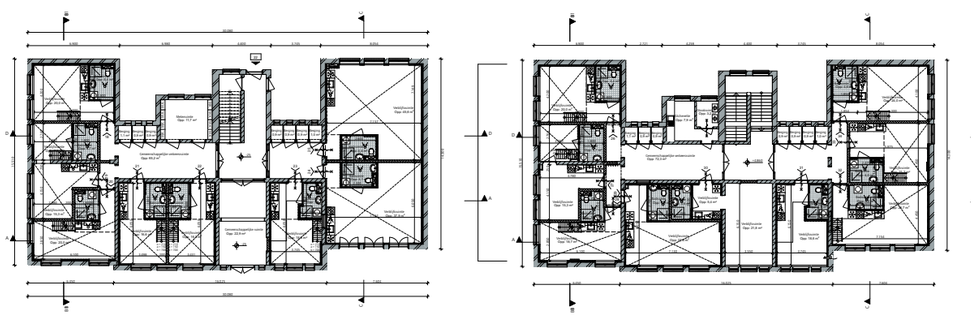
Address: Havikslaan 22, Amsterdam Noord
Construction year: 1914-1916
Transformation year: 2018/2019

Transformation architect: Jan Bakers Architecten
Monument status: Order 1
Housing type: 17 dwellings and common room

a) Research case (Gemeente Amsterdam, 2019)



b) Original floor plans (Jan Bakers Architecten, 2019)



c) New floor plans (Jan Bakers Architecten, 2019)

Figure 29 - Case 9 .

About the case:

Between 1914 and 1916 there were three school buildings built based of a design by H.P. Berlage and J.C. van Epen. In 2004 these three schools were given the title of municipal monument. Two of these schools on the Havikslaan 20 and 22 were transformed into 17 dwellings each between 25 and 50 m2. Both schools were transformed using the same methods and ideology. Just like case 8, half of the apartments are rented to young adults between 18 and 28 years and the other half for status holders of the same age group. These apartments are insulated and due to the high ceilings, entresols were created (Gemeente Amsterdam, 2019; Jan Bakers Architecten, 2019).

The facade and some authentic interior detailing were left intact and restored, such as stained-glass windows, existing tiles, paneled doors and stairwells. The surroundings of these buildings are designed as a buffer between the old school buildings and the surrounding buildings. In the green there is communal vegetable garden for the residents. There is also a common space on the first floor and in the garden around the buildings. The residents are expected to contribute at least one hour a week to the community to promote integration (Gemeente Amsterdam, 2019; Jan Bakers Architecten, 2019).

Findings:

Function:
- education spaces
- sanitary spaces
+ 17 entresol apartments h≈5m
+ collective spaces
= stairs circulation for apartments

Interior:
+ entresols
+ interior walls for creating bathroom, toilet, and bedroom
- removing some interior walls to create openings for doors
= interior detailing

Exterior:
= stained glass windows
= paneled doors
= existing facade tiles

Legend

+ added
- removed
= kept
! drastically

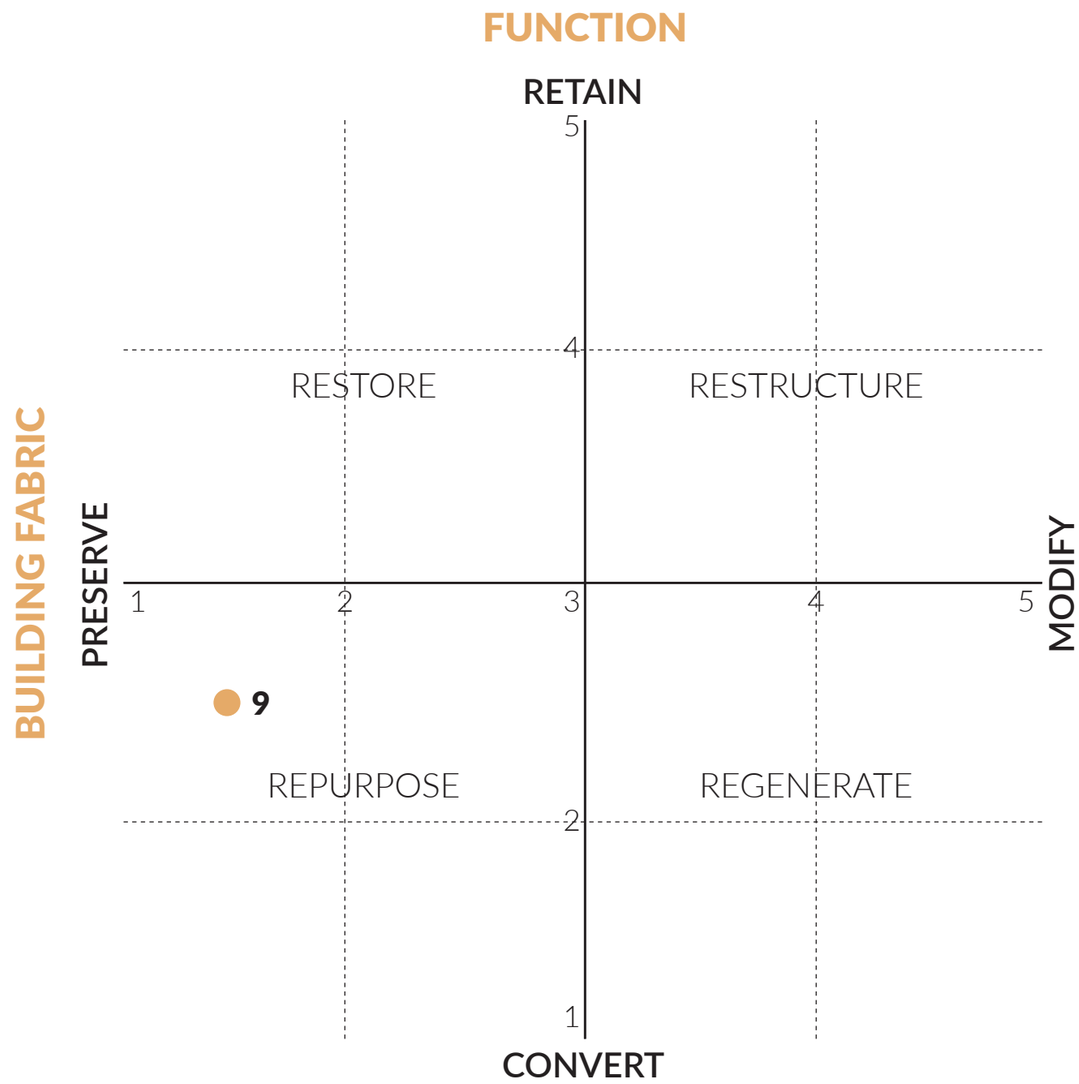
Guidelines given by Ibelings, and Diederenendirrix	**Category: Repurpose**	Restore	Repurpose	Regenerate	Restructure
function	-	=	-	-	=
interior building fabric	+/-	=	+/-	+/-	+/-!
exterior building fabric	=	=	=	+/-	+/-!

a) Category case 9.

b) grid position case 9.

Category:

Repurpose and closer to retain (restore), because of the function obviously changing and that the facade and interior detailing were restored. And that the function in the building is not just a housing function but that there is a communal part.



c) Result classification case 9.

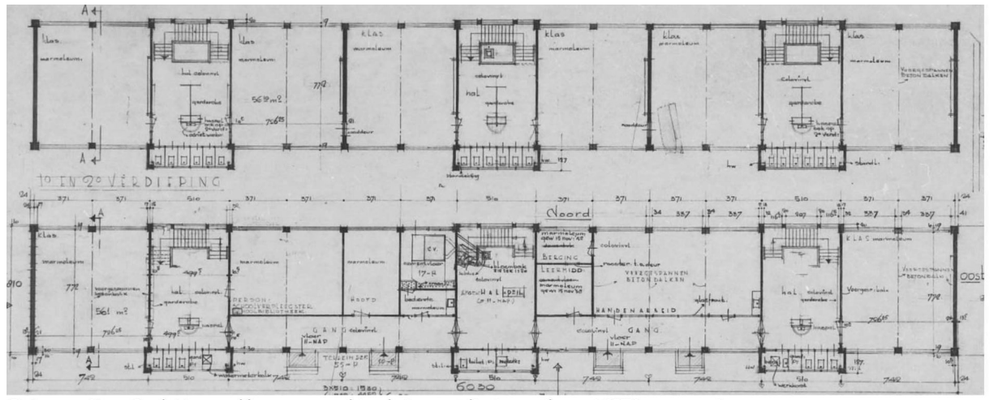
Figure 30 - Results case 9.

3.11 Case 10: Lukasschool

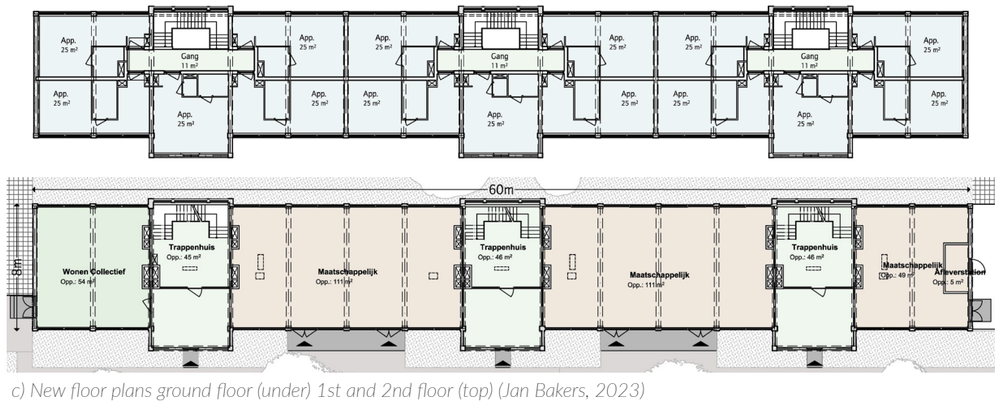
Address: Notweg 32, Amsterdam Nieuw West
Construction year: 1959
Transformation year: 2022/2023
Transformation architect: Jan Bakers Architecten

Monument status: municipal monument order 1
Housing type: 30 starter and student studios & 1 co-housing

a) Research case (Jan Bakers Architecten, 2023)



Ontwerp uit 1958, plattegrond begane grond (onder) en verdiepingen (boven) (CTA 37202-01)
b) Original floor plans (Jan Bakers Architecten, 2023)



c) New floor plans ground floor (under) 1st and 2nd floor (top) (Jan Bakers, 2023)
Figure 31 - Case 10.

About the case:

This building was originally built in 1959 as public elementary school known as Heimansschool. The entrance is on the southside, while the northside is orientated towards the Veldzicht street. The construction consisted of prefabricated elements. Around this time some other schools were built with the “Systeembouw” method in Overtoomse Veld and in Geuzenveld, due to population growth in the 1960s. This building, located in the Osdorp neighborhood, was built by “Publieke Werken” in collaboration with The Hague architectural firm A.N. & N. Schippers (Amsterdam op de kaart, 2023; Jan Bakers Architecten, 2023).

The ground floor had two classrooms, a crafts rooms, and the school library. The first and second floor had twelve classrooms that were accessible through three stairwells. Each stairwell was made of concrete and led to four classrooms. Originally this building had no corridors. The gym was in a building on Vrijburg 2 street. From 1984 till 1988 there was a part of Joke Smit School located here. The next user was the RC elementary school Lukasschool. After this the school moved to a new building. This current building had a variety of functions and got transformed in 2022/2023. This transformation created 30 young adult dwellings on the 1st floor and 1 co-housing unit, and three public functions were added on the ground floor. To achieve sustainability measures, this building was insulated, connected to district heat and got PV-panels on the roof (Gemeente Amsterdam, 2023; Jan Bakers Architecten, 2023).

Findings:

Function:
- education spaces
- sanitary spaces
+ studios 25 m2
+ co-housing
+ public functions
= stairs circulation for studios

Interior:
+ interior walls for creating bathroom, toilet, and bedroom
- removing some interior walls to create openings for doors

Exterior:
= restoring facade to the original look by restoring concrete construction, prefab-elements and paint
+ exterior entrances

Sustainability:
+ insulation
+ connected to the district heat
+ PV-panels on roof

Legend

+ added
- removed
= kept
! drastically

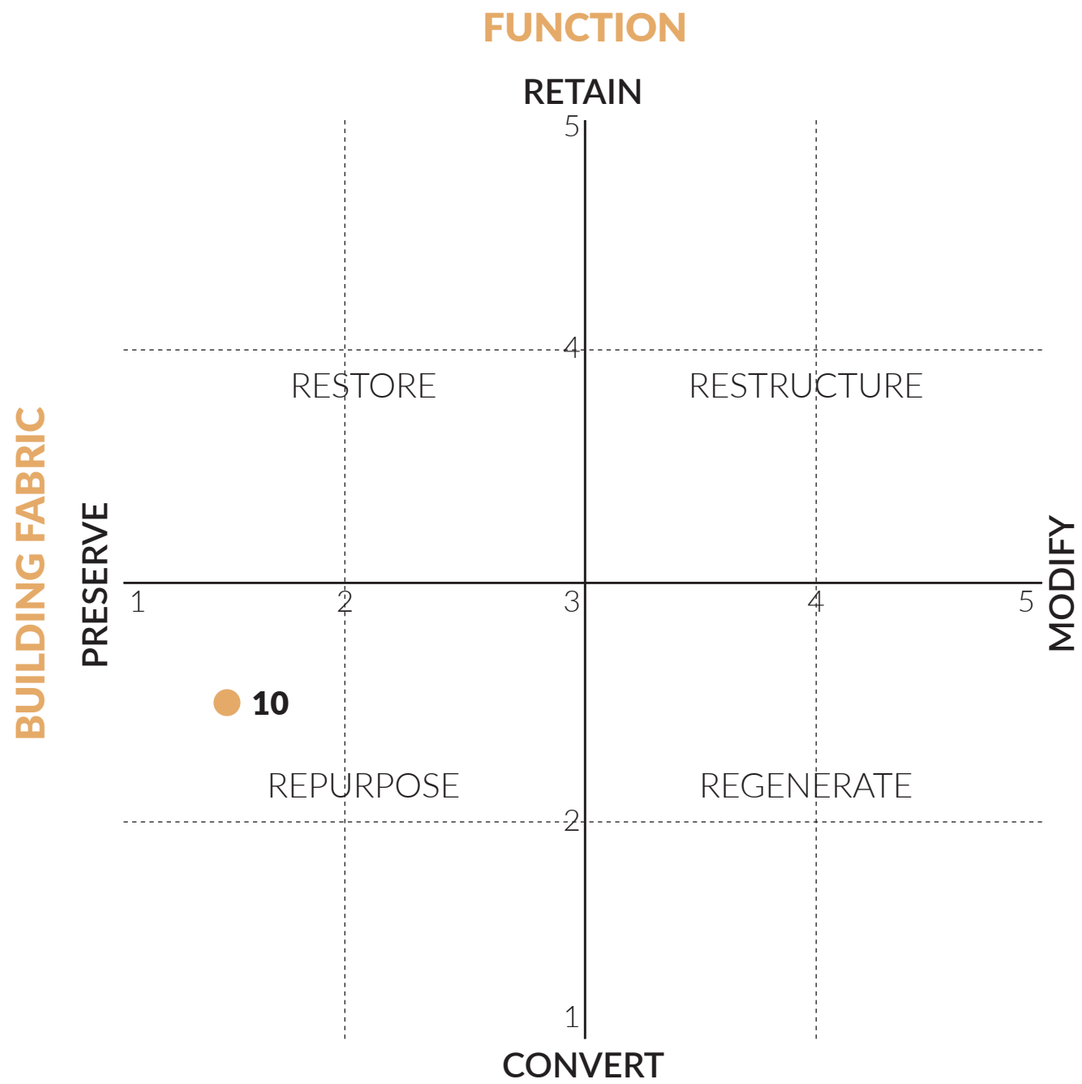
Guidelines given by Ibelings, and Diederenendirrix	Category: **Repurpose**	Restore	Repurpose	Regenerate	Restructure
function	-	=	-	-	=
interior building fabric	+/-	=	+/-	+/-	+/-!
exterior building fabric	=	=	=	+/-	+/-!

a) Category case 10.

b) grid position case 10.

Category:

Repurpose, closer to the preservation line and closer to restore, due to the obvious of the function changing but also because of the building's facade being restored to the same colors and materials.



c) Result classification case 10.

Figure 32 - Results case 10.

Chapter 4: In depth research on case 5 Amundsenhofje

4.1 Cultural Value Assessment with colors of values framework by Pereira Roders (2007)

Legend cultural values

Historic Values	Political	Social
Aesthetical Values	Age	Ecological
Scientific	Economic	Additional important info

Beschrijving van Amundsenweg 1

Datum: 7 augustus 2008
Bezoekdatum: 4 augustus 2008
Auteur: Marjanne Statema
Architect: Evers en Sarlemijn Architecten
Ontwerp: 1959-1963

Stedenbouwkundige context
Het vrijstaande schoolgebouw, gebouwd als katholieke kleuterschool, tegenwoordig de islamitische basisschool El Amien, is gesitueerd aan de Amundsenweg, aan de noordzijde van het trapeziumvormige 'hart' van de Poolbuurt in Bos en Lommer. De Poolbuurt wordt omsloten door de Erasmusgracht (N), de Hoofdweg (O), de Jan van Galenstraat (Z) en de James Rosskade (W). Het hart, een voormalige katholieke enclave, wordt begrensd door de Franciscus en Juliaschool aan de oostzijde van de Robert Scottstraat, gebouwd door de architecten K.P. Tholens en L. Van Steenhardt Carré. De westzijde wordt gevormd door de ULO-school, net als de kleuterschool een ontwerp van Evers en Sarlemijn Architecten. Tussen de scholen is een grote speelplaats gerealiseerd. De Josephkerk en de noord-zuid georiënteerde rijtjes bejaardenwoningen naar ontwerp van G. Holt besluiten het plein aan de zuidzijde.
Het stedenbouwkundige ontwerp voor Bos en Lommer maakt deel uit van het Algemeen Uitbreidingsplan (AUP) uit 1934 van de afdeling Stadsontwikkeling van de Dienst der Publieke Werken. In het uitbreidingsplan waren in de Poolbuurt oorspronkelijk drie scholen parallel aan de Erasmusgracht gesitueerd. Ten zuiden van de scholen was een aantal noord-zuid georiënteerde stroken woningen geprojecteerd. Door de trapeziumvorm van het gebied bleef er een wigvormig terrein over dat werden bestemd voor bejaardenwoningen, in oost-west gerichte rijtjes. Dit ontwerp werd herzien in 1944. In het nieuwe plan vormen de kerk en de scholen het hart van de wijk, min of meer conform de bestaande situatie. Begin jaren zestig was de Poolbuurt voltooid. De drie scholen, de kerk met klooster en de bejaardenwoningen vormen een krachtig stedenbouwkundig en architectonisch ensemble.

Gebouwtype en bouwgeschiedenis in hoofdlijnen
De voormalige katholieke kleuterschool is tot stand gekomen in opdracht van de Onze Lieve Vrouwe Stichting uit Amersfoort naar ontwerp van Evers en Sarlemijn Architecten uit 1963. Het plat afgedekte bouwwerk telt twee bouwlagen op een rechthoekige plattegrond en is min of meer symmetrisch ingedeeld. De gang van de corridorschool is evenals de hoofdingang aan de noordzijde gesitueerd, de lokalen aan de zuidzijde, aan het schoolplein. De trappenhuizen zijn op de kop gesitueerd, waarbij het linker (O) trappenhuis parallel aan de noordgevel is gesitueerd naast de zogenaamde speellokalen die in de oostelijke kop zijn gesitueerd. Het rechter trappenhuis is in de westelijk kop geplaatst, parallel aan de westgevel. Naast de twee speellokalen, zijn er in het gebouw zes zogenaamde werkklokalen ondergebracht, drie op elke bouwlaag. Tussen de lokalen zijn de overige ruimtes ondergebracht, zoals de kamer van het schoolhoofd, de lerarenkamer, de leermiddelenkamer en een enkel toilet. De grotere toiletgroepen zijn op beide bouwlagen ter weerszijden van de lokalen gesitueerd. Op de tekeningen is er vanuit de hoofdingang een doorgang naar de speelplaats te zien en heeft ook de kamer van het hoofd een uitgang aan deze zijde evenals de grotere toiletgroepen. Op de verdieping zijn hier inpandige balkons aangebracht, die bereikbaar zijn vanuit de lerarenkamer en de leermiddelenkamer. Tegenwoordig zijn deze uitgangen dichtgemetseld en is er een toegang in de westelijke kop geplaatst. Wanneer dit is gebeurd, is onbekend, maar in ieder geval na 1977. In 1977 is er tegen de westgevel een eenlaagse aanbouw met schoorsteen geplaatst, ten behoeve van c.v. en bergruimte. Op de tekeningen is nog de oorspronkelijke situatie afgebeeld.
Onderdeel van het ontwerp was een speelplaats aan de west- en zuidzijde van het gebouw, afgerasterd van de grote speelplaats die tussen de ULO-school en de kerk is gesitueerd. In het ontwerp was voorzien in een betegelde speelplaats, waarin een vakverdeling met vierkante vakken is getekend. Langs de randen werden rechthoekige borders geprojecteerd, evenals rechthoekige ruimtes voor tuintjes. In de strook langs de westzijde van het gebouw, toegankelijk via een hek in de tussenmuur tussen de kleuter- en de ULO-school, staan twee zandbakken afgebeeld. De huidige speelplaats is sterk vereenvoudigd met plaveisel van stoeptegels en hoge bossage tussen de speelplaats bij de school en de grote speelplaats en wat lage struiken langs de school.

Architectonische verschijningsvorm
Exterieur
De architectonische verschijningsvorm van de voormalige kleuterschool kenmerkt zich door een eenvoudig, maar zorgvuldig vormgegeven bouwvolume. De gevelgeleding wordt vooral bepaald door de verschillende venstervormen, aangepast aan de functie van de verschillende achtergelegen ruimtes. Zelfs de ingangspartij is ondergeschikt aan de gevelritmiek.
De koppen van het bouwvolume zijn iets uitgemetseld, waarbij de oostgevel van de linkerkop enigszins schuin wegloopt, aansluitend op de trapeziumvorm van het bovengenoemde ensemble. Tussen de koppen is langs de voorgevel een betegelde strook aangebracht, waarop een rij betonnen paaltjes is geplaatst. De gangen worden ter hoogte van elk lokaal verlicht door twee gepaarde hoge stalen vensters op lage borstweringen met betonnen lateien en onderdorpels. De overige ruimtes worden gekenmerkt door een hoger geplaatst venster met dubbele draairamen. Deze vensters zijn evenals de hoofdingang in een over de gehele hoogte aangebracht verdiept gevelveld geplaatst. De rondbogige gevelvelden, die het gebouw ten opzichte van de ULO-school een wat vriendelijker uiterlijk geven, zijn de enige versieringen die de ontwerpers zich hebben gepermitteerd.
De ingang is voorzien van een dubbele draaideur met smalle hoge ruitjes. Vermoedelijk is achter het bord, waarop de huidige schoolnaam El Amien is aangegeven, nog het oorspronkelijke kunstwerk aanwezig. Op een foto in het Stadsarchief Amsterdam lijkt het een betonnen reliëf te zijn, met een afbeelding van een boom en een door stralenkrans omgeven niet nader te benoemen heilig figuur. Dergelijke kunstwerken werden aangebracht vanuit het idee dat het mensen geestelijk zou verheffen door hen met kunst in aanraking te brengen. De kunstenaar is vooralsnog onbekend.
De trappenhuizen ter weerszijden van de lokalen worden evenals de speellokalen (O) eveneens verlicht door de gepaarde vensters. Ondanks de vele vensters aan de noordzijde en ter hoogte van de speellokalen, moeten de lokalen aan de zuidzijde worden overspoeld door een zee van licht door de stalen raampartijen. De gevel tussen de beide koppen van het bouwvolume is opgevat als een groot venster, omlijst door betonnen kolommen en lateien. De raampartijen worden op de begane grond afgewisseld door de inmiddels dichtgezette deurpartijen, op de verdiepingen door de inpandige balkons.

Interieur
Het was op het moment van schrijven niet mogelijk de school te bezoeken, maar uit fotomateriaal van een bezoek ter plaatse in 2005, blijkt dat het interieur op hoofdlijnen nog gaaf is.

Cultuurhistorische context
Het stedenbouwkundige plan voor het hart van de Poolbuurt kwam in verschillende fasen tot stand. Het oorspronkelijke plan maakt deel uit van het AUP van 1934. Op basis van dit plan besloot men architect G. Holt de opdracht te geven voor de kerk en de bejaardenwoningen. Tijdens het ontwerpproces bleek Holt niet alleen een uitgesproken visie te hebben op het ontwerp van de kerk en de woningen, maar ook op het stedenbouwkundige plan. De progressieve afdeling Stadsontwikkeling, met name hoofdontwerper Van Eesteren, was geïnteresseerd in de ideeën van Holt en de samenwerking resulteerde in 1944 in een nieuw plan.
De nieuwe configuratie, met een kerk en scholen rond een plein, gaf uitdrukking aan veranderende stedenbouwkundige ideeën over de relatie tussen het sociale leven in een woonwijk en de openbare ruimte. Met name in Engeland was dit kort na de oorlog een aspect waaraan veel aandacht werd besteed. Ook de naoorlogse bijeenkomsten van de CIAM zouden zich concentreren op de verschijningsvorm van de openbare ruimte, waarbij steeds meer naar historische voorbeelden werd gekeken. De centrale ruimte in het dorp Nagele laat zien dat ook de Nederlandse CIAM-leden, onder wie natuurlijk Van Eesteren, naar Engeland keken en zochten naar een nieuwe visie op de openbare ruimte.
Dat de Afdeling Stadsontwikkeling grote waarde hechtte aan deze ontwikkeling blijkt wel uit het feit dat concessies werden gedaan aan verkavelingsprincipes, zowel voor woningen als voor scholen. Het schoolgebouw aan de Robert Scottstraat, weliswaar vrijstaand, is opgenomen in het bouwblok aan de Orteliusstraat. Deze oplossing strookte niet met het streven naar functiescheiding en schoolgebouwen die rondom omringd worden door ruim groen. De wens om bij de kerk van Holt een plein met katholieke scholen te creëren was klaarblijkelijk sterker dan de strenge leer van de vooroorlogse stedenbouw.
Holt en Van Eesteren hebben met de kerk, de bejaardenwoningen en de scholen gestalte gegeven aan een architectonisch en stedenbouwkundig idee dat ontbrak in de vooroorlogse visie van de functionalisten op de moderne woonwijk. Zij onderkenden met dit kerkgebouw en de resulterende wijzigingen in het stedenbouwkundig ontwerp dat het leven in een moderne woonwijk niet louter

rationeel is. Door de kerk en de bijbehorende scholen rond een plein in het hart van de Poolbuurt te situeren, werd een plaats gegeven aan het samen zijn van buurtbewoners. Men ging ter kerke, bracht kinderen naar school en sprak met elkaar over het leven. Dit thema zou de naoorlogse bijeenkomsten van de CIAM gaan domineren, vaak aangeduid met de Engelse term 'core', terwijl in Nederland het woord ontmoeting een bijzondere betekenis kreeg voor architecten en stedenbouwers.
Holt bleef betrokken bij de verdere invulling van het stedenbouwkundig plan, nadat de kerk in 1952 in gebruik was genomen. Zowel de opdracht voor het ontwerp van de ULO-school als die van de kleuterschool kwam begin jaren vijftig in handen van Evers en Sarlemijn Architecten. Evers en Sarlemijn vormden in 1941 een bureau dat na de oorlog veel gebouwd heeft in Nederland. Hun architectuur is verwant aan de Bossche School. Een bekend ontwerp is de Catharinakerk uit 1954, onderdeel van een complex van kerk, pastorie en parochieschool.
In samenwerking met Holt en Stadsontwikkeling kon voor de Poolbuurt een 'totaalsituatie', zoals zij schreven in het Bouwkundig Weekblad, worden ontworpen. Zowel in de situering van de verschillende volumes als in de materiaalkeuze en de kleurstelling is gezocht naar harmonie met de kerk en de bejaardenwoningen. Zo fungeert het hoofdvolume van de ULO-school als begrenzing van de noordzijde van het kerkplein tegenover de bejaardenwoningen aan de zuidzijde en is in de architectonische uitwerking gekozen voor een relatie met de vormgeving van de kerk. De bijgebouwen met de fietsenstalling en de gymzaal vormen de noord-westelijke begrenzing van het ensemble, aan de noordzijde aansluitend op de kleuterschool met een bakstenen muur. Kenmerkend voor de vormgeving van de kerk is de in het zicht gelaten betonconstructie, ingevuld met betonnen muurplaten en Limburgs natuursteen. Evers en Sarlemijn vertaalden dit voor de scholen in een in zicht gelaten betonconstructie en muren van baksteen, passend bij de kleinere schaal van de scholen. Toch zijn de beide scholen verschillend van karakter, passend bij de leeftijd van de kinderen. Naast het schaalverschil lijkt de detaillering van het kleuterschoolgebouw met de uitgespaarde rondbogige velden in de straatgevel die het gebouw een vriendelijk karakter geven, maar ook de trappen met de kleine treden en de extraverte oriëntatie van de lokalen op de speelplaats, toegesneden op de kleuters.
De ontwerpers van de schoolgebouwen hebben het experiment van Holt en Van Eesteren definitief gestalte gegeven. Er is een stedelijke ruimte ontstaan die grote kwaliteit heeft. De Poolbuurt heeft een duidelijk herkenbaar centrum gekregen, dat getuigt van een meer complexe visie op het sociale functioneren van een moderne woonwijk. De Josephkerk, de drie scholen, en de omringende woonbebouwing vormen een vroeg naoorlogse woonwijk die zowel architectonisch als stedenbouwkundig uitdrukking geeft aan de eerste gedachtevorming over de wederopbouw.

Het architectenduo A. Evers en G.J.M. Sarlemijn behoort tot de vooraanstaande architecten van de Bossche School, die in de naoorlogse periode ontstane architectuurstroming die bij uitstek gekt als 'van een katholiek karakter'. Aart Evers (1914-1997) en Geert Josephus Maria Sarlemijn (1909-1993) waren beiden Amsterdammers en hadden van 1941 tot 1981 een gezamenlijk bureau. In 1947 namen ze deel aan de cursus Katholieke Architectuur in het Bossche Kruithuis, waar de door de benedictijner monnik Dom Hans van der Laan gedomineerde lessen leidden tot het ontstaan van de Bossche School. Uitgaande van klassiek-bouwkundige principes en met de nadruk op verhoudingen en maten (Plastisch Getal) schiep deze School vernieuwende architectuur met vrij robuuste maar zorgvuldig gelede bouwmassa's en de nadruk op vlakken, lijnen en metselwerk met grove voegen. Klassieke motieven zoals kolommen en sierreliëfs behoren tot de regelmatig terugkerende vormentaal. Een ander kenmerk is de aaneenschakeling van open en gesloten ruimtes, zoals binnenhoven en vleugels. Evers en Sarlemijn bouwden in en buiten Amsterdam een groot aantal objecten. Bekende hoofdstedelijke voorbeelden zijn de r.k. vakschool voor banketbakkers aan de Reinaert de Vosstraat (1957) en de reeds genoemde r.k. ulo aan de Erik de Roodestraat (1958-1960), beide in Bos en Lommer. De Bossche School zocht naar overeenkomsten in de contrasten, zoals het begrippenpaar binnen en buiten. (Later zijn het juist deze ontwerpprincipes, die het Burgerweeshuis van Aldo van Eyck zo beroemd maken.)

Conclusie
De voormalige kleuterschool Amundsenweg 1 is stedenbouwkundig van belang als onderdeel van het ensemble dat wordt gevormd door de Josephkerk, de bejaardenwoningen, de ULO-school en de Franciscus en Juliaschool. Het ensemble vormt bovendien het hart van de Poolbuurt. Daarnaast is het ensemble architectuurhistorisch van belang doordat de de stedenbouwkundige plannen voor het ensemble uit 1934 en 1944 het veranderde denken van na de oorlog laten zien, waarin het wijkcentrum een belangrijke rol was gaan spelen. De kleuterschool is eveneens architectuurhistorisch van belang vanwege de esthetische kwaliteiten van het ontwerp, niet alleen vanwege de zorgvuldige

vormgeving van het bouwwerk, zoals de wijze waarop het gebouw op de kleuters is toegesneden, maar ook vanwege de harmonische werking, zowel in de situering van de bouwmassa's als in de materiaal- en kleurkeuze van het bouwwerk met de overige bouwwerken in het ensemble, met name met de kerk, het kloostergebouw en de ULO-school. Het geeft een goede indruk van het werk van het Amsterdamse architectenduo A. Evers en G.J.M. Sarlemijn die als vooraanstaande architecten van de Bossche School gelden. Het ontwerp is gaaf, met uitzondering van de dichtgezette toegangen en de nieuwe toegang aan de zuidzijde en de inrichting van de speelplaats.

Bronnen en literatuur
Archief Stadsdeel Bos en Lommer, dossiernr. 29592
BMA, pandenarchief
A. Evers, G.J.M. Sarlemijn, 'U.L.O.-school in Amsterdam West', *Bouwkundig Weekblad* (1966), nr.6, pp.90-92
Stadsarchief Amsterdam, beeldbank

Deelsysteem

Uitgangspunten
De oudste delen van het AUP liggen voornamelijk in Bos en Lommer en hebben als basis een open, vaak middelhoge blokbebouwing langs overwegend stenige straten.
Bijzondere elementen zijn de gebouwen met afwijkende functies, zoals scholen, kerken en bedrijfsgebouwen. Deze bebouwing heeft een individueel karakter en staat vrij op de kavel. Massa en uitwerking variëren per gebouw, maar zijn vaak per buurt of cluster in samenhang. Andere bijzondere elementen zijn de hoogteaccenten die als landmark fungeren en veelal aan een parkrand zijn gekoppeld.

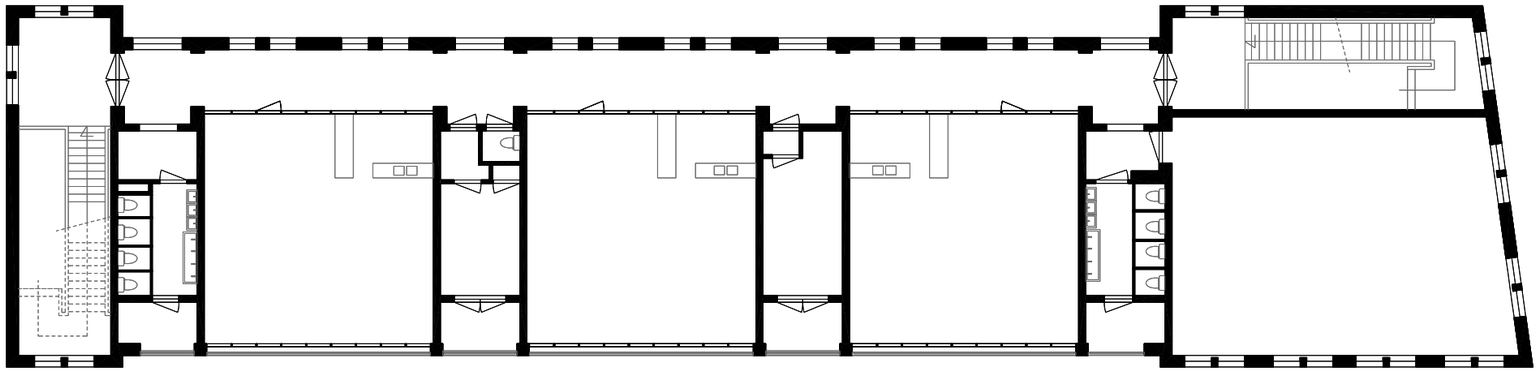
Waardering
De waarde ligt vooral in de structuur van de functionalistische stedenbouw en het rustige beeld van de straten met eenvoudige bouwblokken en het groen van bomen, voortuinen, hoven en plantsoenen.
Alle niveaus van de stedenbouwkundige structuur zijn het behouden waard. In tegenstelling tot de overige delen van het AUP vermengen volume en architectuur zich hier in het silhouet. De ontsluitingen en buitenruimten als balkons zijn de basis voor de gevelritmiek, waarin horizontale en verticale lijnen met elkaar zijn verweven. Daklijsten zijn nadrukkelijk vormgegeven en geven het silhouet van de blokken maat en schaal. De verfijnde architectuur wordt gerelateerd aan specifieke hoekoplossingen en bijbehorende kenmerkende koppen van blokken. Deze AUP-gebieden zijn verwant aan de Gordel '20-'40 en relatief cultuurhistorisch waardevol.

Beoordeling
Het beleid is gericht op het behoud van de rust in de straten en het aanzien vanuit omringende gebieden. Bouwplannen aan een achterkant zonder invloed op het straatbeeld worden beperkt getoetst. Bij de advisering wordt onder meer aandacht geschonken aan het behoud van het beeld met herhaling in rooilijnen en gevelindeling en samenhang in zowel de architectonische uitwerking als het gebruik van materiaal en kleur.

Figure 33 - Cultural Value assessment using monumental documents provided by the municipality of Amsterdam Source: (Monumenten Register Amsterdam, 2008) with own work.

4.2 Interior and exterior building fabric

Before transformation



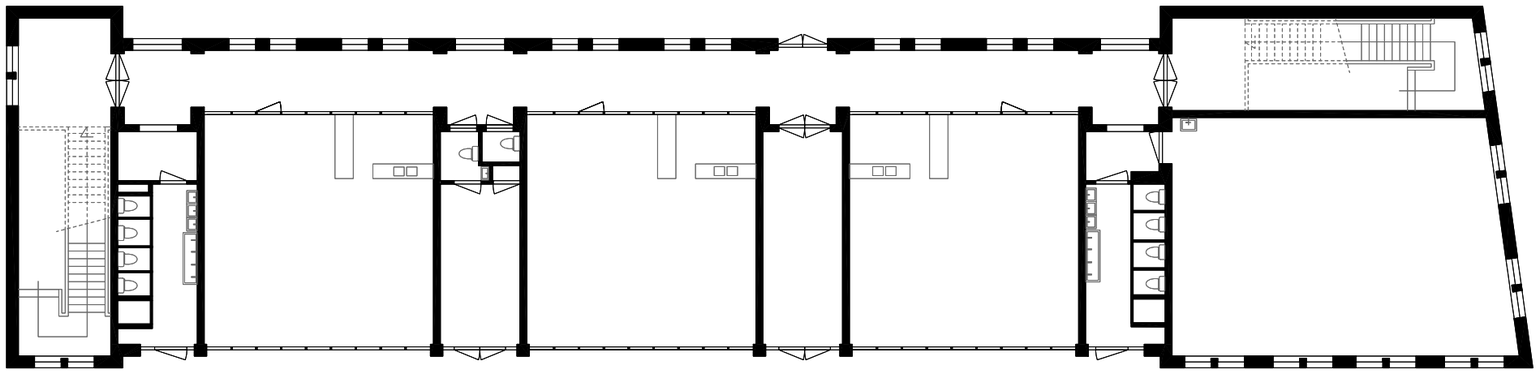
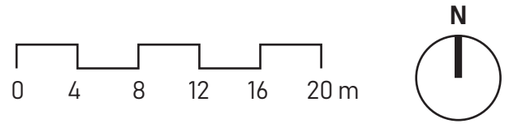
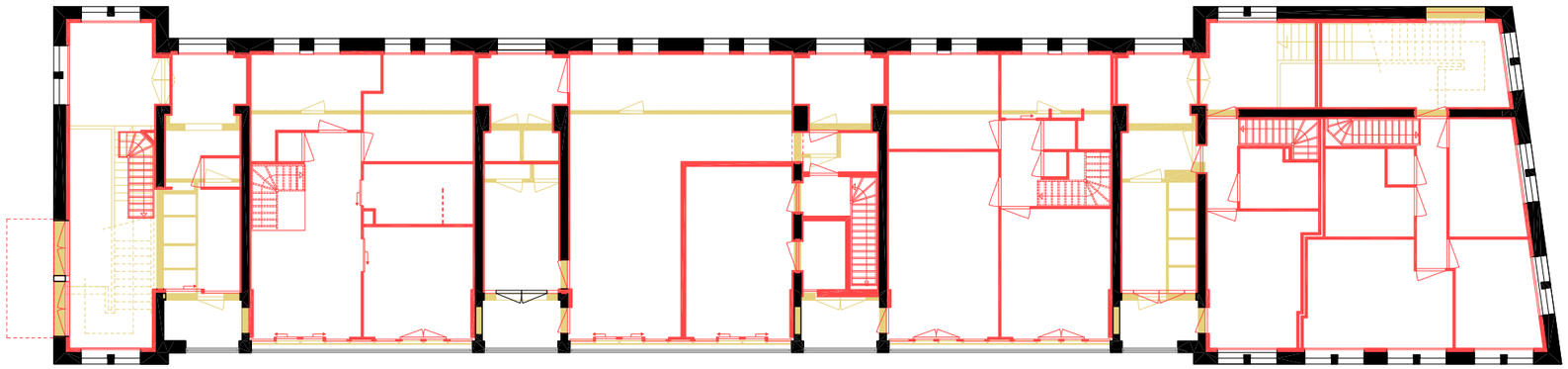


Figure 34 - Amundsenhof floor plan before transformation.

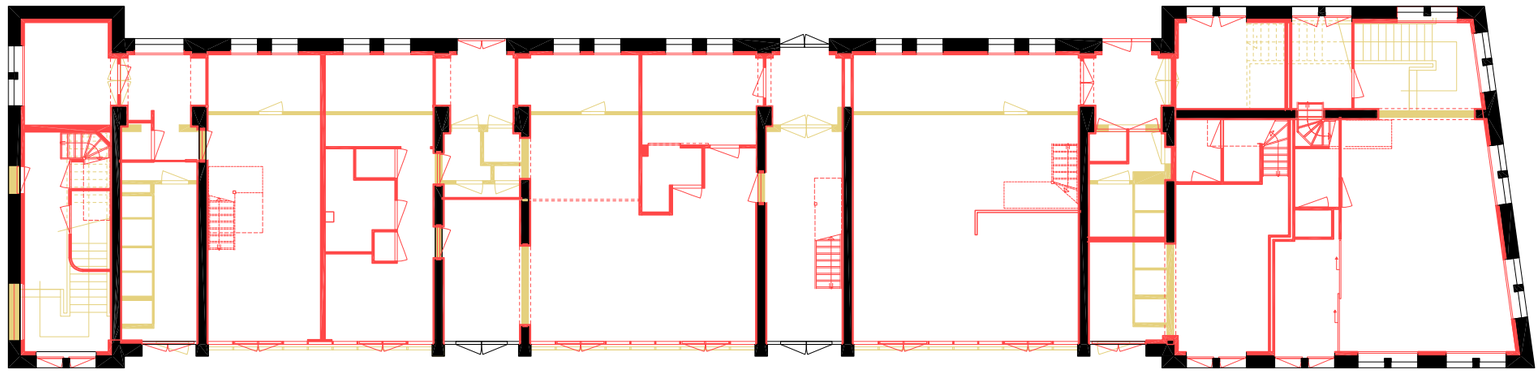


Interior and exterior building fabric

Transformation



1st floor transformation



Groundfloor transformation

Figure 35 - Amundsenhof added and removed building fabric.

Add

Remove

0 4 8 12 16 20 m

N

Interior and exterior building fabric

Stairs

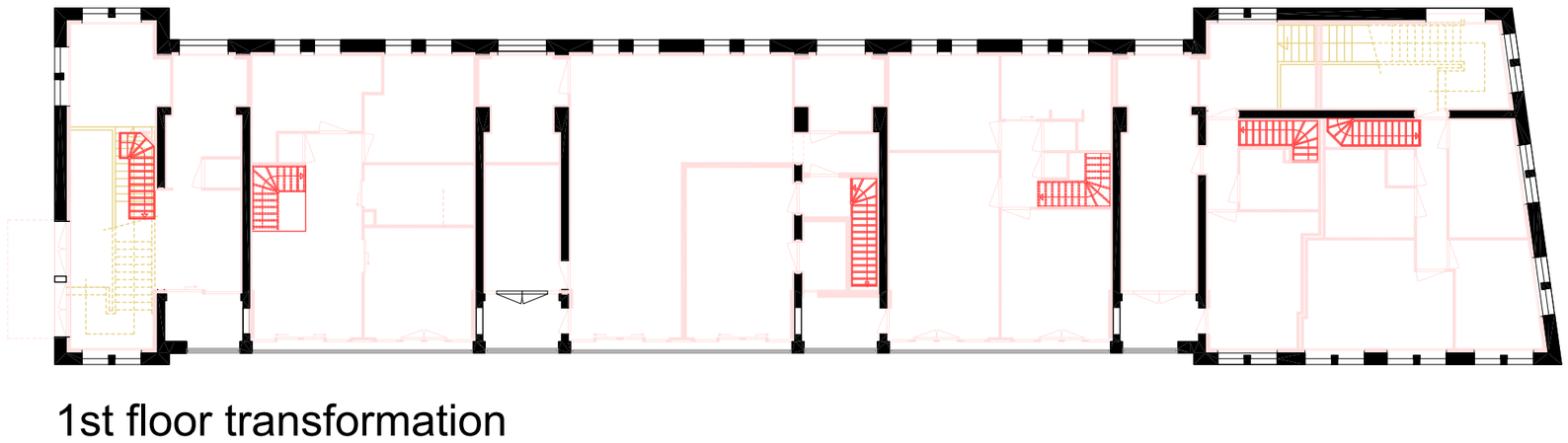
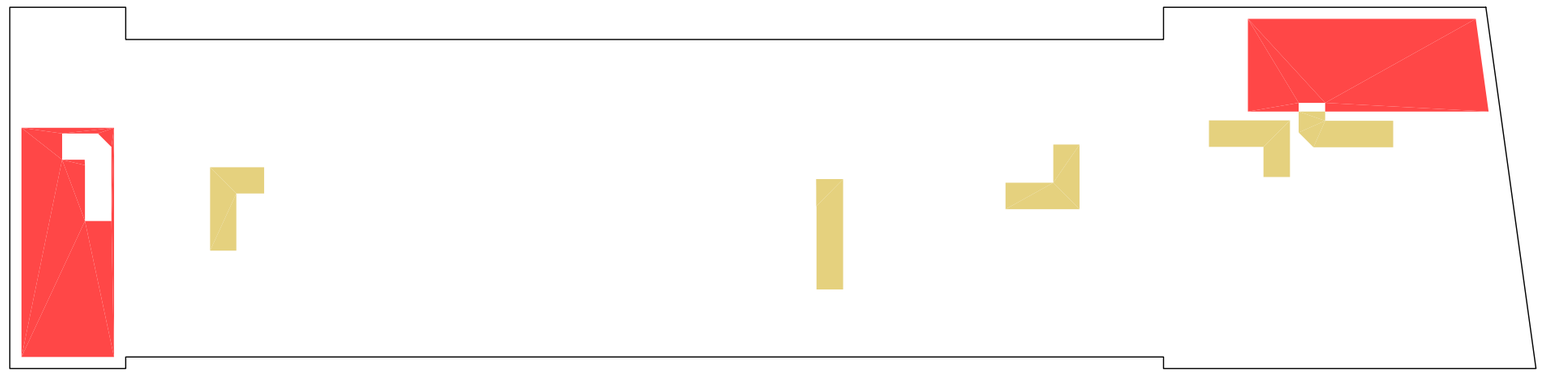


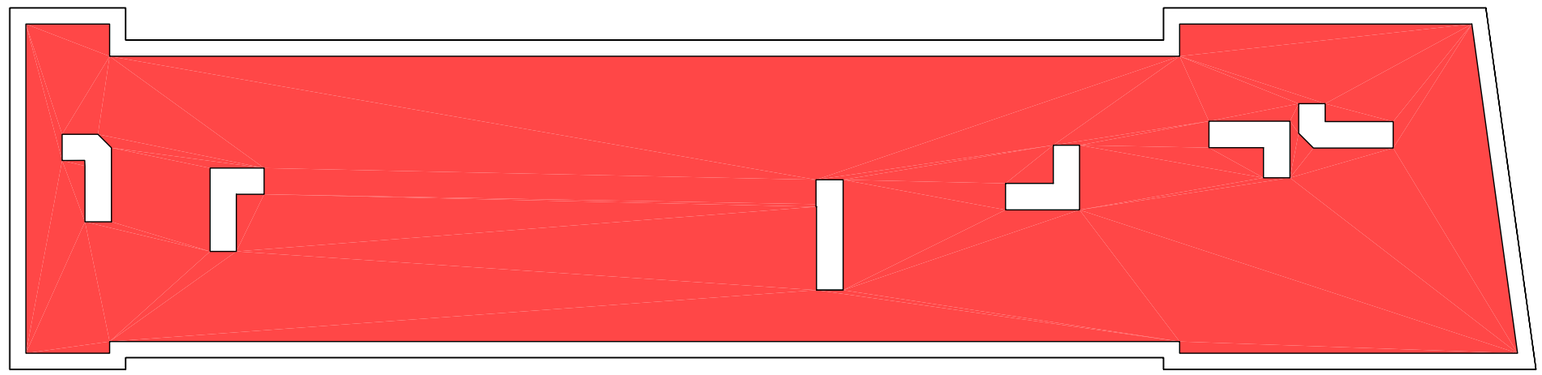
Figure 36 - Amundsenhof added and removed stairs.

Interior and exterior building fabric

Floor/ stairwells



Add and remove of floor structure



new ground floor ceiling and 1st floor layer

Figure 37 - Amundsenhof added and removed floors/stairwells.

Add

Remove

0 4 8 12 16 20 m

N

Interior and exterior building fabric

Furniture/Use

Figure 38 - Amundsenhof added and removed furniture/use.

Total added and removed volumes per “fabric” layer

total volume old school = 614 m3

Add groundfloor **h= 3,097 m**		**Add 1st floor** **h= 3,133 m**
Interior		**Interior**
Walls/ Insulation	23.77 m2 x 3,097 m = 73,62 m3	25.66 m2 x 3,133 m = 80,39 m3
Floors	464,11 m2 x 0,145 m = 67,30 m3	**closing of old stairwells:** 42,38 m2 x 0,170 m = 7,20 m2 **Ragidur E30MF flooring:** 445,56 m2 x 0,05 m = 22,28 m3
Ceiling	**Gyproc MS 63p/50.1A** = 41,21 m3 = **ceiling insulation:** 445,56 m2 x 0,080 m = 35,64 m3 + **ceiling:** 445,56 m2 x 0,0125 m = 5,57 m3	464,11 m2 x 0,0125 m = 5,8 m3
Doors	27 doors = 3,4 m3	28 doors = 2,9 m3
Stairs	6 stairs = 3,8 m3	N/A
Exterior		**Exterior**
Roof	N/A	**PIR insulation** 0,160 m x 481,21= 77,04 m3 **Gravel:** 60mm x 16,31 m2 = 0,98 m3
Floor	N/A	balcony = 1,0 m3
Doors	30 doors = 3,4 m3	20 doors = 3,0 m3
Windows	23 wooden frame tilt and turn window with HR++ glass = 1 m3	49 windows = 1,2 m3
Railing	N/A	0,35 m2 x 0.9 m = 0,315 m3

Remove groundfloor **h= 3,097 m**	**Remove 1st floor** **h= 3,133 m**
Interior	**Interior**
10,46 m2 x 3,097 m = 32,40 m3	12,91 m2 x 3,133 m = 40,45 m3
N/A	**remove floor for new stairwells:** 15,31 m2 x 0,170 m = 2,60 m3
N/A	**Wooden ceiling:** 481,51 x 0,05 m = 24,08 m3
15 doors = 3,0 m3	15 doors = 3,2 m3
2 stairs = 3,2 m3	N/A
Exterior	**Exterior**
N/A	N/A
N/A	N/A
2 doors = 0,4 m3	4 doors = 0,8 m3
26 windows (removed for doors) = 0,4 m3	27 removed and moved more inwards = 0,4 m3
N/A	N/A

Figure 39 - Amundsenhof added and removed calculations
Source: own work

4.3 Utility function and living space

Before transformation

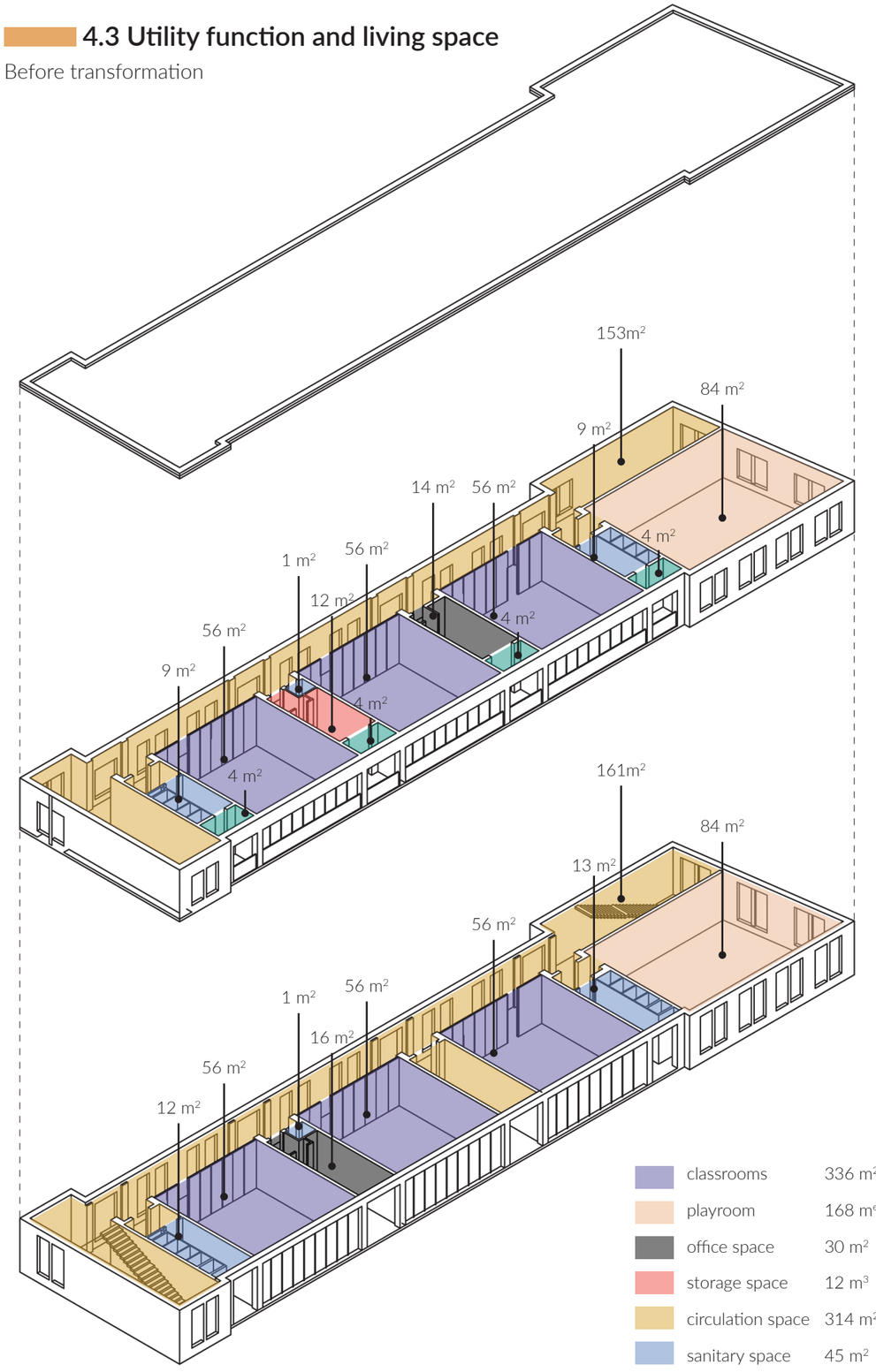


Figure 40 - Amundsenhof utility function and living space before transformation.

Utility function and living space

After transformation

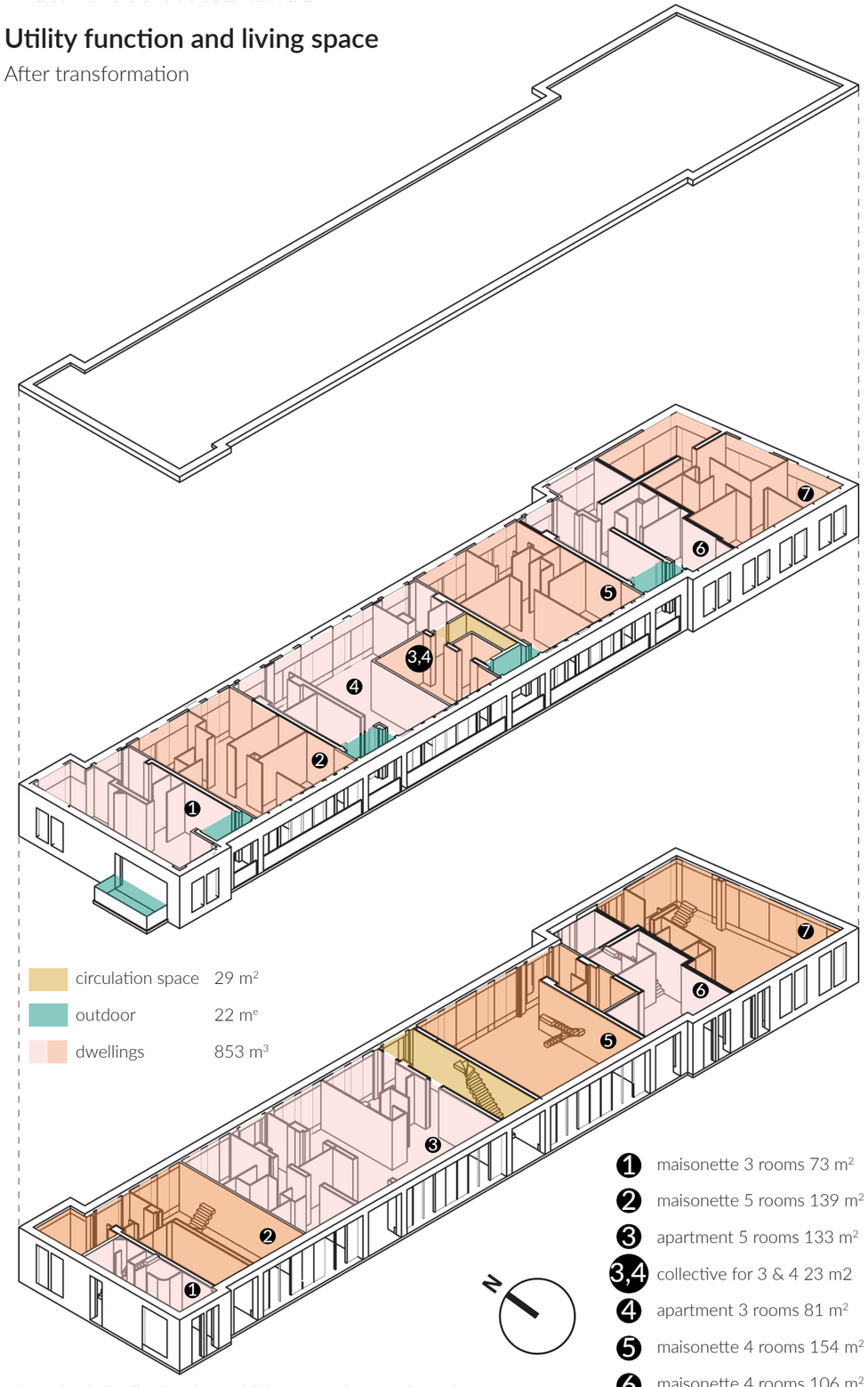


Figure 41 - Amundsenhof utility function and living space after transformation.

Chapter 5: Results

Of the 19 cases 9 were filtered out due to lack of information about them, the remaining 10 cases were then further analyzed.

5.1 Findings on the 10 cases

When using the Ibelings & Diederendirrix (2018) guidelines to classify the cases based on four approaches, it is discovered that three key features can be extracted from these four approaches: function, interior building fabric, and exterior building fabric. Furthermore, further defining these four approaches by showing the interior and exterior interventions, and function changes with a +, -, and =, together with defining a grid system helped position and classify the 10 cases.

These analyses resulted in four cases being classified as part of the repurpose approach, and five cases as part of the regenerate approach (figure 43, 44 and 45). This leaves one case right in the middle of “repurpose” and “regenerate”. This means that for half of the cases, it was chosen to modify the building fabric, rather than preserving it. Also, all the cases are below grid position 3 when it comes to function making them closer to “convert”, because the functions of the building change since there is a typological change between the school and housing. Of all the 10 cases, 6 cases are between grid positions 1-2 closer to “convert”, due to not having any collective space or public functions (figure 42).

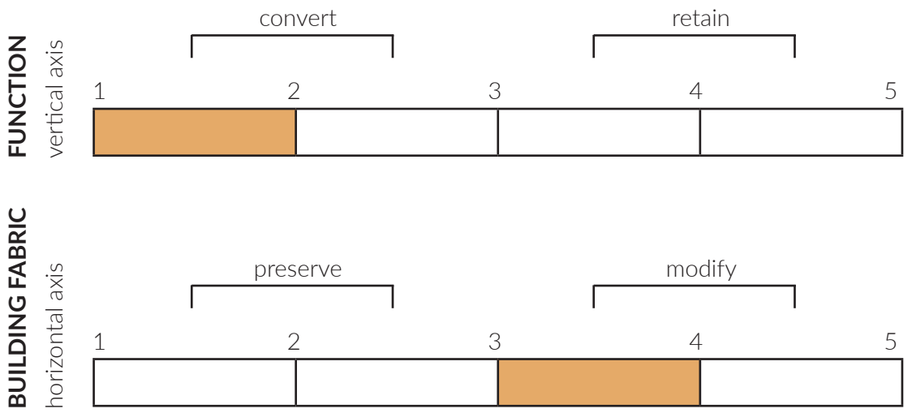


Figure 42 - Main grid position from the 10 cases.

Guidelines given by Ibelings, and Diederenendirrix	Category: **Regenerate**	Restore	Repurpose	Regenerate	Restructure
function	-	=	-	-	=
interior building fabric	+/-	=	+/-	+/-	+/-!
exterior building fabric	+	=	=	+/-	+/-!

Figure 43 - Main category from the 10 cases.

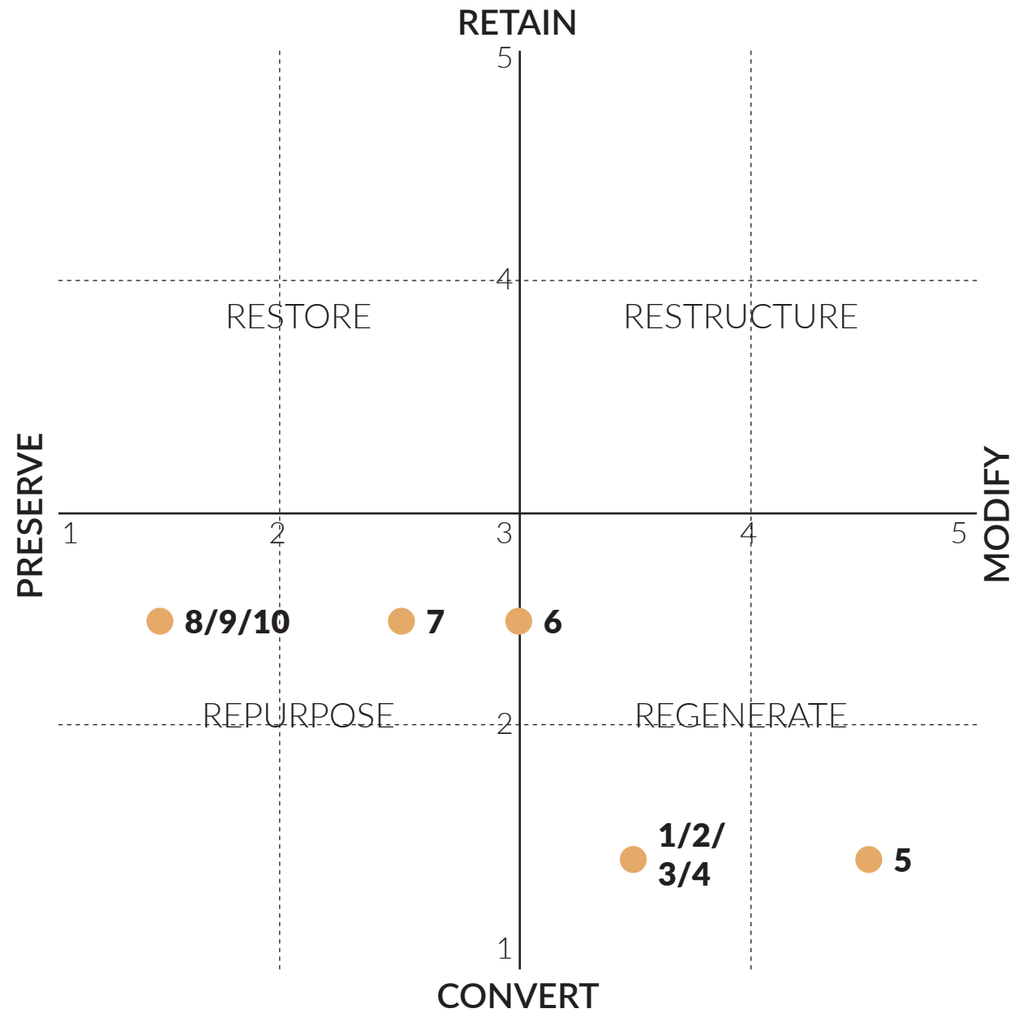


Figure 44 - Results classification of 10 cases.

Another noticeable intervention was that in a lot of cases, doors were added where there used to be windows on the exterior building fabric (figures 45, 46 and 47). The addition of multiple doors could be due to the desire to enter a dwelling from the garden. A school building has one main entrance. If more homes are added and people want to enter the house through the garden, then the exterior building fabric requires entrances. Furthermore, it is noticeable that in all the cases when changing the function from school to housing adaptations are made to the interior building fabric such as removing the old toilets, wardrobes, and some walls, and adding walls. Interior adaptations are done, because space and walls are needed to create livability for the new housing functions, and these adaptations have to qualify with the rules in the Bouwbesluit (2012).
Further analyses of the features revealed the addition of three housing typologies: apartments, maisonettes, and studios. The results show 9 cases adding apartments, 6 cases adding maisonettes, and 1 case adding studios. All the cases with maisonettes also added apartments. Meaning that apartments were the most common typology.

Furthermore, when it comes to the two approaches repurpose and regenerate the most chosen functions (housing type) can be seen in the overall analysis of the cases. Repurpose showed the most common typology is apartments. Regenerate showed 6 cases that added apartments as well as maisonettes. Furthermore, cases in the regenerate category modified more on the building fabric. The cases with apartments and maisonettes modified the interior more by making the dwellings bigger than the classrooms. This could be because bigger family homes are needed.

Also, it can be concluded that for each typology there were common interventions used for interior and exterior building fabric. This leads to the choice of function (housing type) affecting the type of interventions on the interior and exterior building fabric (figure 48).

5.1.1 Apartments

For the choice of adding apartments, it could be that family homes are needed but the interior needs to be less modified. Cases with apartments used various design interventions. In the Bouwbesluit (2012) it is said that each new home needs outdoor space, and during the analyses, this can be seen reflected in the case studies (Rijksoverheid, 2023).
Apartments are seen being added but then outdoor space is needed such as balconies, galleries, or loggias (figure 49).

Also 8 of the 9 cases that have apartments kept the building's staircases as circulation space for entering the apartments. In 4 of the 7 cases, apartments incorporated an indoor collective space for the residents.

5.1.2 Maisonettes

On the other hand, a typology that is also seen a lot is maisonettes (figure 50) . The choice for maisonettes is due to efficiency, so more living space can be realized. Also, it could be that as many family homes are needed, but a classroom of 56 m2 is too small so they instead extend the living space vertically instead of horizontally. The reason for extending the homes vertically is that when extending the homes horizontally in a school building with 2 or more layers the second floor may need a hallway to connect the homes, especially because the school buildings have 1 or 2 staircases. If you must create a corridor for access to the floor and apartments on the other floors, it takes up a lot of space. This can lead to homes having just one facade for daylight. An alternative could be to add a gallery on the outside, but this also disrupts the original exterior building fabric.
Furthermore, inside maisonettes, staircases are added for vertical circulation. Maisonettes also tend to affect the exterior building fabric by adding entrances on the outsides of the building. And when maisonettes are stacked on each other outdoor space is added by adding balconies or a roof patio. When it comes to the maisonettes none of the cases incorporated an indoor collective space or public function.

Additionally, if the height of the old classrooms is around 5m entresols can be added to an apartment or maisonette. This is also connected to Bouwbesluit which states that new homes are supposed to have living space of a minimum of 2,6 m high (Rijksoverheid, 2023).

5.1.3 Studios

Finally, case 10 which is positioned most extreme left, close to "preserve", only has studio as a typology. When it comes to studios added to a building fewer interior walls are needed for rooms making it more resourceful compared to other typologies (figure 51). Also, in case 10 the staircases were kept, which resulted in less material being removed from inside the building. Because the studios were meant for students, the rule of outdoor space for a dwelling does not apply in this case, making studios with students as the target group a good option to keep the exterior building fabric intact.

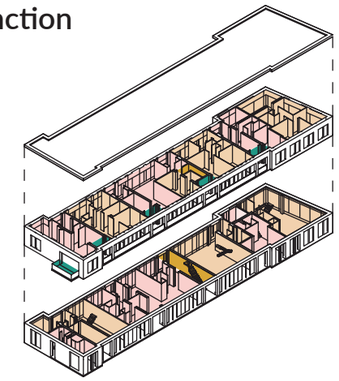
It can be concluded that when more focus is set on preserving the exterior building fabric the best choice could be to add studios and as a second option maisonettes. When preserving the interior, the choice can be made to add apartments or studios due to there not having to cut through the floor to create stairwells and circulation space of the original staircases are kept. However, the choice of the typology of the house depends on the cultural value of the building and on what the client demands.

Design Interventions repurpose & restructure

Legend

\+ added
\- removed
= kept

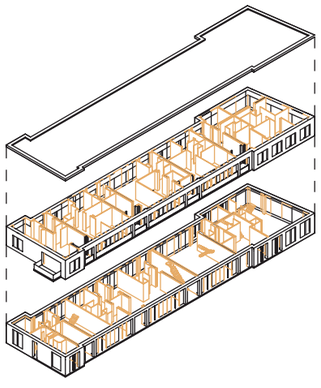
Function



Repurpose total 5/10 cases	total cases
+ apartments	**4**
+ maisonettes	**1**
+ studios	**1**
+ collective space dwelling	4
+ public functions	1
- educational spaces	5
- sanitary spaces old school	5
= circulation space (keeping old staircase)	5

Regenerate total 6/10 cases	total cases
+ maisonettes	**6**
+ apartments	**6**
+ collective space dwelling	2
- educational spaces	6
- sanitary spaces old school	6
- circulation space (remove original staircases)	1
= circulation space (keeping old staircase)	5

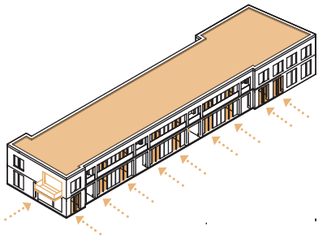
Interior building fabric



Repurpose total 5/10 cases	
+ interior walls for creating rooms in dwellings	5
+ entresols height old classrooms ≈ 5m	3
- remove some interior walls to create bigger spaces	5
- remove interior walls old toilets and wardrobes	5
= interior detailing	2

Regenerate total 6/10 cases	
+ interior walls for creating rooms in dwellings	6
+ new staircases for maisonettes	5
+ elevator	4
+ entresols if height classrooms ≈ 5m	1
- remove some interior walls to create bigger spaces	6
- remove interior walls old toilets and wardrobes	6
= interior detailing	1

Exterior building fabric



Repurpose total 5/10 cases	
+ exterior entrances for dwellings	4
+ roof patio	2
+ dormer windows	1
+ balconies	1
+ extension of existing building	1
+ sedum vegetation on roof	1
= facade material	5
= windows	2
= doors	2
= restoring facade to the original look	1
= restore original entrances	1

Regenerate total 6/10 cases	
+ balconies	4
+ exterior entrances for dwellings	4
+ roof patio	3
+ sedum vegetation on roof	2
+ additional building	2
+ gallery	1
+ extension of existing building	1
+ dormer windows	1
= facade material	6
= loggia's	1
= restore original entrances	1

Figure 45 - Design Interventions Repurpose and Restructure.

Design Interventions repurpose

Legend

\+ added
\- removed
= kept

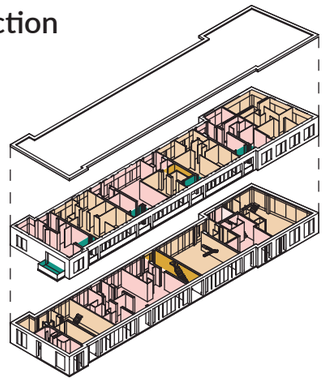
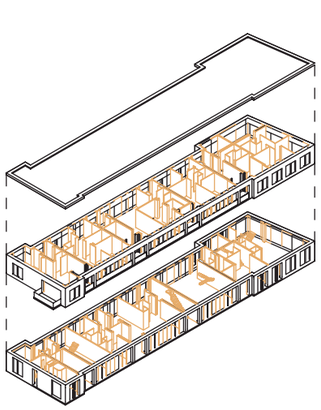
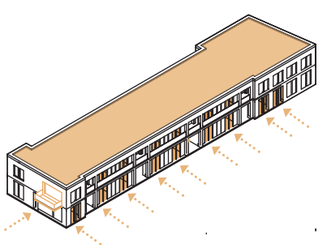
	common strategies (all 5 cases)	total cases	strategies (2-4 cases)	total cases	unique strategies (1 case)	total cases
Function 			**+ apartments**	**4**	**+ maisonettes**	**1**
			+ collective space dwelling	4	**+ studios**	**1**
	- educational spaces	5			+ public functions	1
	- sanitary spaces old school	5				
	= circulation space (keeping old staircase)	5				
Interior building fabric 	+ interior walls for creating rooms in dwellings	5	+ entresols height old classrooms ≈ 5m	3		
			= interior detailing	2		
	- remove some interior walls to create bigger spaces	5				
	- remove interior walls old toilets and wardrobes	5				
Exterior building fabric 	= facade material	5	+ exterior entrances for dwellings	4	+ dormer windows	1
			+ roof patio	2	+ balconies	1
					+ extension of existing building	1
			= windows	2	+ sedum vegetation on roof	1
			= doors			
					= restoring facade to the original look	1
					= restore original entrances	1

Figure 46 - Design Interventions Repurpose.

Design Interventions restructure

Legend

\+ added
\- removed
= kept

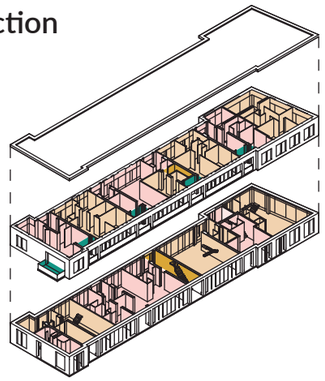
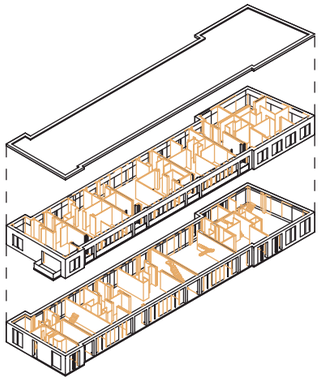
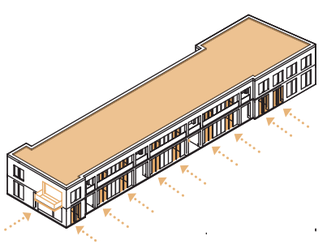
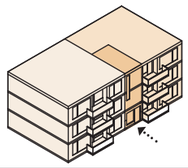
	common strategies (all 6 cases)	total cases	strategies (2-5 cases)	total cases	unique strategies (1 case)	total cases
Function 	**+ maisonettes**	**6**	+ collective space dwelling	2	- circulation space (remove original staircases)	1
	+ apartments	**6**	= circulation space (keeping old staircase)	5		
	- educational spaces	6				
	- sanitary spaces old school	6				
Interior building fabric 	+ interior walls for creating rooms in dwellings	6	+ new staircases for maisonettes	5	+ entresols if height classrooms ≈ 5m	1
			+ elevator	4	= interior detailing	1
	- remove some interior walls to create bigger spaces	6	= interior detailing	1		
	- remove interior walls old toilets and wardrobes	6				
Exterior building fabric 	= facade material	6	+ balconies	4	+ gallery	1
			+ exterior entrances for dwellings	4	+ extension of existing building	1
			+ roof patio	3	+ dormer windows	1
			+ sedum vegetation on roof	2		
			+ additional building	2	= loggia's	1
					= restore original entrances	1

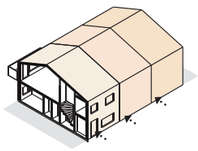
Figure 47 - Design Interventions Restructure.

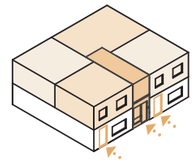
Design Interventions Overview all 10 cases

Legend

\+ added
\- removed
= kept







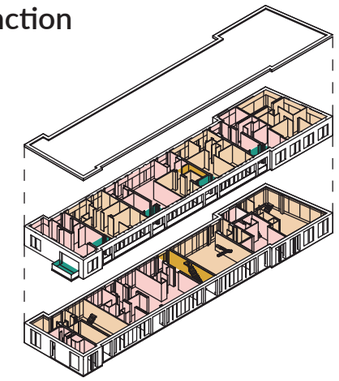
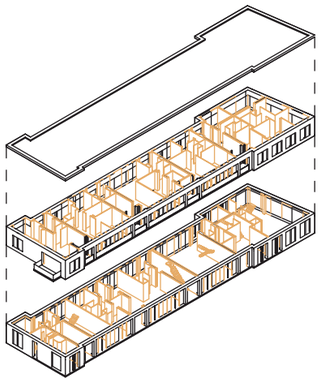
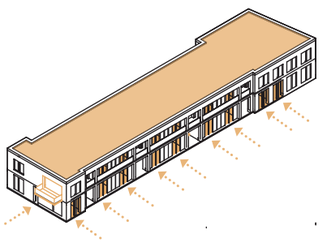
very common typology added: Apartments	total cases	common typology added: Maisonettes	total cases	unique typology added: Studio's	total cases
Function					
					
+ apartments	**9**	**+ maisonettes**	**6**	**+ studios**	**1**
+ collective space dwelling	**4**			**+ public functions**	**1**
- educational spaces	9	- educational spaces	6	- educational spaces	1
- sanitary spaces old school	9	- sanitary spaces old school	6	- sanitary spaces old school	1
= circulation space (keeping old staircase)	8	- circulation space (remove original staircases 1)	1	= circulation space (keeping old staircase)	1
Interior building fabric					
					
+ interior walls for creating rooms in dwellings	9	+ interior walls for creating rooms in dwellings	6	+ interior walls for creating rooms in dwellings	1
+ elevator	3	+ new staircases for maisonettes	5		
+ entresols height old classrooms ≈ 5m	3	+ entresols height classrooms ≈ 5m	1	- remove some interior walls to create bigger spaces	1
- remove some interior walls to create bigger spaces	9	- remove some interior walls to create bigger spaces	6	- remove interior walls old toilets and wardrobes	1
- remove interior walls old toilets and wardrobes	9	- remove interior walls old toilets and wardrobes	6		
= interior detailing	3				
Exterior building fabric					
					
+ gallery	1	+ exterior entrances for maisonettes	4	+ exterior entrance co-housing and public functions	1
+ additional building	2	+ sedum vegetation on roof	2		
+ exterior entrances for apartments	2	+ balconies (for maisonette on top of another dwelling)	1	= restoring facade to the original look by restoring concrete construction, prefab-elements and paint	1
+ extension of existing building	1	+ roof patio (maisonette on top of apartment)	1		
+ balconies	4				
+ roof patio	4				
+ dormer windows	2	= facade material	6		
+ sedum vegetation on roof	2				
= loggia's	1				
= windows	2				
= doors	2				
= facade material	9				

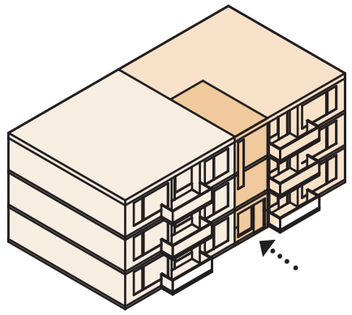
Figure 48 - Design Interventions Overview all 10 cases.

Design Interventions apartment typology

Legend

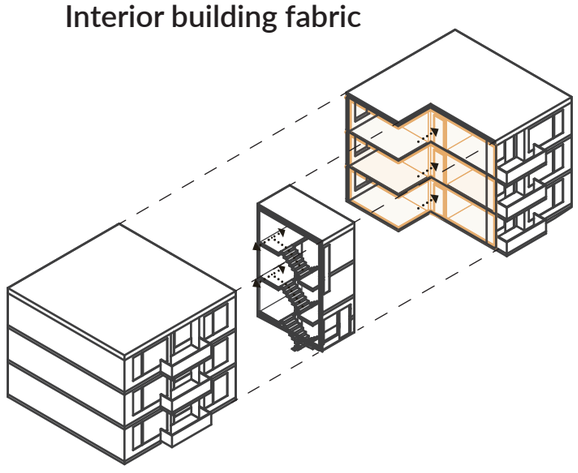
+ added
- removed
= kept

Function



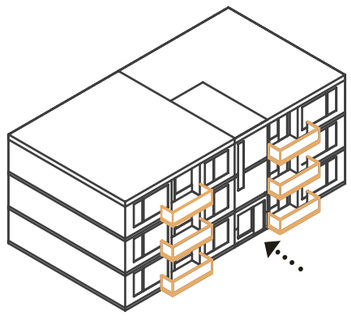
very common interventions (all 9 cases)	total cases	common interventions (2-8 cases)	total cases	unique interventions (1 case)	total cases
+ apartments	**9**	**+ collective space dwelling**	**4**		
- educational spaces	9	= circulation space (keeping old staircase)	8		
- sanitary spaces old school	9				

Interior building fabric



+ interior walls for creating rooms in dwellings	9	+ elevator	3		
		+ entresols height old classrooms ≈ 5m	3		
- remove some interior walls to create bigger spaces	9				
- remove interior walls old toilets and wardrobes	9	= interior detailing	3		

Exterior building fabric



= facade material	9	+ additional building	2	+ gallery	1
		+ exterior entrances for apartments	2	+ extension of existing building	1
		+ balconies	4		
		+ roof patio	4	= loggia's	1
		+ dormer windows	2		
		+ sedum vegetation on roof	2		
		= windows	2		
		= doors	2		

Figure 49 - Design Interventions apartment typology.

Design Interventions maisonette typology

Legend

\+ added
\- removed
= kept

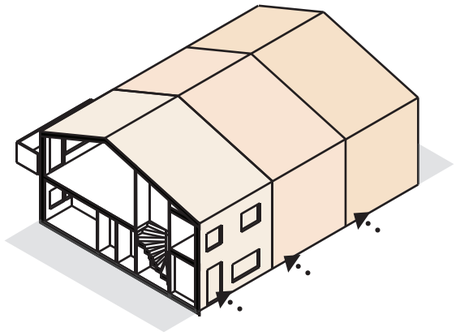
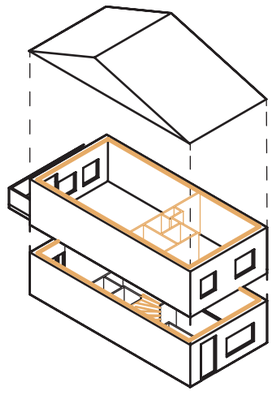
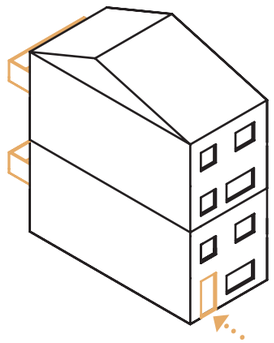
	very common interventions (all 6 cases)	total cases	common interventions (2-5 cases)	total cases	unique interventions (1 case)	total cases
Function 	**+ maisonettes**	**6**			- circulation space (remove original staircases 1)	1
	- educational spaces	6				
	- sanitary spaces old school	6				
Interior building fabric 	+ interior walls for creating rooms in dwellings	6	+ new staircases for maisonettes	5	+ entresols height classrooms ≈ 5m	1
	- remove some interior walls to create bigger spaces	6				
	- remove interior walls old toilets and wardrobes	6				
Exterior building fabric 	= facade material	6	+ exterior entrances for maisonettes	4	+ balconies (for maisonette on top of another dwelling)	1
			+ sedum vegetation on roof	2	+ roof patio (maisonette on top of apartment)	1

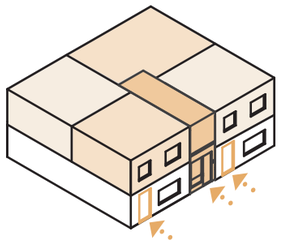
Figure 50 - Design Interventions maisonette typology.

Design Interventions studio typology

Legend

+ added
- removed
= kept

	interventions	total cases
Function	**+ studios for students**	**1**
	+ public functions	**1**
	- educational spaces	1
	- sanitary spaces old school	1
	= circulation space (keeping old staircase)	1
Interior building fabric	+ interior walls for creating rooms in dwellings	1
	- remove some interior walls to create bigger spaces	1
	- remove interior walls old toilets and wardrobes	1
Exterior building fabric	+ exterior entrance co-housing and public functions	1
	= restoring facade to the original look by restoring concrete construction, prefab-elements and paint	1



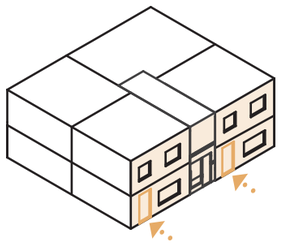


Figure 51 - Design Interventions studio typology.

5.2 In-depth research on case 5: Amundsenweg 1

5.2.1 Cultural value Amundsenweg 1

During the cultural value assessment, which utilized the monumental description as source provided by the municipality, historical and aesthetic values were identified as significant aspects of this school building (Monumenten Register Amsterdam, 2008). From the historic values the historic-artistic and historic-conceptual values are important, and from the aesthetical values the evidential and conceptual values are important. The values seen in this building are the Bossche School architecture style, urban planning, and the aesthetic qualities of the kindergarten design. The values are further expounded in headings 5.2.2 and 5.2.3. The attributes that are related to the values were found to be: the ensemble formed by the church, elderly homes, and the school. Also, the structure, color choice, classroom orientation, and small steps for stairs are seen as valuable (Monumenten Register Amsterdam, 2008).

5.2.2 Historic values

Historic-artistic: The school building makes use of the Bossche School architecture style, which is seen as valuable. The Bossche School style is a movement by Amsterdam architect duo A. Evers and G.J.M Sarlemijn, who were one of the first leading this style. This architectural movement emerged in the postwar period that is considered primarily “of a Catholic character” (Monumenten Register Amsterdam, 2008).

Historical-conceptual: The former kindergarten at the Amundsenweg 1 is of urban planning significance as part of the ensemble formed by the St. Joseph’s Church, the homes for the elderly, the ULO school and the Francis and July school. Moreover, the ensemble forms the heart of the Poolbuurt. In addition, the ensemble is architecturally significant because the urban development plans for the ensemble from 1934. The urban design for Bos en Lommer is part of the 1934 algemeen Uitbreidingsplan (AUP) of the Urban Development Department of the Dienst der Publieke Werken. 1944 show the changed thinking after the war, in which the community center had come to play an important role (Monumenten Register Amsterdam, 2008).

5.2.3 Aesthetical values

Evidential and Conceptual: The kindergarten is also architecturally important because of the aesthetic qualities of the design, not only because of the careful design of the structure, such as the way the building is tailored to the preschoolers, but also because of the harmonious effect, both in the siting of the building masses and in the material and color choice of the building with the other buildings in the ensemble, especially with the church, the convent building and the ULO school (Monumenten Register Amsterdam, 2008).

The design of the Joseph church is the exposed concrete structure, filled in with concrete wall slabs and the use of stone from Limburg. Evers and Sarlemijn translated this to the school by using a concrete construction and brick walls, to match the smaller scale of the schools. For the schools Evers and Sarlemijn were more specific when it came to the age of the students attending the school. For the kindergarten at the Amundsenweg 1 a friendlier character was given by adding recessed round-arched façade parts on the side of the street, the stairs were made of small steps, and the orientation of the classrooms were set towards the playground for the preschoolers.’ (Monumenten Register Amsterdam, 2008)

VALUES					
Historic values				**Aesthetical values**	
Historic-artistic		**Historic-conceptual**		**Evidential and conceptual**	
Bossche School Architecture style	mentions: 3	Urban planning and community center	mentions: 14	Aesthetic qualities of the kindergarten design	mentions: 10

Figure 52 - Values case 5 Amundsenweg 1. With use the monument description document.

	VALUES					
	Historic values				**Aesthetical values**	
	Historic-artistic		**Historic-conceptual**		**Evidential and conceptual**	
ATTRIBUTES	Catholic character	mentions: 2	the ensemble formed by the St. Joseph’s Church, the homes for the elderly, the ULO school and the Francis and July school.	mentions: 5	structure and material	mentions: 8
					color choice	3
					stairs small steps	1
					orientation classrooms	2

Figure 53 - values with attributes case 5 Amundsenweg 1. With use the monument description document.

5.2.4 Quantitative vs qualitative findings on Amundsenweg 1

For the in-depth research, case 5 was chosen located on Amundsenweg 1. The choice for this case was due to this case being a municipal monument and due to it being a post-war building. This building was classified as regenerated based on previous research. In this research, the addition is excluded, solely the school building was researched.

In this building, it was found that five maisonettes were realized ranging from 73- 154 m2 making this area larger than an original classroom of 56 m2. The way this expansion was tackled was by extending the size of the classrooms to the other side of the building, making it so that the dwellings have a north and south façade. By doing so, the old corridors that functioned as circulation space, are removed. The stairs at the end of the buildings are also removed to add dwellings in their place. Sanitary, storage, and office spaces were also removed to make bigger dwellings wider than the 7,5 m classrooms (figure 54). The levels of the school are also 3,097m and 3,133m high making the spaces suitable for maisonettes and apartments, but not high enough to add entresols on the levels.

While asking the architecture firm that transformed this building from school into housing the question: “What was allowed to be preserved and demolished?” Ineke Hulshof (2024) head architect of Hulshof Architecten, mentioned when it comes to retaining the cultural values of the building, excellent communication was kept with the municipality’s monuments office. This led to the characteristics of the front façade being retained by keeping the windows and these windows were provided with rear windows on the inside. Also, to not have visible ventilation grilles on the façade, a ventilation system was developed without visible grilles. Besides the building itself, the urban ensemble of the neighborhood was one of the main concerns (Hulshof, 2024).

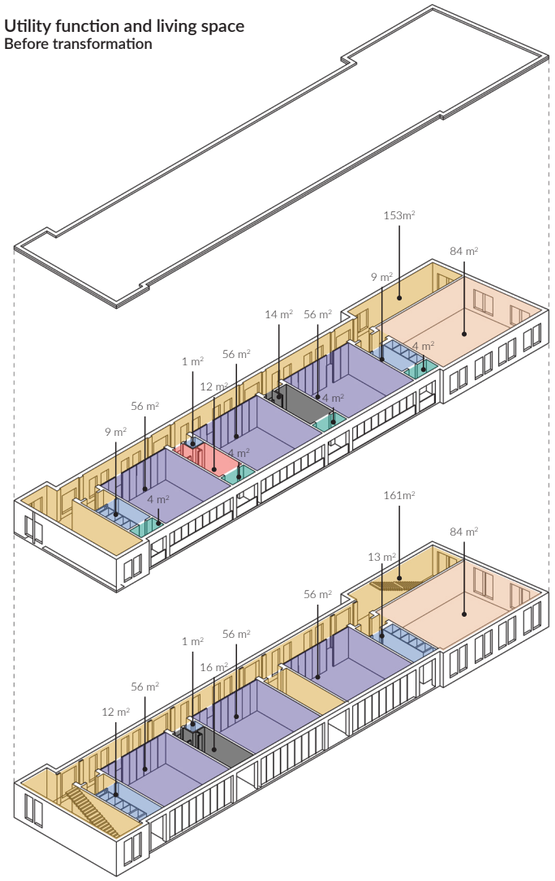
When it comes to the actual outcome of the adaptations and interventions, it can be seen that the outside remains almost untouched, but the interior building fabric is adapted by removing 18% of the building’s volume and adding 50% to the building (figures 55, 56 and 57). On the exterior building fabric, the biggest intervention is seen on the roof where 13% has been added as insulation. Besides the roof, other exterior adaptations included removing some doors and windows that were 0,33% of the building to add new doors and rear windows on the inside that contributed 0,4% to the building (figures 56 and 57). So, when it comes to exterior adaptations there were no major differences, compared to the adaptations done to the interior building fabric. When it comes to the building’s interventions linked to the cultural value, there is no significant text about its interior written in the monument document, and this is seen back in the adaptations of the floorplan. It seems like the classroom walls were kept because of them probably being structural.

It should also be noted that the choice of maisonettes also had less influence on the exterior, besides doors being added for entrances (figure 57). However, the choice for maisonettes could also be why the added interior building walls and insulation were bigger. The addition of maisonettes thus resulted in closing stairwells, adding 7,20 m3, and removing stairs that make up a small part of the 614 m3 of the original building.

For the building to be energy efficient to house a housing function the Rc-values 4,5 $m^2 \times K/W$ for the walls, 6,0 $m^2 \times K/W$ for the roof, and 3,5 $m^2 \times K/W$ for the ground floor had to be reached to combat heat loss and to not use too much energy Also, for the windows and doors on the exterior building fabric had to qualify with the U-value of no more than 2.2 $W/m^2 \times K$. To qualify for the thermal resistance, insulation was added all inside the building, except the roof being insulated on the outside (figures 56 and 57). The reason for the roof to be insulated on the outside could be due to the ceiling height not getting too low because it has to be a minimum of 2,6 m for new dwellings (Rijksoverheid, 2023). The choice of insulating the walls on the inside of the façade is due to the preservation of the exterior building skin and brick look.

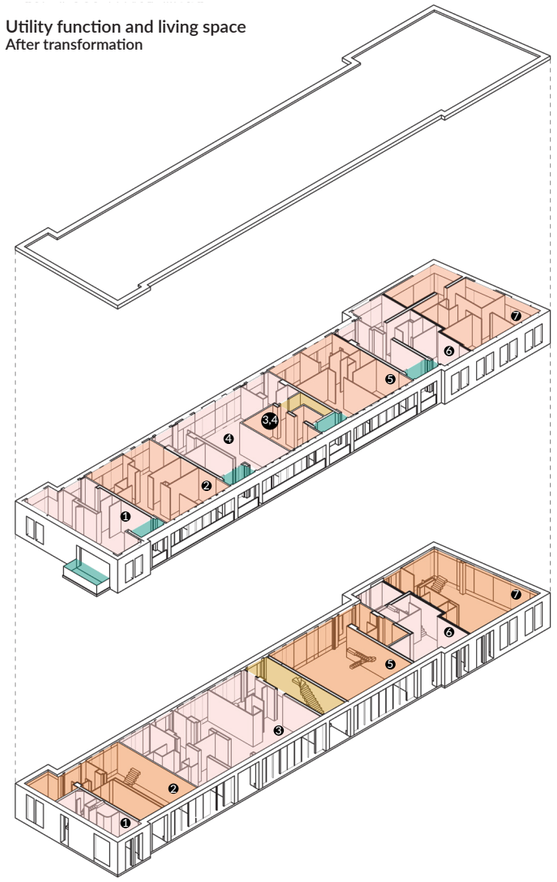
For acoustic and noise requirements of a new dwelling, there should be some kind of sound insulation between rooms and dwellings as mentioned in the Bouwbesluit (2012). The noise requirements between homes require airborne noise to be at least 52dB, the higher the dB the better the insulation quality. Furthermore, the contact noise should be a maximum of 54 dB meaning the lower the dB, the better the insulation quality. Other requirements mentioned for the sound insulation between bedrooms or other rooms within a home are airborne noise a minimum of 32 dB and contact noise a maximum of 79 dB (Rijksoverheid, 2023). In a building where the function was educational and is now dwellings, all the walls must be properly insulated. Therefore, in the case of Amundseweg, the adaptations have led to a box-in-box being created for acoustic and noise requirements (figure 57).

Utility function and living space
Before transformation



classrooms	336 m²	
playroom	168 m²	
office space	30 m²	
storage space	12 m³	
circulation space	314 m²	
sanitary space	45 m²	
outdoor space	16 m²	

Utility function and living space
After transformation



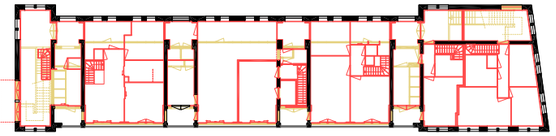
circulation space	29 m²	1 maisonette 3 rooms 73 m²
outdoor	22 m²	2 maisonette 5 rooms 139 m²
dwellings	853 m³	3 apartment 5 rooms 133 m²
		3,4 collective for 3 & 4 23 m2
		4 apartment 3 rooms 81 m²
		5 maisonette 4 rooms 154 m²
		6 maisonette 4 rooms 106 m²
		7 maisonette 5 rooms 144 m²

0 4 8 12 16 20 m

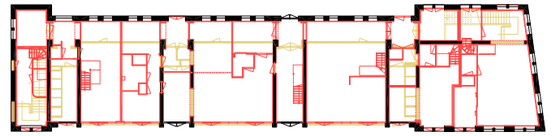
N

Figure 54 - Overview utility function analyses.

Interior and exterior building fabric
Transformation



1st floor transformation



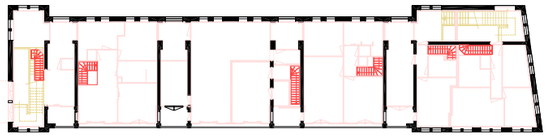
Groundfloor transformation

Add
Remove

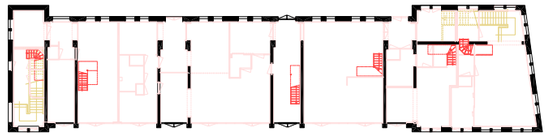
0 4 8 12 16 20 m

N

Interior and exterior building fabric
Stairs



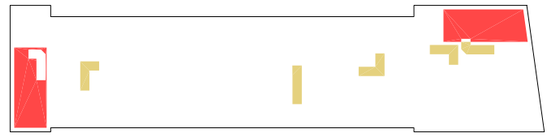
1st floor transformation



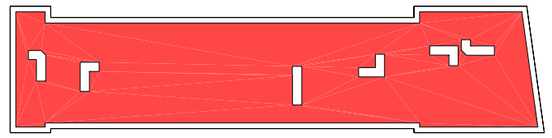
Groundfloor transformation

Add 2.0 (stairs)
Remove (stairs)
Add

Interior and exterior building fabric
Floor/ stairwells



add and remove of floor structure



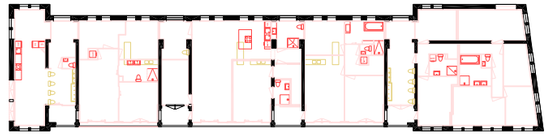
new ground floor ceiling and 1st floor layer

Add
Remove

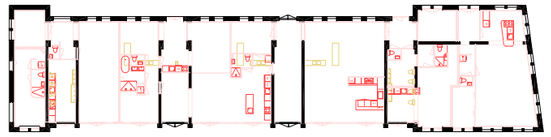
0 4 8 12 16 20 m

N

Interior and exterior building fabric
Furniture/Use



1st floor transformation



Groundfloor transformation

Add 2.0 (furniture)
Remove (furniture)
Add

Figure 55 - Overview Black/Yellow/Red analyses.

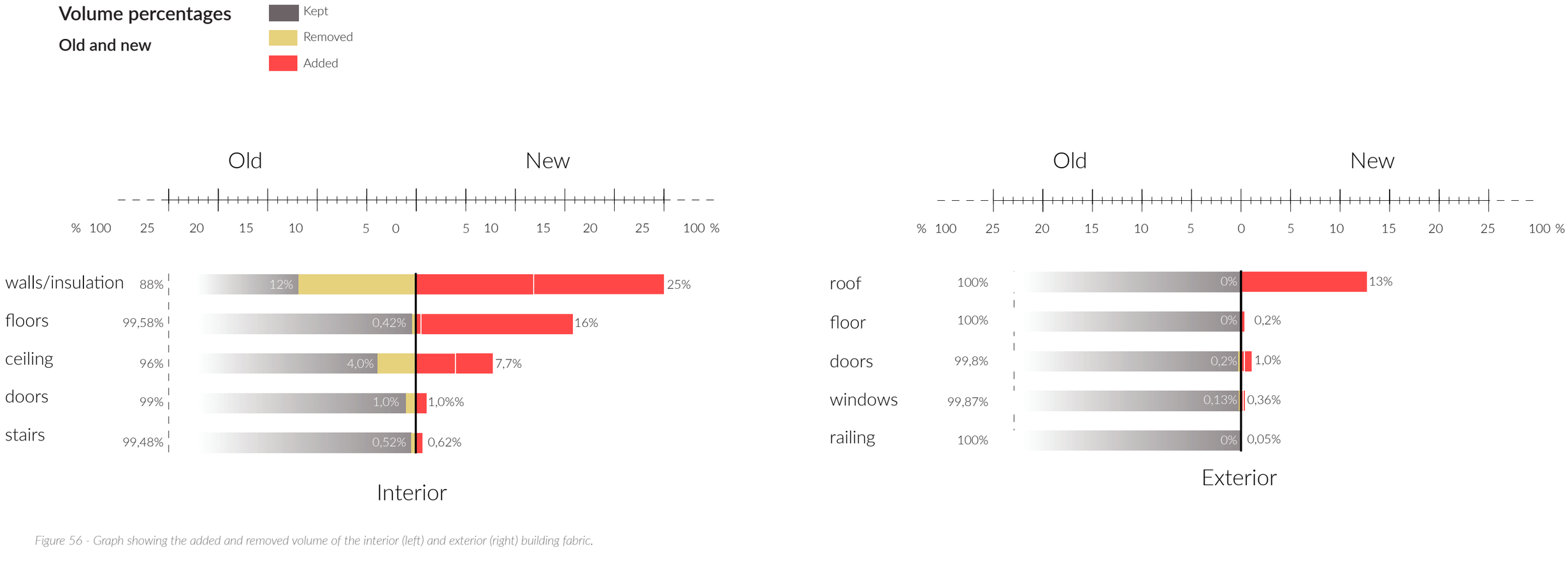


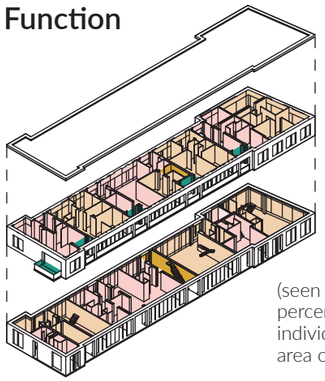
Figure 56 - Graph showing the added and removed volume of the interior (left) and exterior (right) building fabric.

Design interventions Regenerate quantitative vs qualitative

Legend

+ added
- removed
= kept

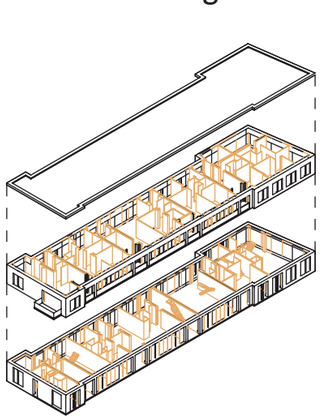
Function



(seen individually, percentages of the utilities individual area so not the area of the whole building)

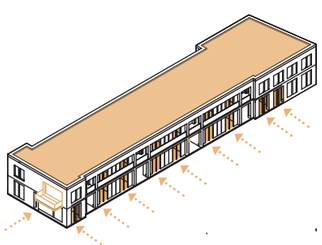
quantitative	keep	removed	added	qualitative remove	qualitative addition
classrooms	0%	-100%	0%	Desire for housing function	
playroom	0%	-100%	0%		
office space	0%	-100%	0%		
storage	0%	-100%	0%		
old sanitary space	0%	-100%	0%		
circulation	=9%	-91%	0%	Desire for less wasted circulation space	
outdoor	=100%	0%	38%		Desire for keeping and adding a bit more outdoor areas
dwellings:					Daylight linked to “Bouwbesluit”
maisonettes	N/A	N/A	+91%		Desire for bigger living area
apartments	N/A	N/A	+9%		Desire for another housing type

Interior building fabric



quantitative	removed	added	qualitative remove	qualitative addition
walls/ insulation	-12%	+25%	desire for bigger spaces and openings	Desire for dwellings and rooms, and **heat and sound insulation.**
floors	-0,42%	+16%	desire for maisonettes -> so new openings in floor for stairwells	Maisonettes do not need the old stairs so **filling of the old stairwells**, and **sound insulation** between floor levels.
ceiling	-4%	+7,7%	better box in box sound insulation so remove old ceiling	Better sound insulation between floor levels so adding better sound absorbent ceiling
doors	-1%	+1%		Desire to connect between new spaces in dwellings and more flexible floor plan
stairs	-0,52 %	+0,62%		Desire to have circulation vertical in house -> so maisonette typology which needs new stairs

Exterior building fabric



quantitative			qualitative remove	qualitative addition
roof	0%	+13%	N/A	Necessity for building to be insulated and less heat loss
floor	0%	+0,02%	N/A	Desire for outdoor space (balcony) on first floor facing the east
doors	-0.2%	+1,0%	Desire for wider doors	Desire for more outdoor access to French balconies and desire to enter maisonettes from the garden
windows	-0.13%	+0.36%		Keeping exterior facade look, but less heat loss from aluminum frames and single glazing -> wooden frames and double-glazed windows on the back of old windows
railing	0%	+0,05%	N/A	

Figure 57 - Overview of Design Interventions of regenerate approach on a quantitative vs qualitative level based on case 5 Amundsenweg 1

5.3 Which cultural values are important for Rendorpschool?

As preliminary research to the design, the cultural values identified in the Rendorpschool are historic-artistic, historic-conceptual, evidential, and conceptual shown in Figure 58 (Monumenten Register Amsterdam, 2011). These values were Identified from the monument description of Herman de Manstraat 1 retrieved from the municipality of Amsterdam.

5.3.1 Historic values

Historic-artistic: the school building has architectural value due to it being part of a new school type, the H-school which used the concept of light and air, also known as “licht en lucht” in Dutch. This new school type was developed by the “Publieke Werken” for public primary education after World War 2. Attributes correlated to this historic-artistic value are the choice of low parapets consisting of blue-painted wood panels, and windows for max lighting. Also, the use of red brick as facade material, and a saddle roof. Furthermore, this school type also had a boiler house with a coal cellar and boiler cellar which made a stout chimney with red brick, an attribute to the historic-artistic value (Monumenten Register Amsterdam, 2011).

The urban planning is an ensemble of residential and special buildings, making the school building and the churches in its whole important anker points. Therefore, the church that is now used as a mosque, and the Public Primary School building on Herman de Manstraat are of great importance to the urban composition. Other attributes mentioned are the greenery of trees, front gardens, courtyards and parks. (Monumenten Register Amsterdam, 2011)

5.3.2 Aesthetical values

Evidential and conceptual: the school is also architecturally important because of the aesthetic qualities of the design, not only because of the careful design of the structure, such as the way the building is tailored to the primary school students but also because of the harmonious effect, both in the siting of the building masses and the material and color choice of the building with the other buildings in the ensemble. Color choices that have aesthetical values are the blue-painted wood panels of the low parapets and the three large wood frames. Furthermore, the structure of the Rendorpschool is made of a brick structure with a cavity wall (Monumenten Register Amsterdam, 2011).

5.4 Theoretical framework

When talking about the typological evolution of schools into housing, adaptive reuse projects can be classified as “repurpose” or “regenerate”. Result of repurposing, the building fabric is preserved, this can be for the interior or exterior building fabric.

VALUES					
Historic values				**Aesthetical values**	
Historic-artistic		Historic-conceptual		Evidential and conceptual	
H-school Architecture style with “licht and lucht concept”	mentions: 13	Urban planning	mentions: 7	Aesthetic exterior qualities	mentions: 9

	VALUES					
	Historic values				**Aesthetical values**	
	Historic-artistic		Historic-conceptual		Evidential and conceptual	
ATTRIBUTES	H-shape of two solid volumes connected by two glass corridors.	mentions: 3	an early post-war enclave of unusual buildings in the surrounding residential building	mentions: 5	structure	mentions: 2
	North volume is one layer and South volume is two layers.	1	simple building blocks	1	color choice. such as color of the low parapets that consist of blue painted wood panels	4
	low parapets (consist of blue painted wood panels)	2	greenery of trees, front gardens, courtyards and parks	1	three large wooden frames (in bad shape)	1
	red brick facades	4				
	saddle roof	2				
	windows (original ones had deviant color) for max lighting	4				
	The stout chimney, also red brick, is a vertical accent in the composition.	1				

Figure 58 - Values (top) and attributes (bottom) tables of Burgmeester Rendorpschool identified from monument description documents.

Chapter 6: Conclusions

6.1 Results Summary

It can be concluded that the adaptive reuse of schools into housing can be classified as repurpose or regenerate and that three typologies are added: apartments, maisonettes, and studios. The Amundsenweg 1 which is an example of regenerate, is seen to have kept its cultural value of maintaining its exterior building fabric. However, due to a lack of explanation on the interior, this resulted in 50% being added to the interior building fabric especially due to the design protocols posed in the Netherlands. However, quantitative data about the mass of a repurposed building has not been researched yet, resulting in no data on the effects of repurposing. Therefore, for the design case, further research will be done on the design case being seen as a repurpose adaptive reuse project.

To answer the research question, it can be concluded that for the Rendorpschool the values and attributes that are especially mentioned are about the exterior building fabric. The design assignment therefore will be to see the Rendorpschool as a repurpose case and to focus on the three housing typologies and the strategies shown to be used for the repurpose approach in the research done prior. The housing typologies will be seen as three separate scenarios. The goal of the design assignment is to research which scenario would be the best option in three aspects: living quality, cultural value, and resourcefulness. With resourcefulness, sustainability will be linked.

When it comes to cultural value, the preservation of the exterior building fabric is seen as a priority since repurposing is about the preservation of the building fabric and not so much the modification of this building fabric. The functions (building typologies) linked to this repurpose approach will be chosen as scenarios. Therefore, from the interventions listed per housing typology, the ones with the least adaptation to the exterior building fabric will be chosen.
The aspects will be tested quantitatively on what is kept, demolished, and added. And these will serve as reasoning on which scenario can be the best option.
When linked to resources and sustainability, it is more sustainable to reuse as much as possible and remove as little as possible. However, when talking about sustainability nowadays, it is linked to building energy efficiency, and therefore by making the building more sustainable more resources are needed.

6.2 Framing Results

In general, this research results and methods are complementary to the Ibelings and Diederendirrix way of classifying the cases. The research and method itself are a more scientific and objective way to categorize the cases. Furthermore, the results showed a brother insight into interventions of adaptive reuse of schools into housing, which has not been visualized before in another research.

6.3 Discussion

To begin, due to the lack of existing literature, specifically focused on the adaptive reuse of school buildings, the focus in chapter 1.3.1 of the “state-of-the-art” was set on the existing literature on adaptive reuse as a whole. This limitation guided the direction of the research, which consequently helped to broaden the knowledge gap on the adaptive reuse of school buildings, specifically focusing on their transformation into housing.

Moreover, when it comes to the general analyses a lot has changed compared with the original research plan. Not enough cases were found around the Netherlands leading to the scope being narrowed to Amsterdam. Also, of the 19 cases 9 were filtered out due to a lack of information about new and old floorplans. Also, only 2 post-World War 2 cases were found. So, cases from other periods were also chosen. When it comes to the in-depth research, only one case was analyzed. The analyzed case was part of the regenerate category, and it would have been nice if from this stage there were also quantitative results on repurpose to compare the two, but due to time limitations, this was not possible. However, the design case will be seen as part of the “repurpose” category and therefore the research can have more in-depth results.

Even though the classifying of cases was made more scientifically, the positioning of certain cases was still difficult. For example, case 5 with an addition was difficult, because during the building fabric spectrum analyses, it was difficult to decide if the case was seen as a whole or as individual buildings. In the general analyses case 5 with addition resulted in being seen as a whole.

Lastly, a limitation of this research is the focus of the cultural value assessment based solely on two short documents, which provided only limited text and information. These two documents, provided by the municipality, were mostly focused on the tangible attributes that were related to the historical and aesthetical values. Because the documents consist of around four informative pages, the values and attributes were quite limited in the amount mentioned and in their details. Less information was given on other values for example social values. Since also this research was not focused on the method of interviewing. This resulted to a cultural value assessment with less detail and depth.

6.4 Further recommendations

For future research, there should be a further improvement in the definitions that look at the building and the context. Quantitatively the amount that is occupied as a building and if the addition should be looked at as a whole or as an individual that is taking the context from the heritage building on the site. Though in this research the cases were analyzed more generally, it would be nice in the future to further define the definitions by further analyzing all the cases in-depth to fully understand the impact of the interventions.

Additionally, this new objective way of classifying the cases could be applied to the actual cases of Ibelings and Diederendirrix (2018) to compare the positioning of the cases before and after the adapted framework, determining if the cases would be positioned in a similar area as to before the adapted framework.

Furthermore, when doing the cultural value assessment, the residents could also be interviewed to gain more knowledge of the values and attributes of the building, making the assessment not solely determined by the municipality documents.

6.5 Relevance

The objective of using these design intervention overviews is to determine whether they can serve as a new research and documentation tool for architects and researchers in the field of heritage and architecture, in addition to providing answers to the research questions mentioned above. It might be a useful addition to the heritage as vector approach and the current biographical research methodologies, especially for those engaged in the design process. Most disciplines are more text orientated while architects are more visually orientated. The school building interventions overviews may be useful for obtaining a concise, visual overview of all interventions and may serve as a starting point for evaluating the comparative qualities of the various interventions. It makes it simpler for designers to quickly understand what they are dealing with and a more effective way of communicating research. Also, it forces the compiler to at least confirm that data for the three key features: interior building fabric, exterior building fabric, and function, is available.

This research does not only contribute to the societal impact of strategies to reuse a vacant building, but it can also contribute to other professionals having a tool to look at the interventions they can apply on school transformations into housing. Additionally, with the conclusions from the design phase, they can apply the results to their own school transformations and understand what impact their decisions have on the volume of the existing building and the impact on the environment. It can also help with choosing which typology to add to their building.

Chapter 7: Design phase Rendorpschool

7.1 Design Case

Burgemeester Rendorpschool

now Kentalis Signis-school,
Herman de Manstraat 1, Amsterdam Nieuw West

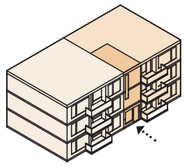
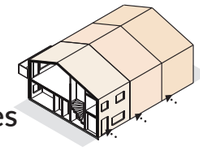
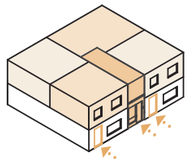
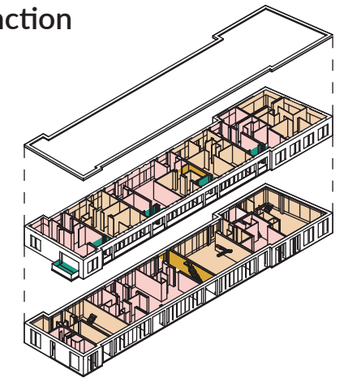
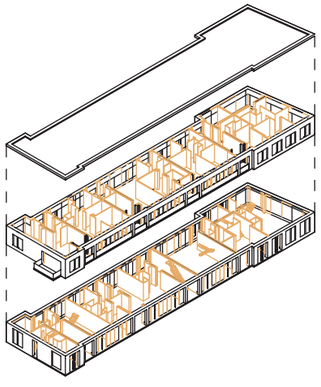
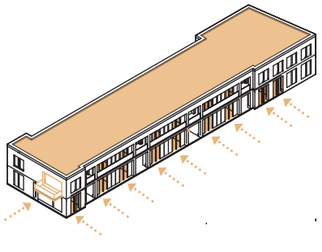
Status: municipal monument
Built: 1955
Architect: Jan Leupen

7.2 Site

Neighbourhood:
Slotermeer-Zuidoost,
Louis Couperusbuurt

7.3 Design Interventions per scenario to be tested

based on the strategies that have less adaptation on the exterior building fabric

	Scenario 1: Apartments 	Scenario 2: Maisonettes 	Scenario 3: Studios 
Function 	**+ apartments** **+ collective space dwelling** - educational spaces - sanitary spaces old school = circulation space (keeping old staircase)	**+ maisonettes** - educational spaces - sanitary spaces old school	**+ studios for students** **+ public functions** - educational spaces - sanitary spaces old school = circulation space (keeping old staircase)
Interior building fabric 	+ interior walls for creating rooms in dwellings + entresols hight old classrooms ≈ 5m - remove some interior walls to greate biggerspaces - remove interior walls old toilets and wardrobes = keeping old staircase	+ new staircases for maisonettes + interior walls for creating rooms in dwellings + entresols hight classrooms ≈ 5m - remove some interior walls to greate biggerspaces - remove interior walls old toilets and wardrobes	+ interior walls for creating rooms in dwellings - remove some interior walls to greate biggerspaces - remove interior walls old toilets and wardrobes
Exterior building fabric 	+ balconies = loggia's = windows = facade material	+ exterior entrances for maisonettes = facade material	+ exterior entrance co-housing and public functions = restoring facade to the original look by restoring concrete construction, prefab-elements and paint

500 m - 5-10 min

800 m - 10-15 min

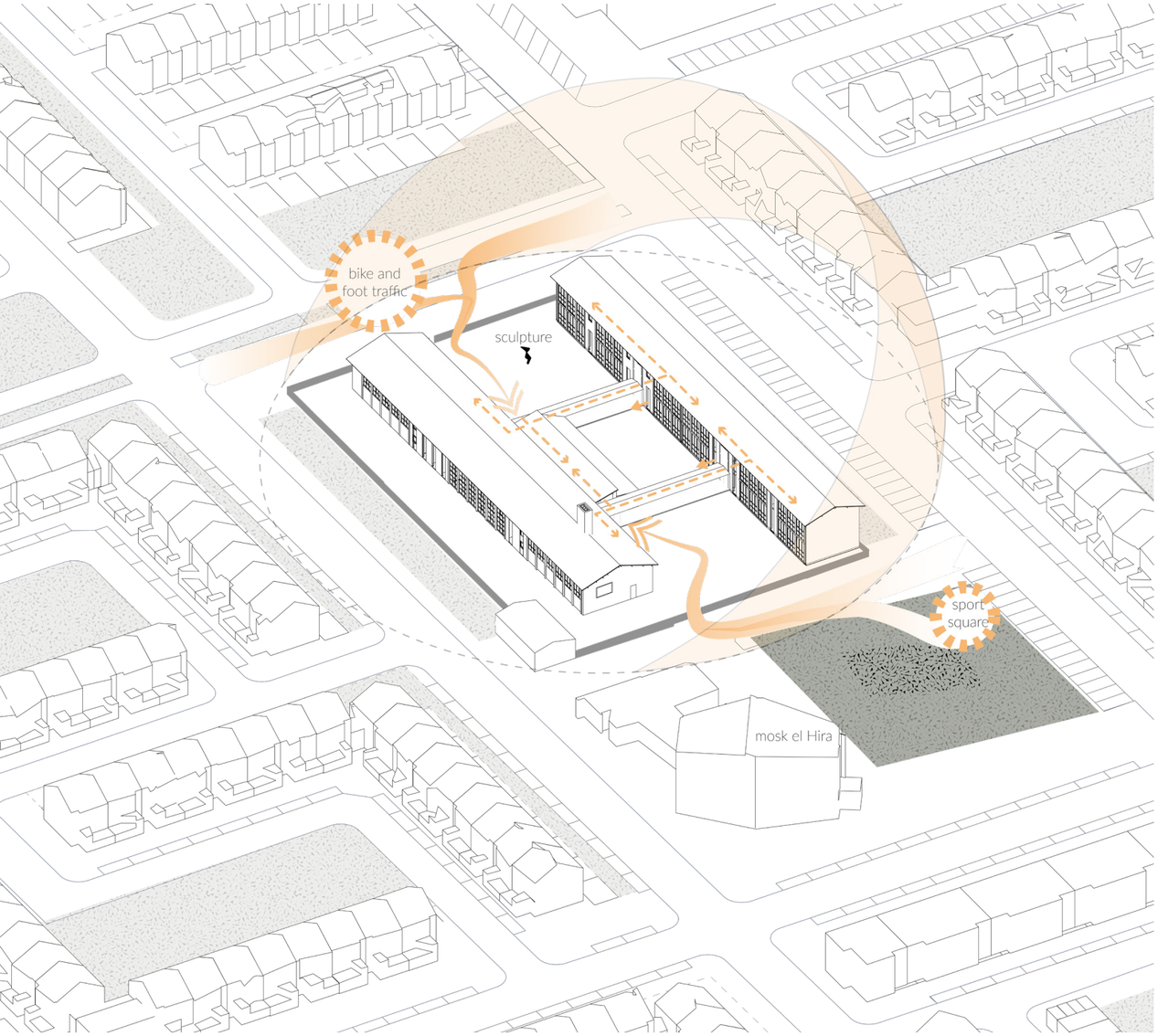
Legend

- education
- religion
- healthcare/dentist
- public function
- retail
- workspace
- horeca
- dwellings
- water
- parking
- green

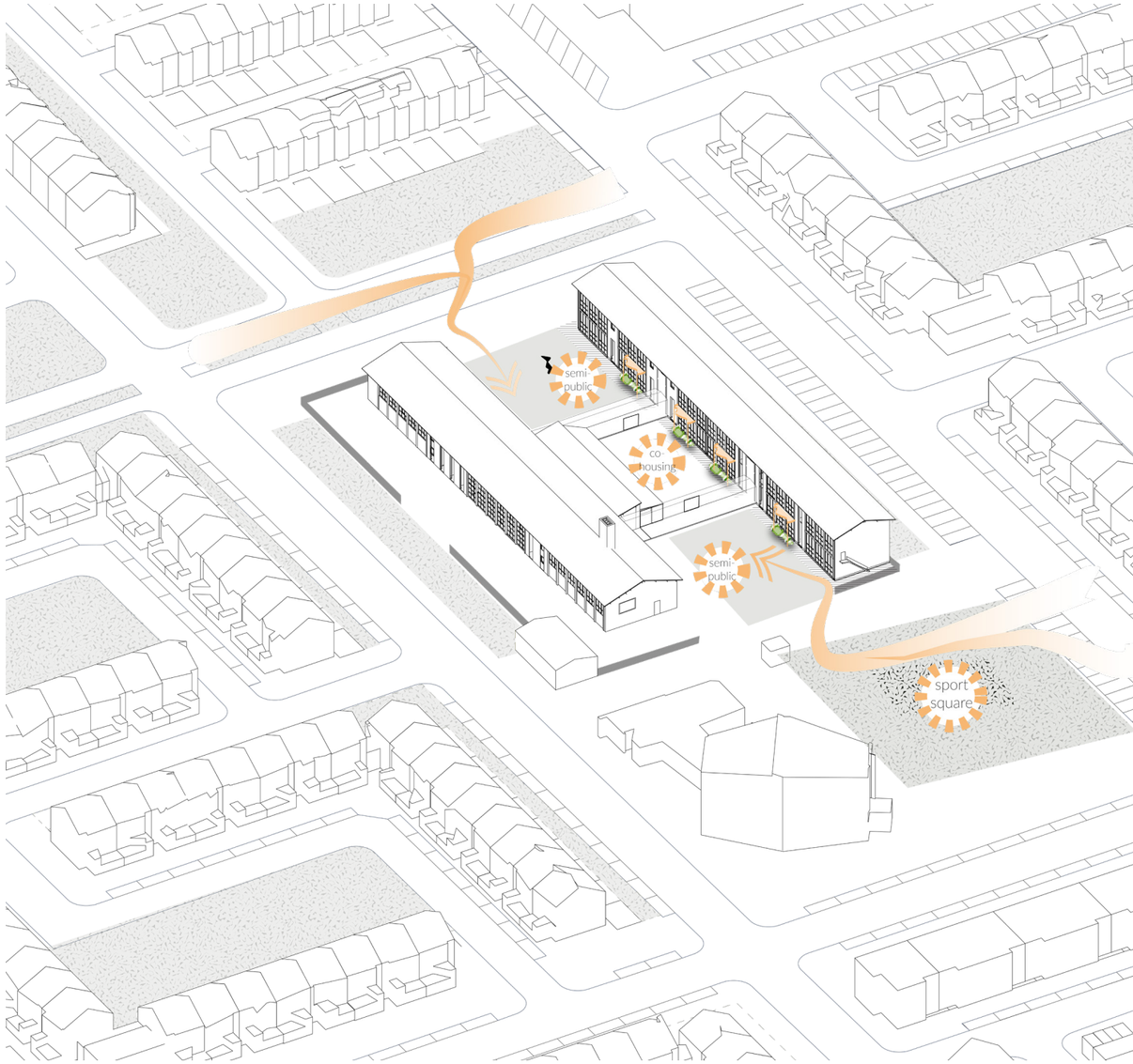
N

7.4 Situation - function 1:4000

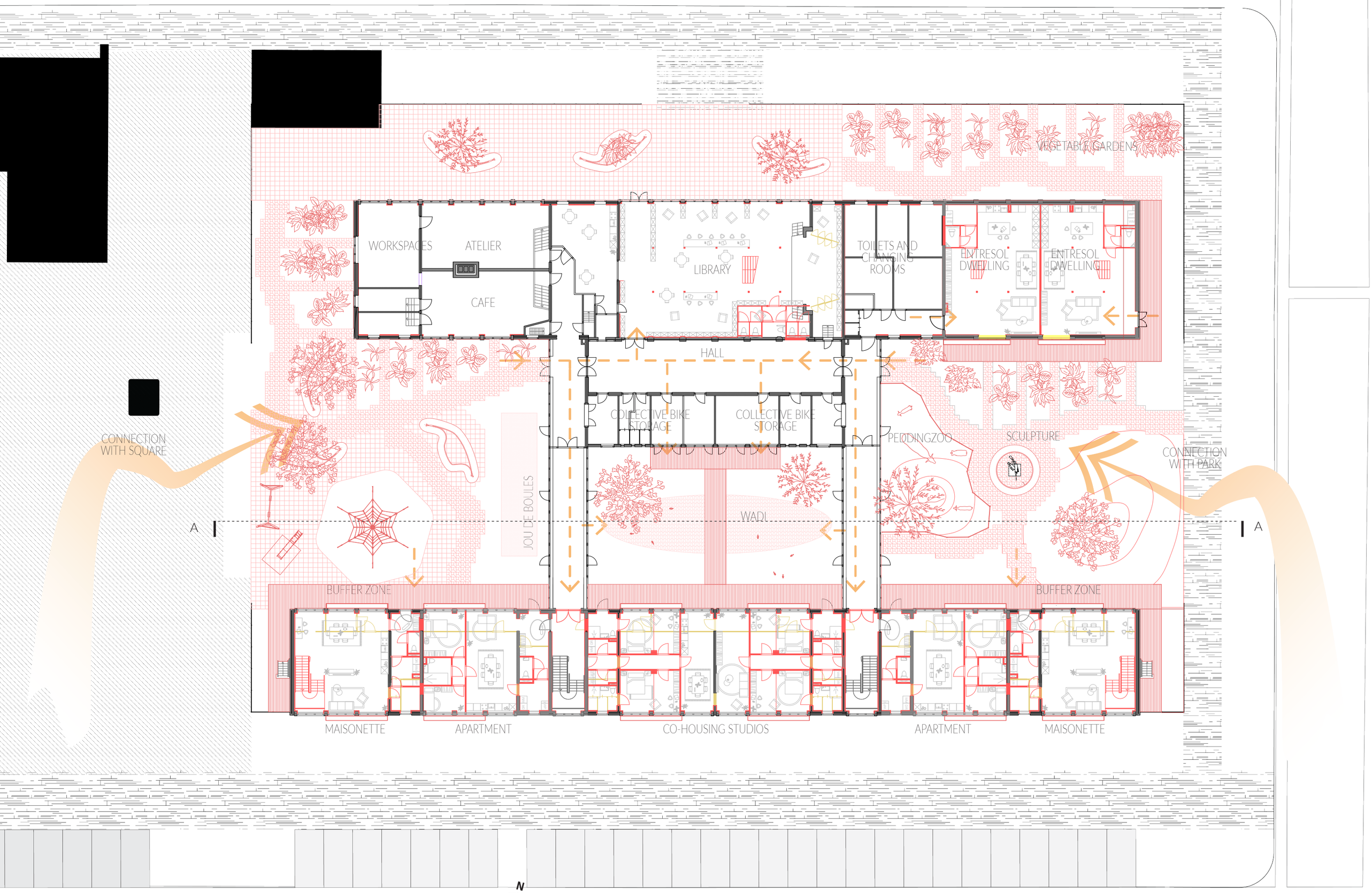
7.5 Site concept



SITE **ANALYSES CURRENT**



SITE **ZONING NEW**



7.6 Site - ground floor 1:200 rescaled

7.7 Section AA courtyard

0 2 4 6 8 10m

Total volumes per “fabric” layer

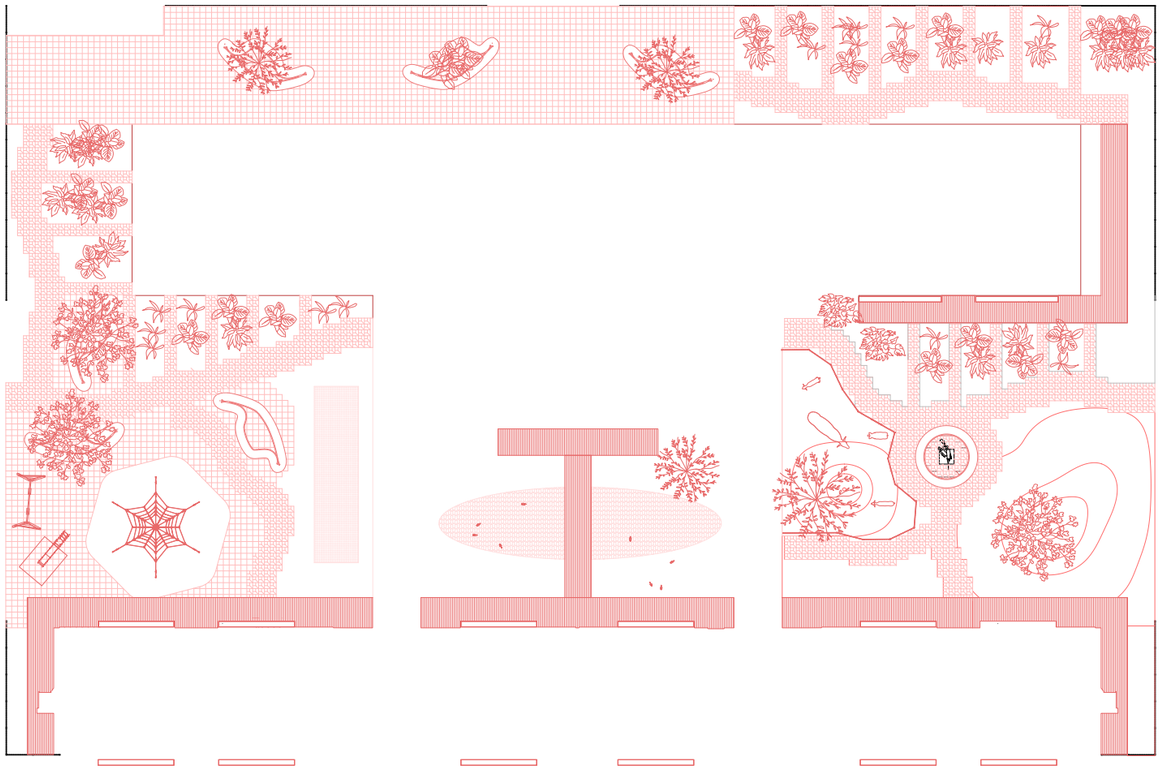
total volume old courtyards = 172 m3

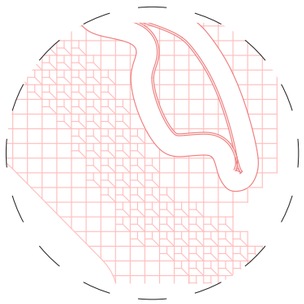
Add courtyards h= m		**Remove entresol h= m**
East		**East**
Ground	28,03 m3	
Green	7,73 m3	- 2,84 m3
Paths	13,34 m3	-50,63 m3
Wooden paths	4,56 m3	
Plant pots wood	0,817 m3	
Benches wood	0,89 m3	
Middle		**Middle**
wooden paths	3,60 m3	
ground		-70 m3
Green	3,02 m3	-3,96 m3
paths		- 8,73
West		**West**
Jou de boules	0,72 m3	
Green	5,03 m3	-2,77 m3
Plant pots wood	0,389 m3	
Paths	32,89 m3	- 55,5 m3
Wooden paths	1,83 m3	
Benches	3,78 m3	
North		**North**
Paths	45,99 m3	- 40,9 m3
Benches	3,78 m3	
Green	2,93 m3	3,95 m3
Green	13,51 m3	
Paths	155,77 m3	

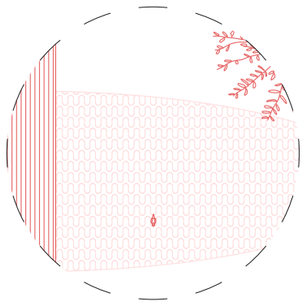
Add courtyards h= m		**Remove entresol h= m**
Total courtyards added		**Total courtyard removed**
Ground	28,03 m3	- 70 m3
Green	18,71 m3	-13,52 m3
Paths	92,22 m3	-155,76 m3
Fencing	0,181 m3	-0,701 m3 (0,511 m3 reused for railings and peddingzoo fencing)
Wooden paths	9,99 m3	
Plant pots wood	1,206	
Jou de boules	0,72 m3	
Benches wood	8,45 m3	

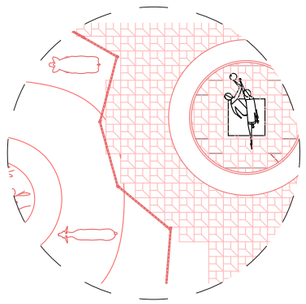
7.8 Courtyard

reuse of pavements and ground



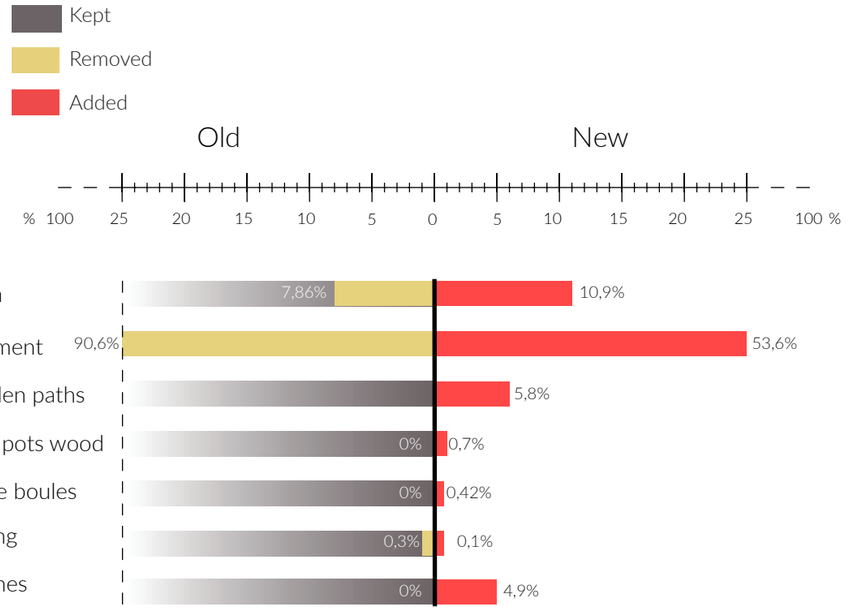


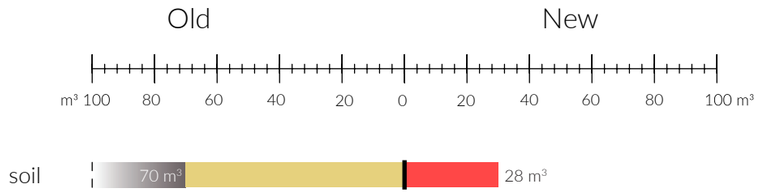




Volume percentages

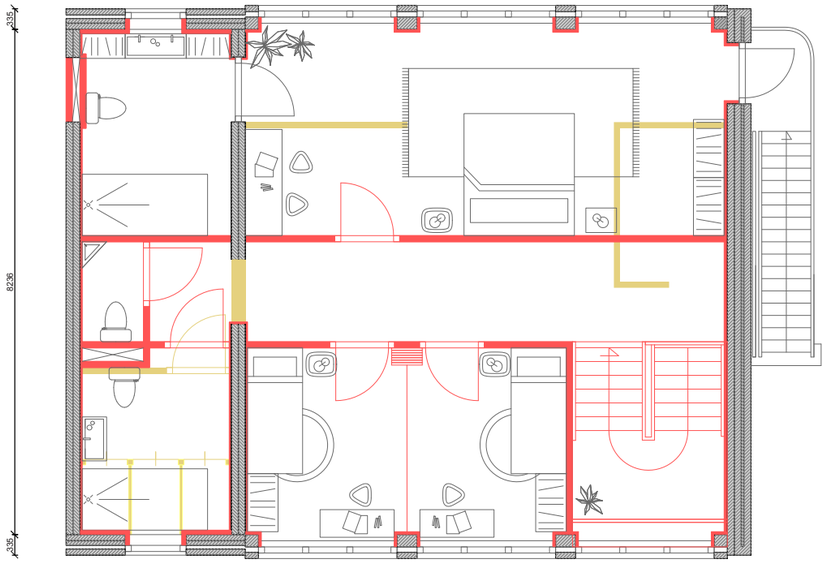
Old and new

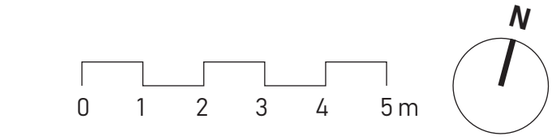


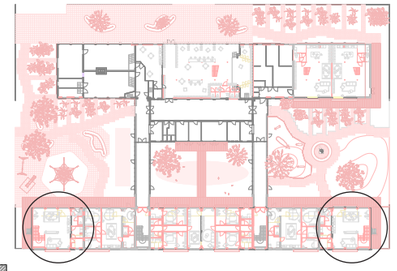


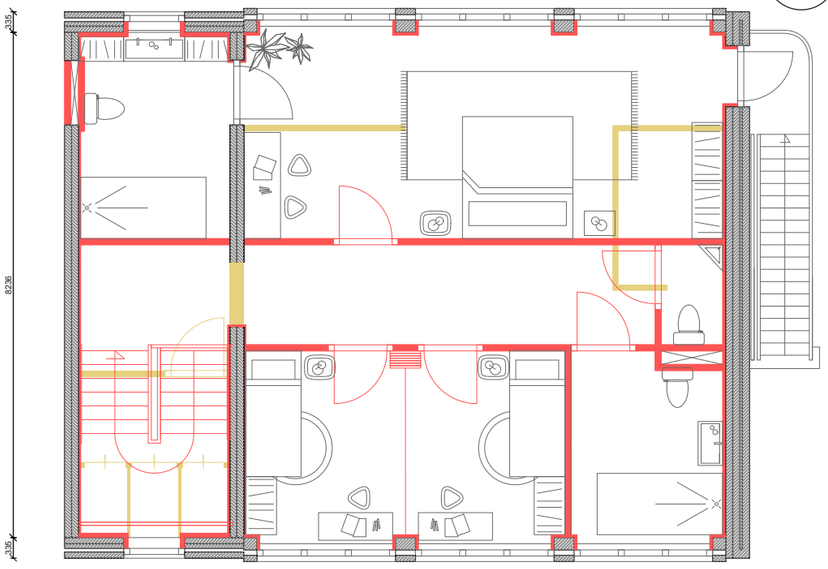
7.9 Maisonettes Family

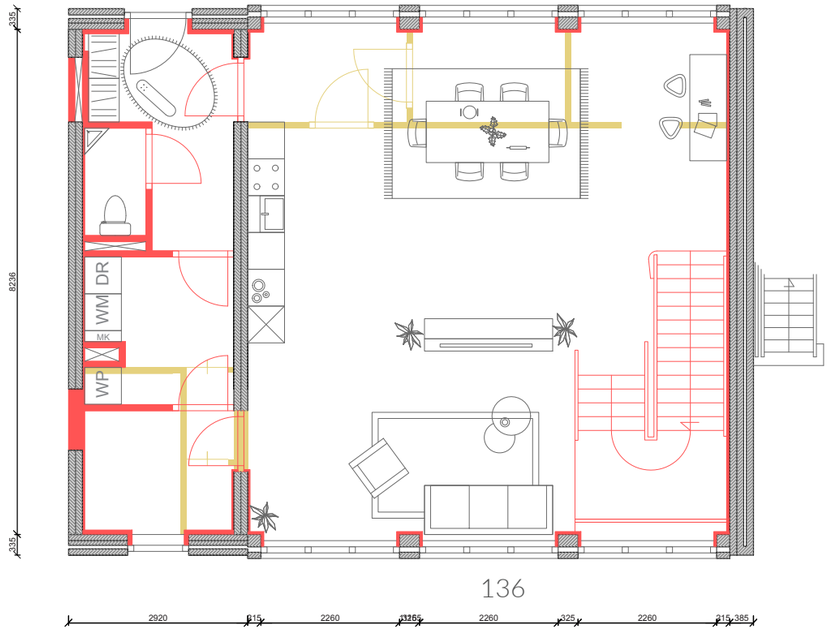
Type 1 and 2



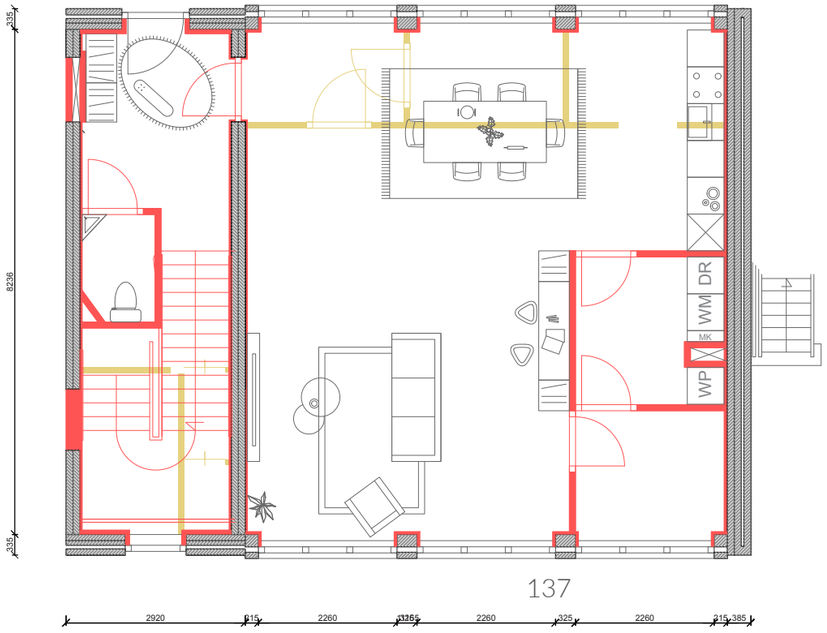








136



137

Total volumes per “fabric” layer

total volume old school = 139 m3

Add maisonette 1 **h= m**		**Remove maisonette 1** **h= m**
Interior		**Interior**
Walls	13,6 m3	8,1 m3
Insulation	**Thermal insulation:** walls = 3,46 + 3,83 m3 = 7,29 m3 floor = 7,20 m3 roof = 16,2 m3 **Acoustic:** walls = 3,4 m3	N/A
Floors	Magnesite flooring: 8,4 m3	**remove floor for new stairwells:** 0,94 m2
Ceiling	N/A	remove ceiling: 1,62 m3
Doors	9 doors = 1,27 m3	3 doors = 0,43 m3
Stairs	1 staircase = 1,1 m3	N/A
Exterior		**Exterior**
Windows	15 wooden frame window with HR+++ glass = 2,88 m3 + 0,53 m3 = 3,41 m3	15 windows wooden frames and single glazing = 2,88 m3
Total	**61,7 m3**	**14,2 m3**

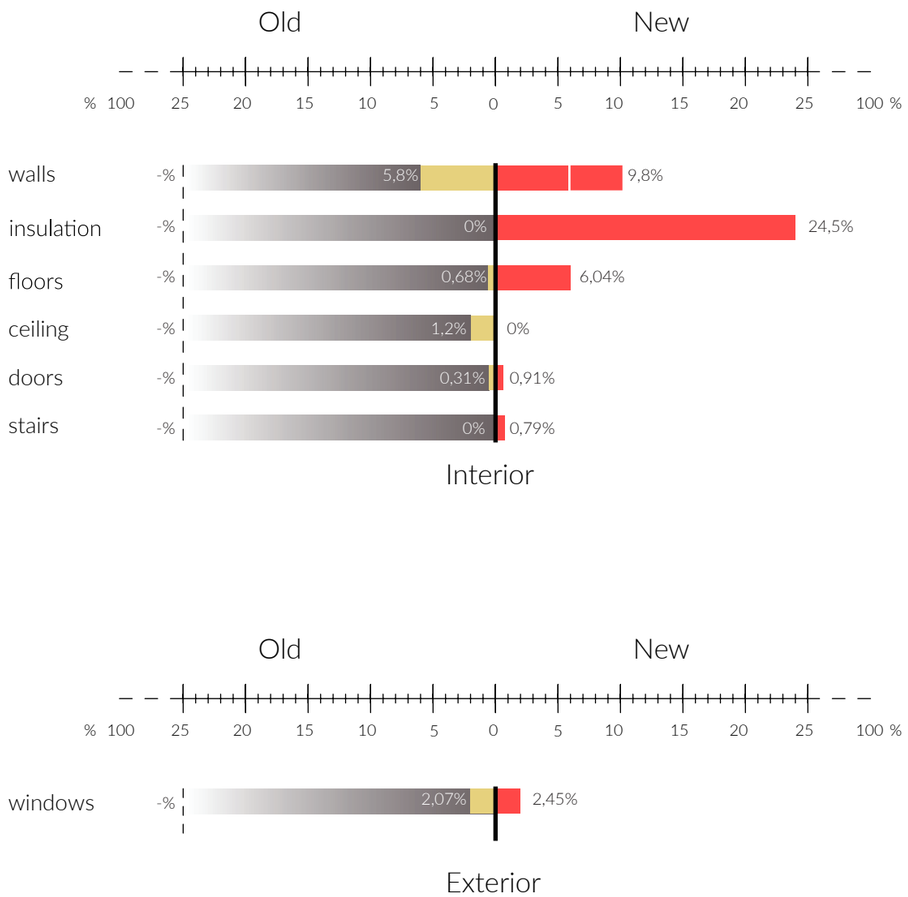
Add maisonette 1 **h= m**		**Remove maisonette 1** **h= m**
Interior		**Interior**
Walls	13,7 m3	7,58 m3
Insulation	**Thermal insulation:** walls = 7,20 m3 floor = 7,20 m3 roof = 16,2 m3 **Acoustic:** walls = 4,0 m3	N/A
Floors	Magnesite flooring: 8,4 m3	**remove floor for new stairwells:** 1,05 m2
Ceiling	N/A	remove ceiling: 1,57 m3
Doors	9 doors = 1,27 m3	3 doors = 0,43 m3
Stairs	1 staircase = 0,99 m3	N/A
Exterior		**Exterior**
Windows	15 wooden frame window with HR+++ glass = 2,88 m3 + 0,53 m3 = 3,41 m3	15 windows wooden frames and single glazing = 2,88 m3
Total	**62,2 m3**	**13,7 m3**

MAISONETTES

Type 1

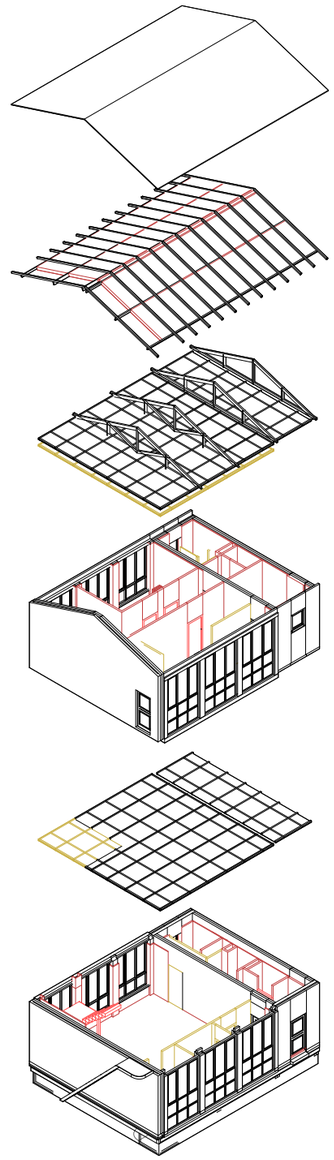
Kept
Removed
Added

Material volume percentages



Livability

	livability	notes
size outdoor space	★★★★★	*courtyard, outside buffer*
added daylight		*n/a*
connection with garden	★★★★★	*garden access, orientation*
south facade	★★★★★	*living room/stairs facing south*
semi private/ bufferzones	★★★★★	*hallways and outside path*
connection with residents	★★★	*no shared corridor, shared garden*
accessibility	★★★★	*from garden*

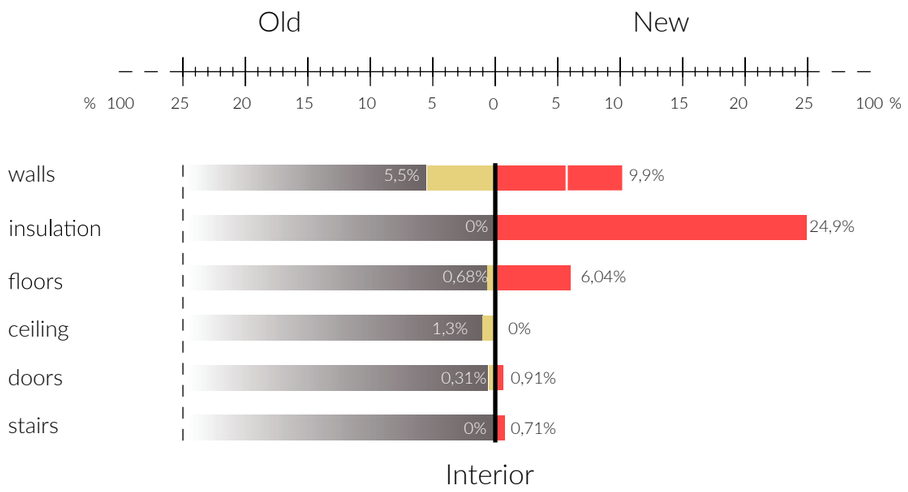


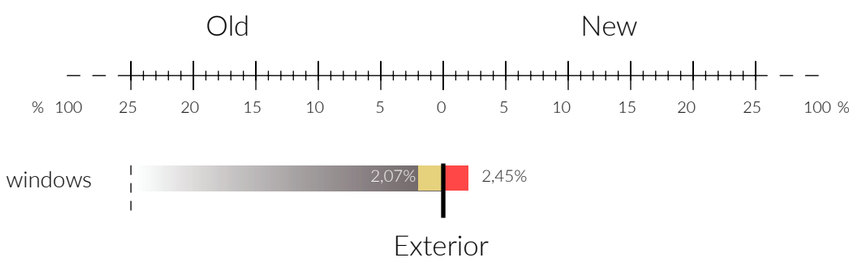
MAISONETTES

Type 2

Kept
Removed
Added

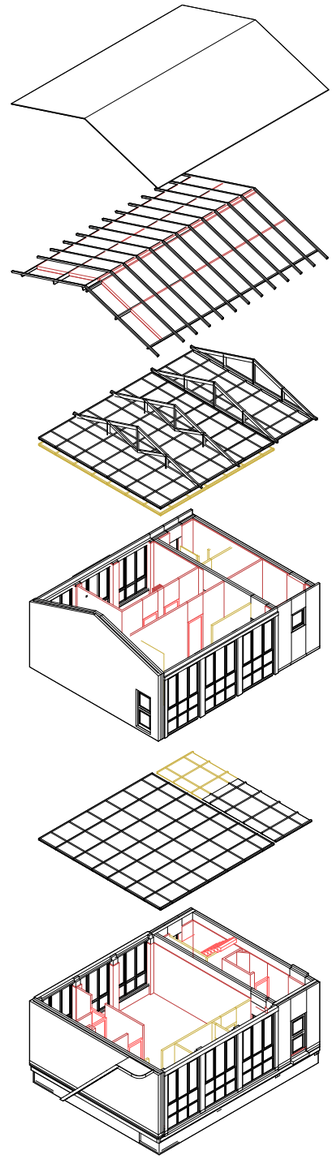
Material volume percentages





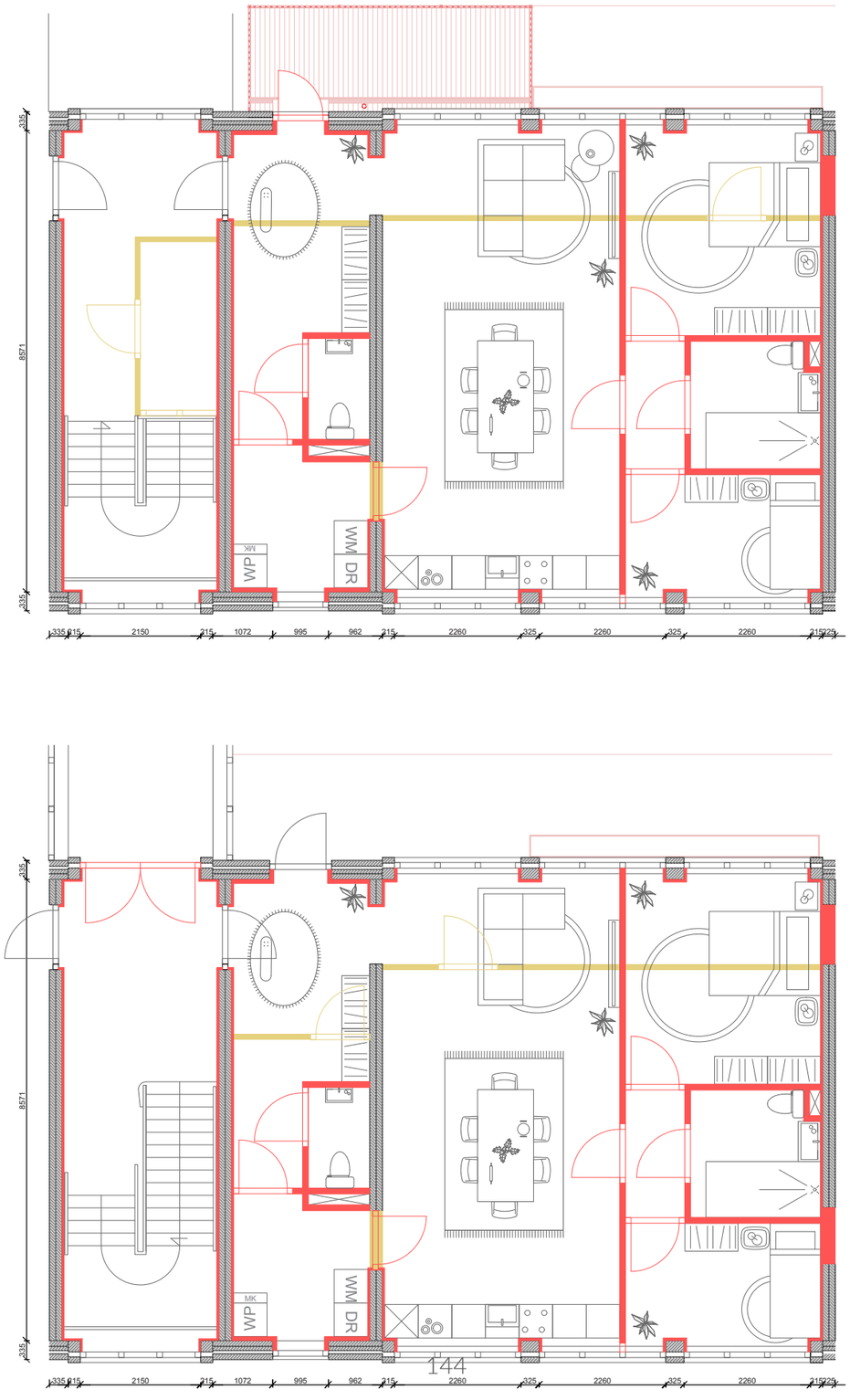
Livability

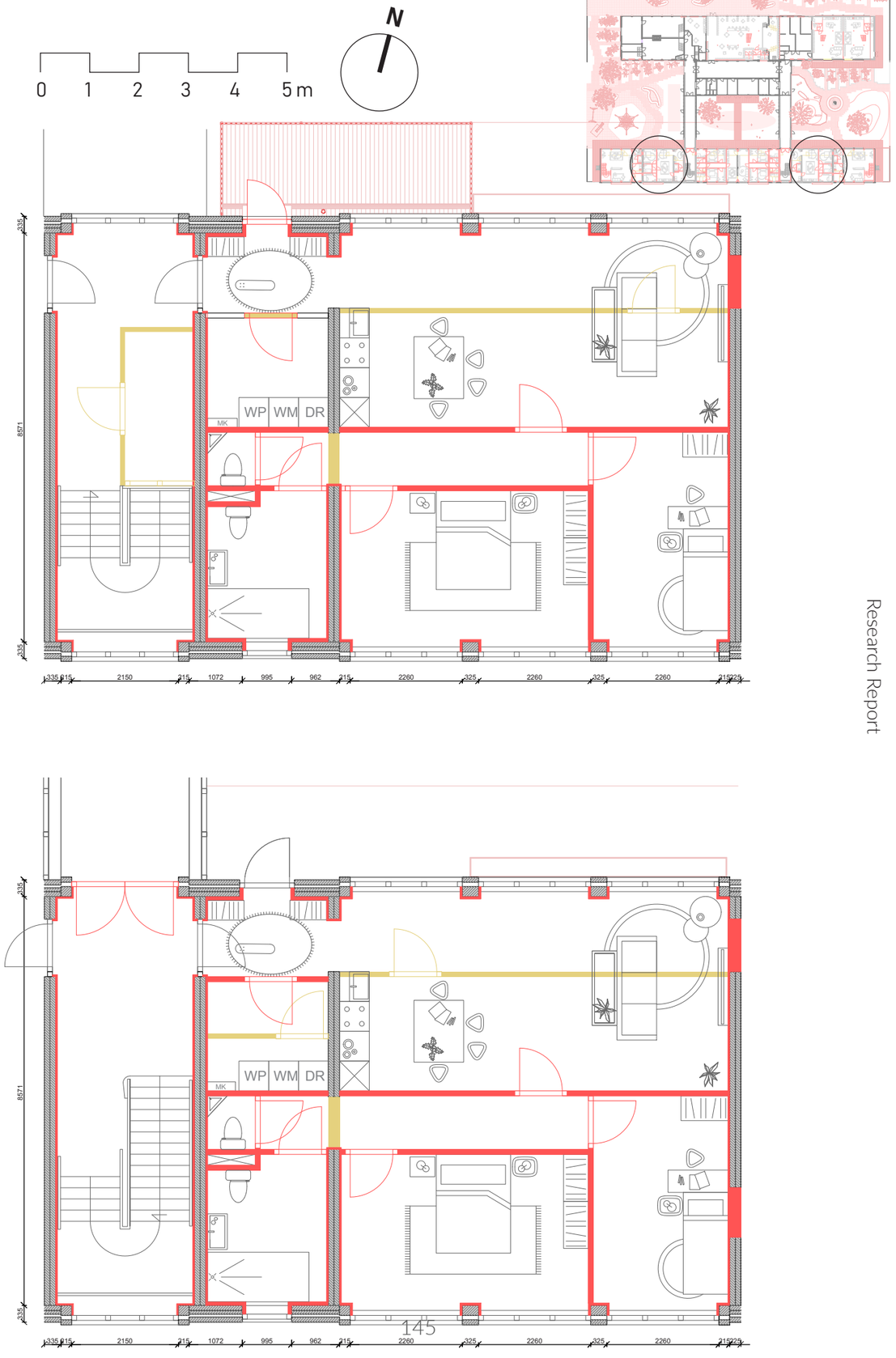
	livability	notes
size outdoor space	★★★★★	*courtyard, outside buffer*
added daylight	★★	*extra walls, no light from both sides*
connection with garden	★★★★★	*garden access, orientation*
south facade	★★★★	*living room not facing south*
semi private/ bufferzones	★★★	*stairs dark, outside path*
connection with residents	★★★	*no shared corridor, shared garden*
accessibility	★★★★	*from garden*



7.10 Apartments Family

Type 1 and 2





Total volumes per “fabric” layer

total volume old school = 153 m3

Add apartment type 1 **h= m**		**Remove apartment type 1** **h= m**
Interior		**Interior**
Walls	13,8 m3	8,37 m3
Insulation	**Thermal insulation:** walls = 4,70 m3 floor = 8,9 m3 roof = 21,1 m3 **Acoustic:** walls = 6,61 m3 floor = 10,4 m3	N/A
Floors	Magnesite flooring: 10,7 m3	N/A
Ceiling	N/A	remove ceiling: 1,41 m3
Doors	14 doors = 2,02 m3	4 doors = 0,58 m3
Exterior		**Exterior**
Walls	N/A	0,50 m3
Windows	19 wooden frame window with HR+++ glass = 2,97 m3 + 0,516 + 0,0141 + 0,1264 m3 = 3,63 m3	19 windows wooden frames and single glazing = 2,97 m3
Doors	1 door = 0,14 m3	N/A
Balcony	**Balcony structure and floor:** 0,825 m3 **Railing**: 0,055 m3	N/A
Total	**91,85 m3 (without balcony)**	**23,7 m3**

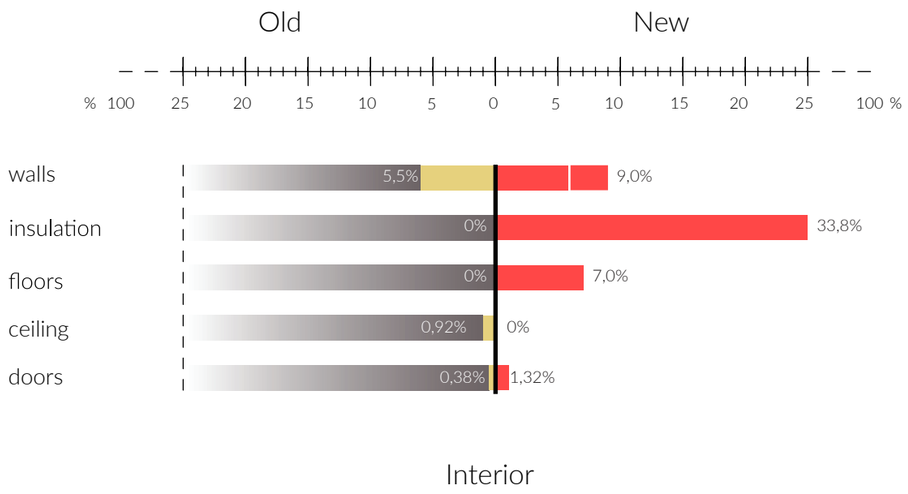
Add apartment type 1 **h= m**		**Remove apartment type 1** **h= m**
Interior		**Interior**
Walls	14,2 m3	6,34 m3
Insulation	**Thermal insulation:** walls = 4,70 m3 floor = 8,9 m3 roof = 21,1 m3 **Acoustic:** walls = 7,41 m3 floor = 10,4 m3	N/A
Floors	Magnesite flooring: 5,95+ 5,56 = 11,5 m3	N/A
Ceiling	N/A	remove ceiling: 1,41 m3
Doors	12 doors = 1,73 m3	4 doors = 0,58 m3
Exterior		**Exterior**
Walls	N/A	0,50 m3
Windows	19 wooden frame window with HR+++ glass = 2,97 m3 + 0,516 + 0,0141 + 0,1264 m3 = 3,63 m3	19 windows wooden frames and single glazing = 2,97 m3
Doors	1 door = 0,14 m3	N/A
Balcony	**Balcony structure and floor:** 0,825 m3 **Railing**: 0,055 m3	N/A
Total	**93,56 m3 (without balcony)**	**21,7 m3**

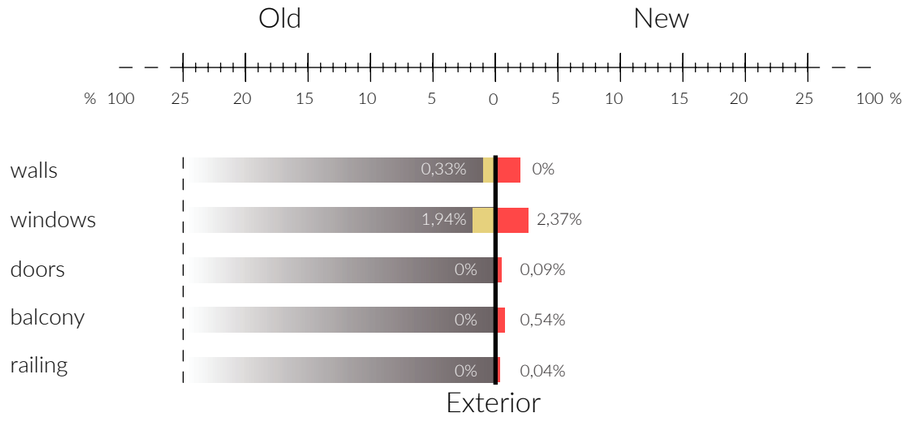
APARTMENTS

Type 1

Kept
Removed
Added

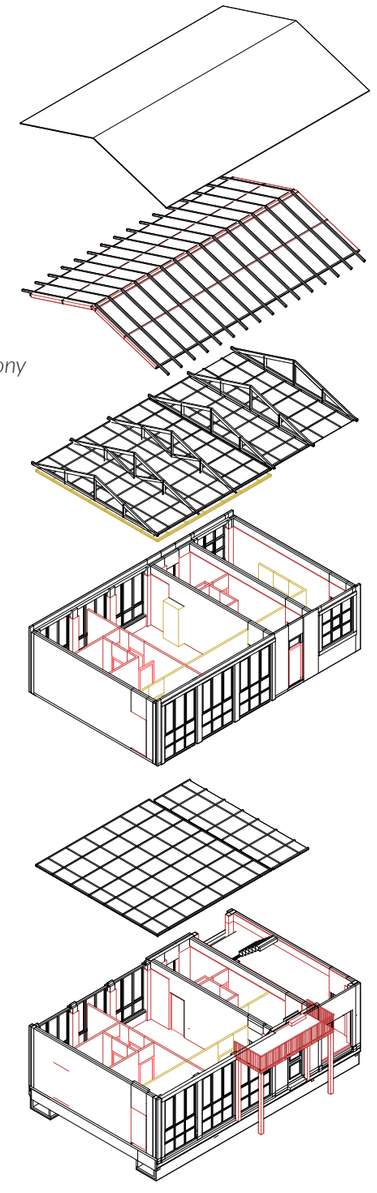
Material volume percentages





Livability

	livability	notes
size outdoor space	★★★★	*courtyard, outside buffer, or balcony*
added daylight		*n/a*
connection with garden	★★★★★	*garden access, orientation*
south facade	★★★★★	*living room facing south*
semi private/ bufferzones	★★★★★	*hallways between living spaces*
connection with residents	★★★★	*shared corridor/garden*
accessibility	★★★★★	*from corridor and/or garden*

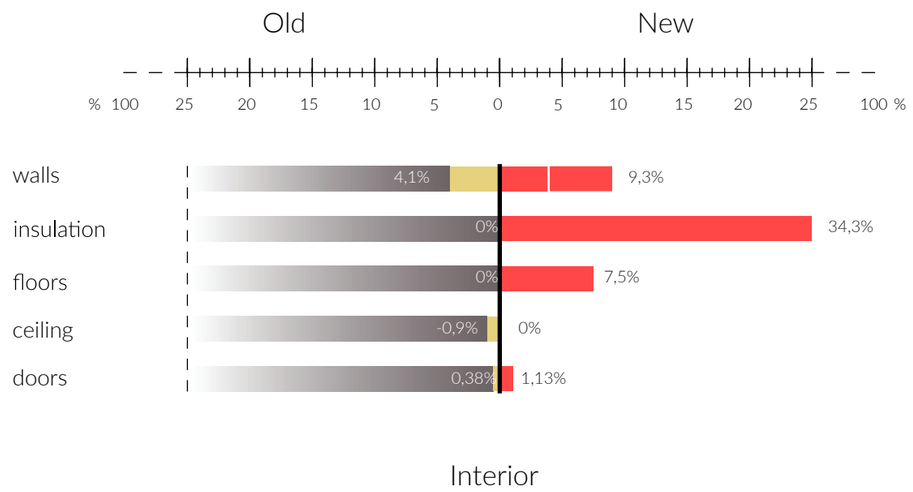


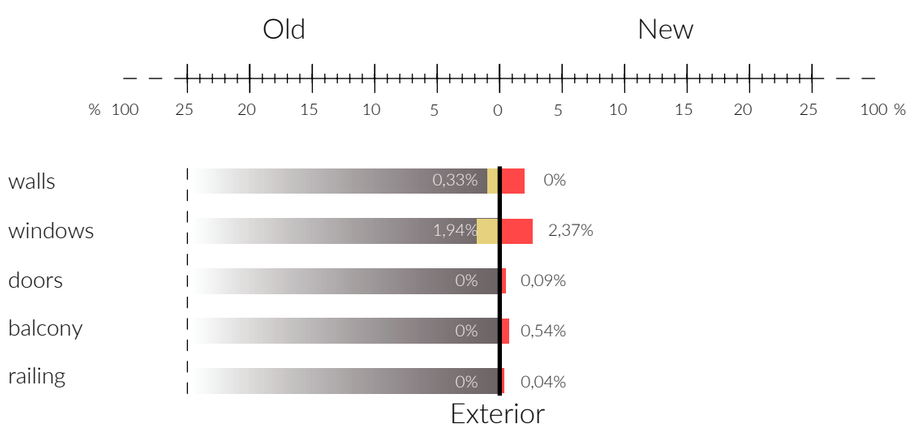
APARTMENTS

Type 2

Kept
Removed
Added

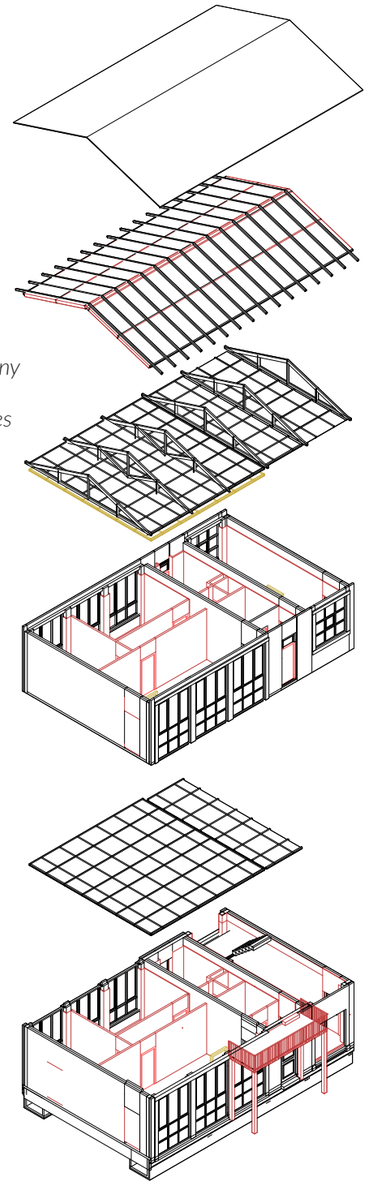
Material volume percentages





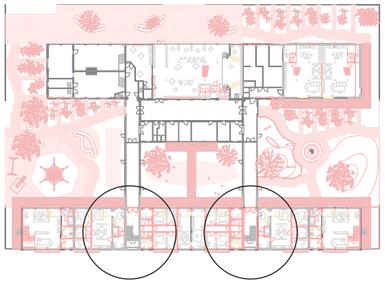
Livability

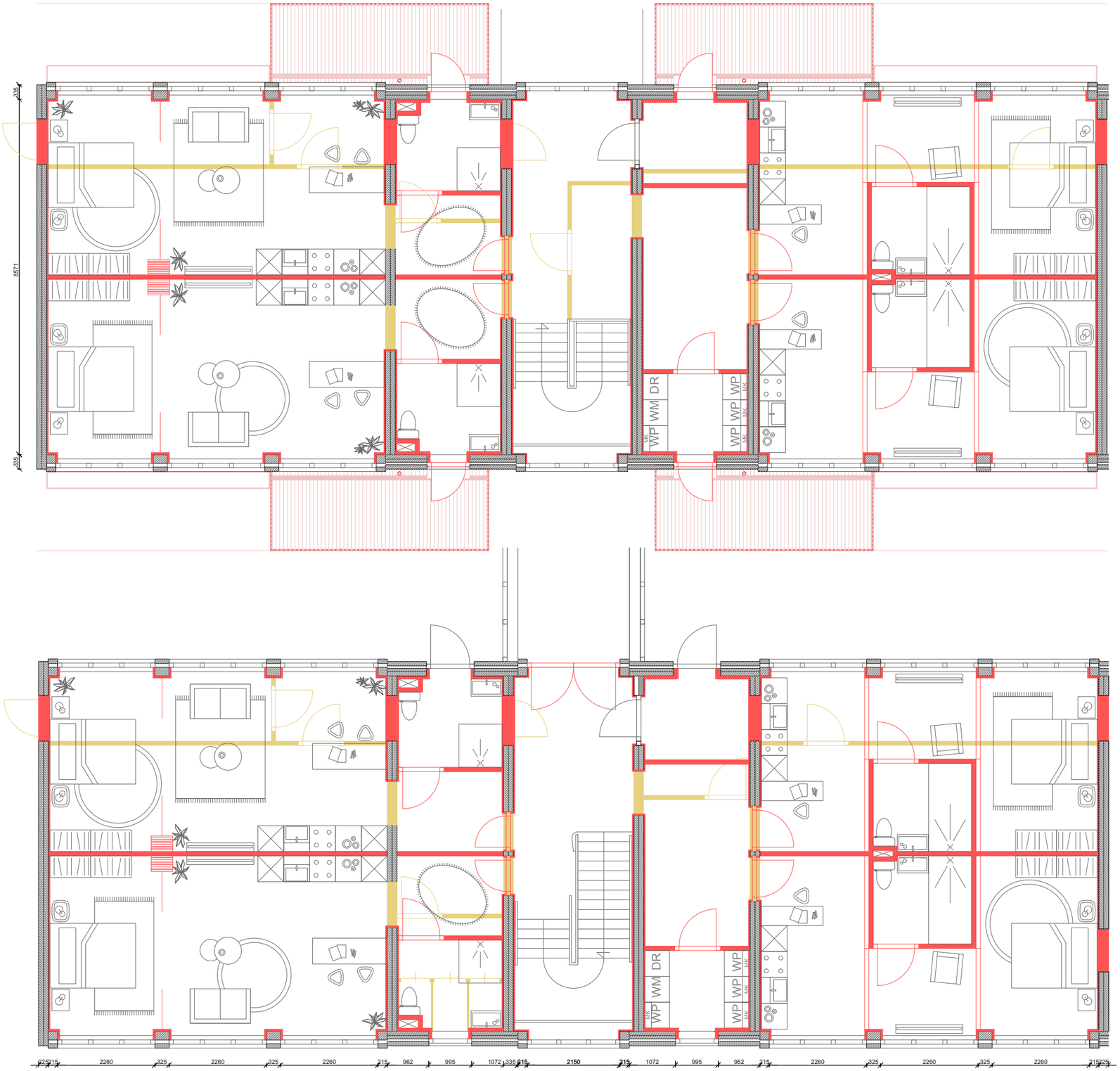
	livability	notes
size outdoor space	★★★★	*courtyard, outside buffer, or balcony*
added daylight	★★	*extra walls, no light from both sides*
connection with garden	★★★★★	*garden access, orientation*
south facade	★★	*living room not facing south*
semi private/ bufferzones	★★★	*hallways between living spaces*
connection with residents	★★★★	*shared corridor/ garden*
accessibility	★★★★★	*from corridor and/or garden*

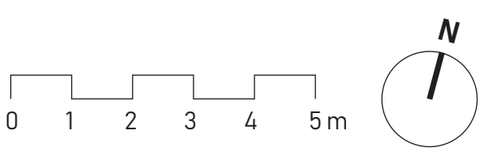


7.11 Studio Students/Elderly

Type 1

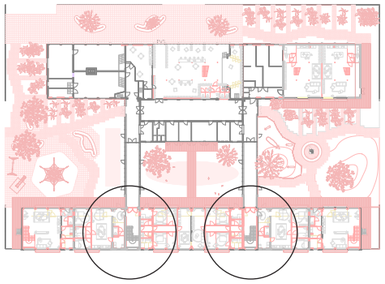






STUDIO Students/Elderly

Type 2

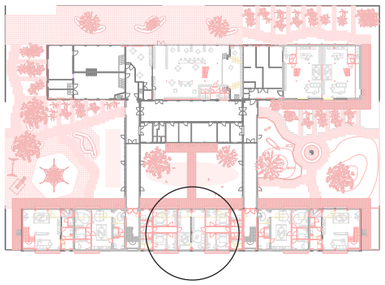


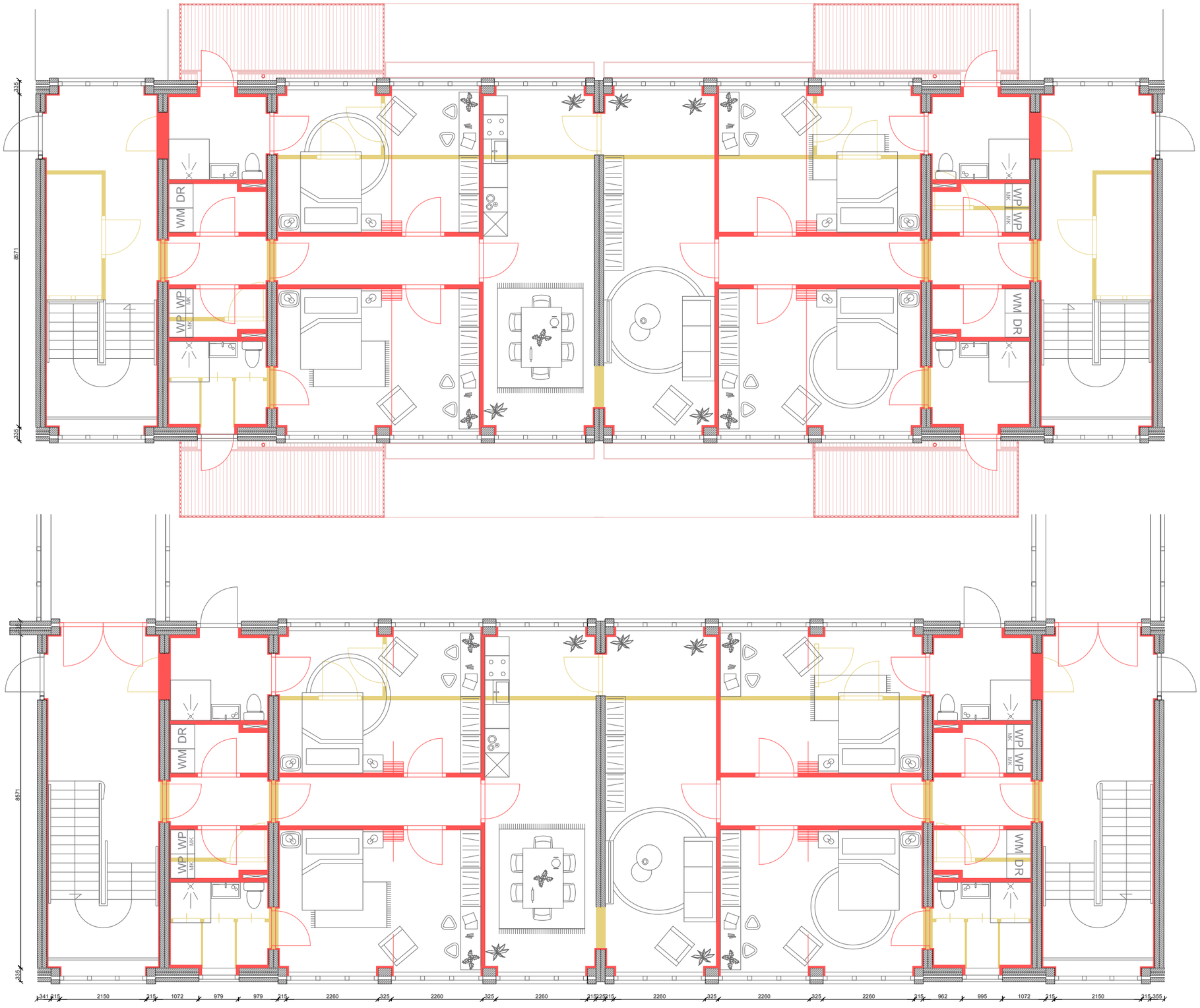
0 1 2 3 4 5 m

N

STUDIO Students/Elderly

Type 3





0 1 2 3 4 5 m

N

Total volumes per “fabric” layer

total volume old school = 237 m3

Add studio type 1 **h= m**		**Remove studio type 1** **h= m**
Interior		**Interior**
Walls	28,9 m3	20,1 m3
Insulation	**Thermal insulation:** walls = 7,13 m3 floor = 16,0 m3 roof = 37,3 m3 **Acoustic:** walls = 15,2 m3 floor = 20,9 m3	N/A
Floors	Magnesite flooring: 19,5 m3	N/A
Ceiling	N/A	remove ceiling: 2,83 m3
Doors	18 doors = 2,54 m3	14 doors = 1,98 m3
Exterior		**Exterior**
Windows	34 wooden frame window with HR+++ glass = 6,68 + 1,19 m3 =7,87	34 windows wooden frames and single glazing = 5,76 m3 + 0,6312 + 0,29019 m3 = 6,68 m3
Option for two balconies		
Walls	N/A	0,50 m3 x 2 =1,0
Doors	2 doors = 0,14 m3 x 2 = 0,28	N/A
Balcony	**Balcony structure and floor:** 0,825 m3 x 2 = 1,65 m3 **Railing**: 0,055 m3 = 0,11 m3	N/A
Total	**91,85 m3 (without balcony)**	**23,7 m3**

Add studio type 1 **h= m**		**Remove studio type 1** **h= m**
Interior		**Interior**
Walls	39,5 m3	13,5 m3
Insulation	**Thermal insulation:** walls = 7,13 m3 floor = 15,9 m3 roof = 37,3 m3 **Acoustic:** walls = 15,7 m3 floor = 20,9 m3	N/A
Floors	Magnesite flooring: 21,1 m3	N/A
Ceiling	N/A	remove ceiling: 2,83 m3
Doors	19 doors = 2,74 m3	14 doors = 1,98 m3
Exterior		**Exterior**
Windows	34 wooden frame window with HR+++ glass = 6,68 + 1,19 m3 =7,87	34 windows wooden frames and single glazing = 5,76 m3 + 0,6312 + 0,29019 m3 = 6,68 m3
Option for two balconies		
Walls	N/A	0,50 m3 x 2 =1,0
Doors	2 doors = 0,14 m3 x 2 = 0,28	N/A
Balcony	**Balcony structure and floor:** 0,825 m3 x 2 = 1,65 m3 **Railing**: 0,055 m3 = 0,11 m3	N/A
Total	**91,85 m3 (without balcony)**	**23,7 m3**

Total volumes per “fabric” layer

total volume old school = 285 m3

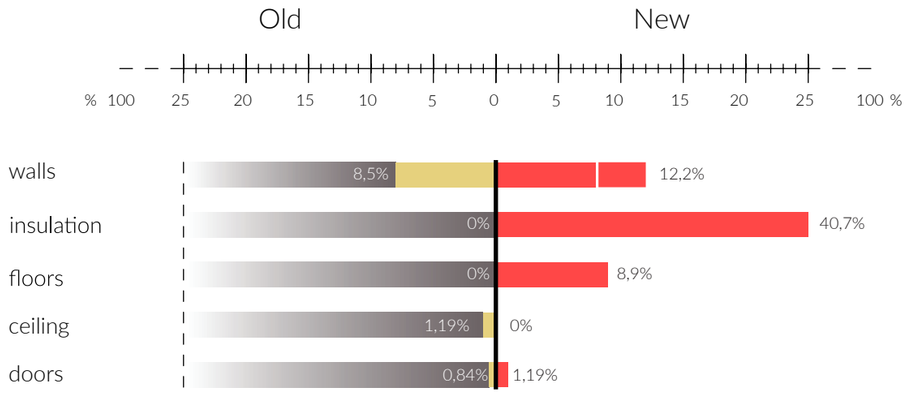
Add studio type 3 **h= m**		**Remove studio type 3** **h= m**
Interior		**Interior**
Walls	35,7 m3	24,4 m3
Insulation	**Thermal insulation:** walls = 9,90 m3 floor = 17,9 m3 roof = 41,8 m3 **Acoustic:** walls = 14,8 m3 floor = 20,9 m3	N/A
Floors	Magnesite flooring: 21,5 m3	N/A
Ceiling	N/A	remove ceiling: 2,83 m3
Doors	36 doors = 5,2 m3	20 doors = 2,85 m3
Exterior		**Exterior**
Windows	34 wooden frame window with HR+++ glass =7,33 + 1,32= 8,65	34 windows wooden frames and single glazing = 7,33 m3
Option for four balconies		
Walls	N/A	0,50 m3 x 4 = 2,0 m3
Doors	4 doors = 0,14 m3 x 4 = 0,56 m3	N/A
Balcony	**Balcony structure and floor:** 0,825 m3 x 4 = 3,30 m3 **Railing**: 0,055 m3 x 4 = 0,22 m3	N/A
Total	**91,85 m3 (without balcony)**	**23,7 m3**

STUDIO

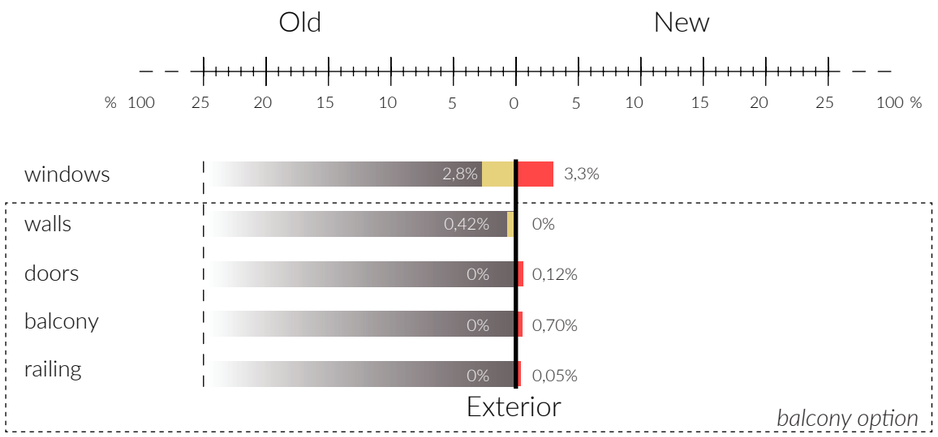
Type 1

Kept
Removed
Added

Material volume percentages



Interior

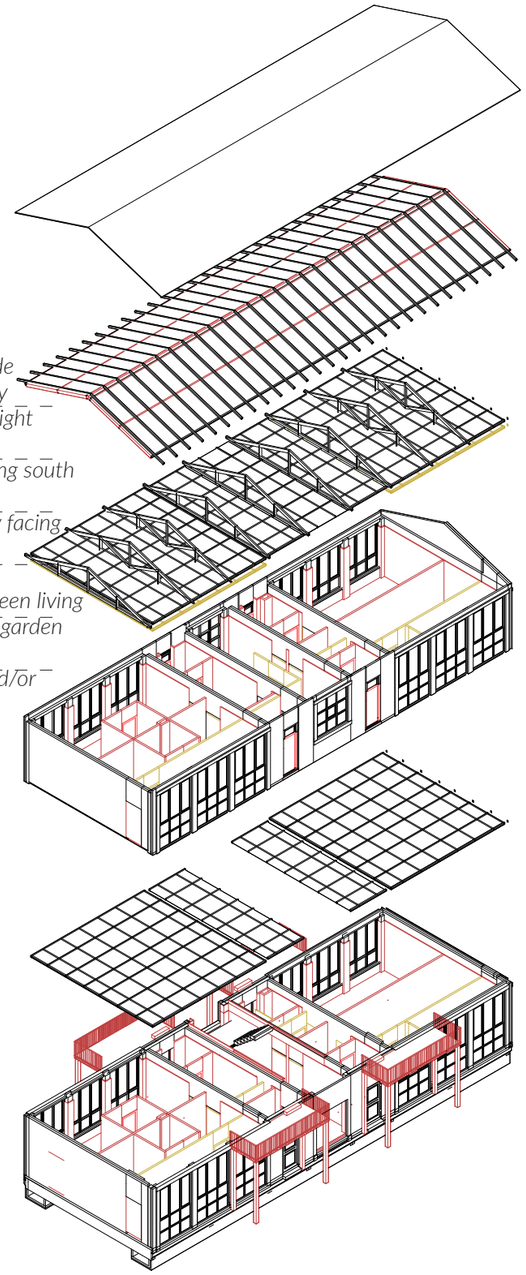


Exterior

balcony option

Livability

	livability	notes
size outdoor space	★★★	*courtyard, outside buffer, or balcony*
added daylight	★★★	*extra walls, less light from both sides*
connection with garden	★★	*two studio's facing south*
south facade	★★	*two studio's only facing north*
semi private/ bufferzones	★★★★★	*flexible walls*
connection with residents	★★★★	*little buffer between living shared corridor/ garden*
accessibility	★★★★	*from corridor and/or garden*

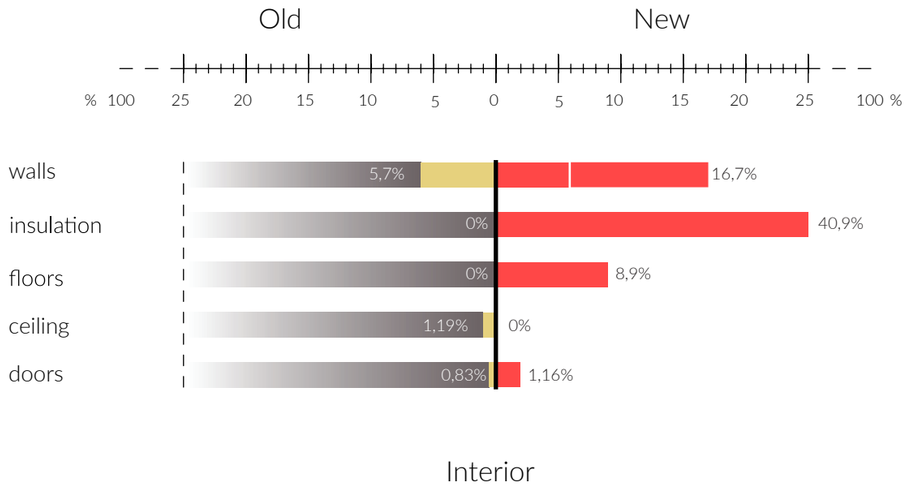


STUDIO

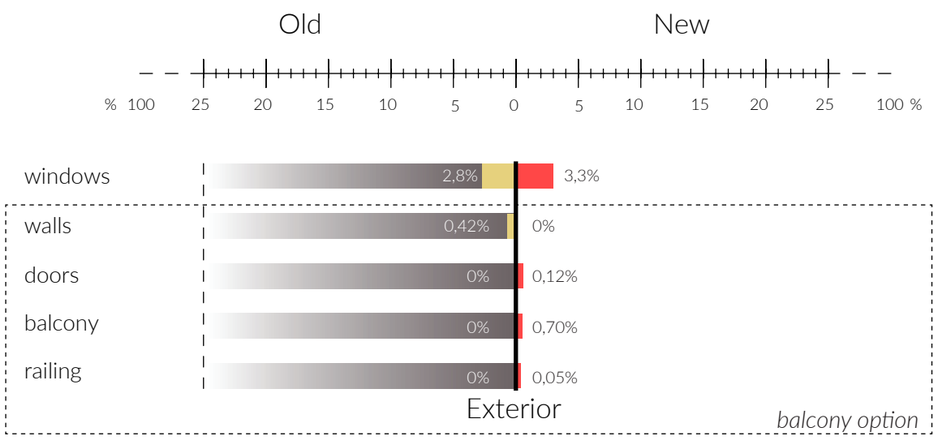
Type 2

Kept
Removed
Added

Material volume percentages



Interior

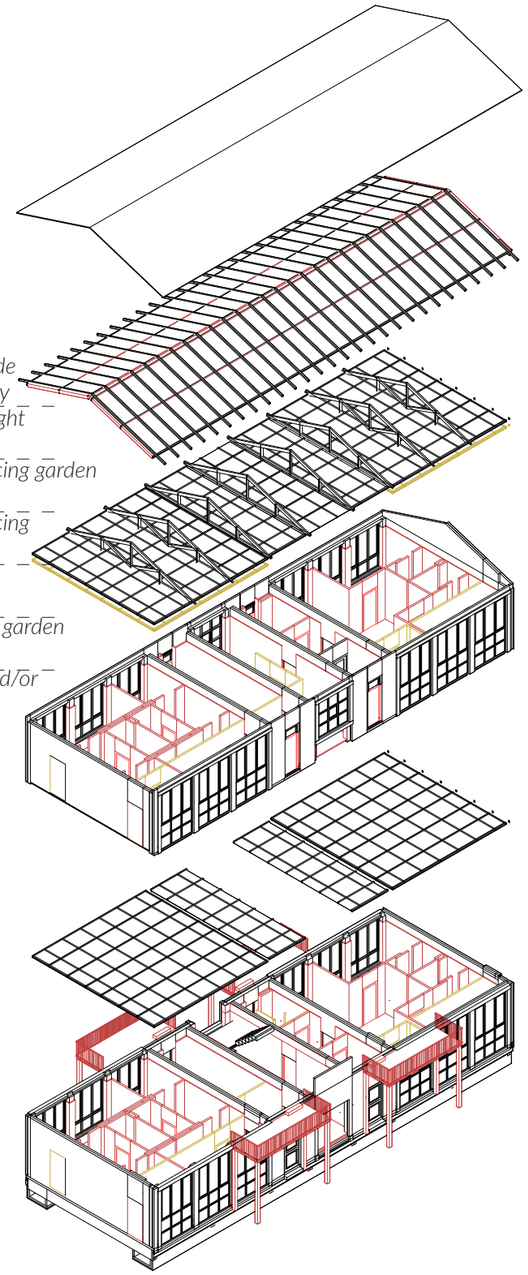


Exterior

balcony option

Livability

	livability	notes
size outdoor space	★★★★	*courtyard, outside buffer, or balcony*
added daylight	★	*extra walls, no light from both sides*
connection with garden	★★★★★	*shared space facing garden*
south facade	★★★★★	*shared space facing south*
semi private/ bufferzones	★★★	*flexible walls*
connection with residents	★★★★	*shared corridor/ garden*
accessibility	★★★★	*from corridor and/or garden*

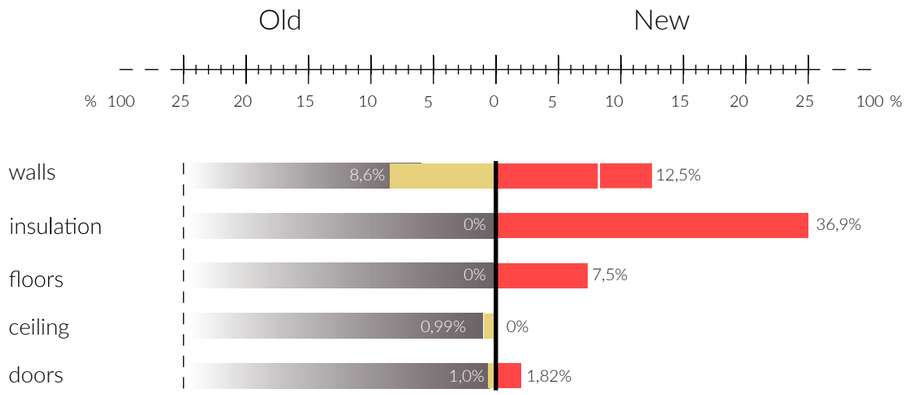


STUDIO

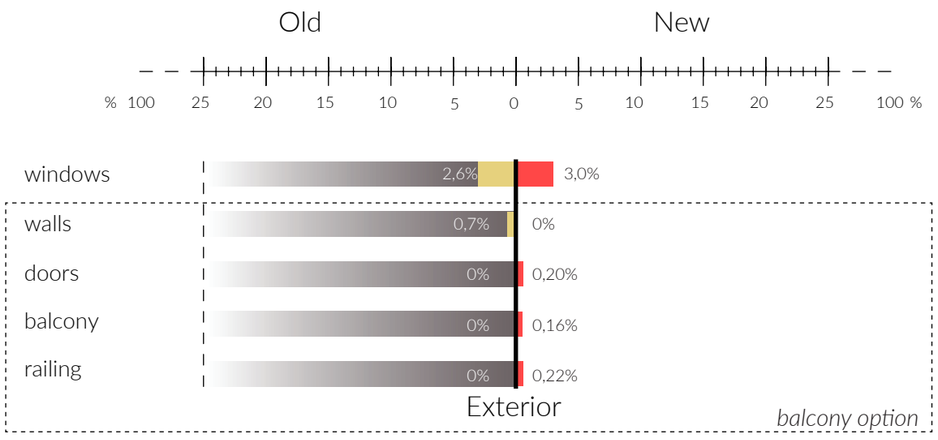
Type 3

Kept
Removed
Added

Material volume percentages



Interior

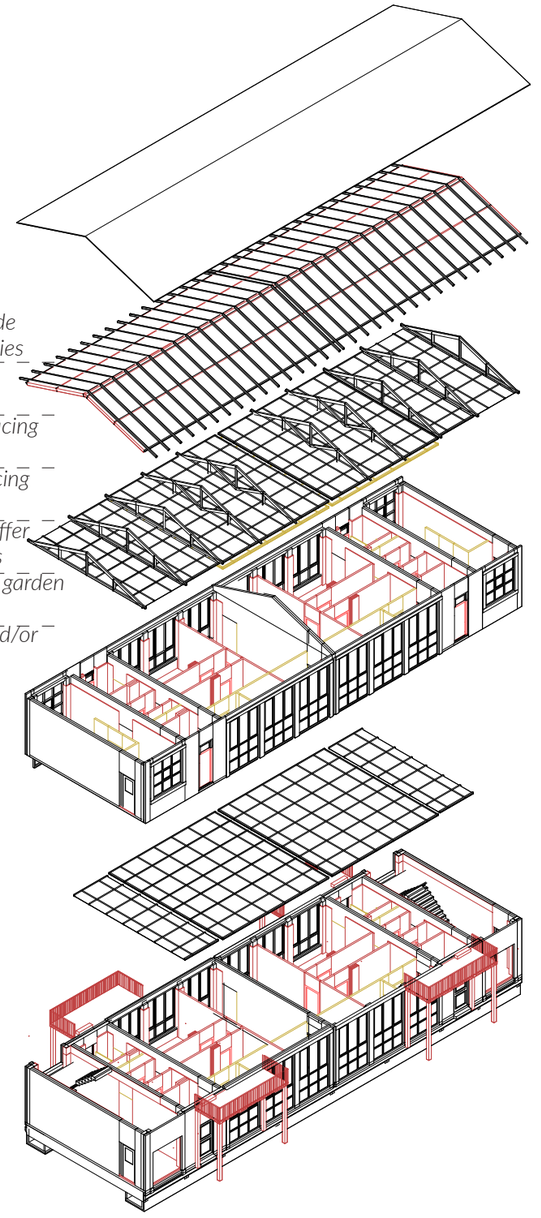


Exterior

balcony option

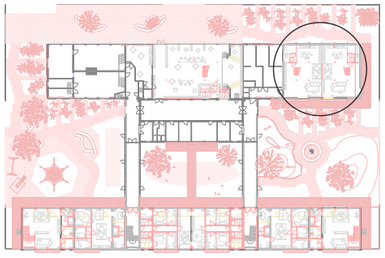
Livability

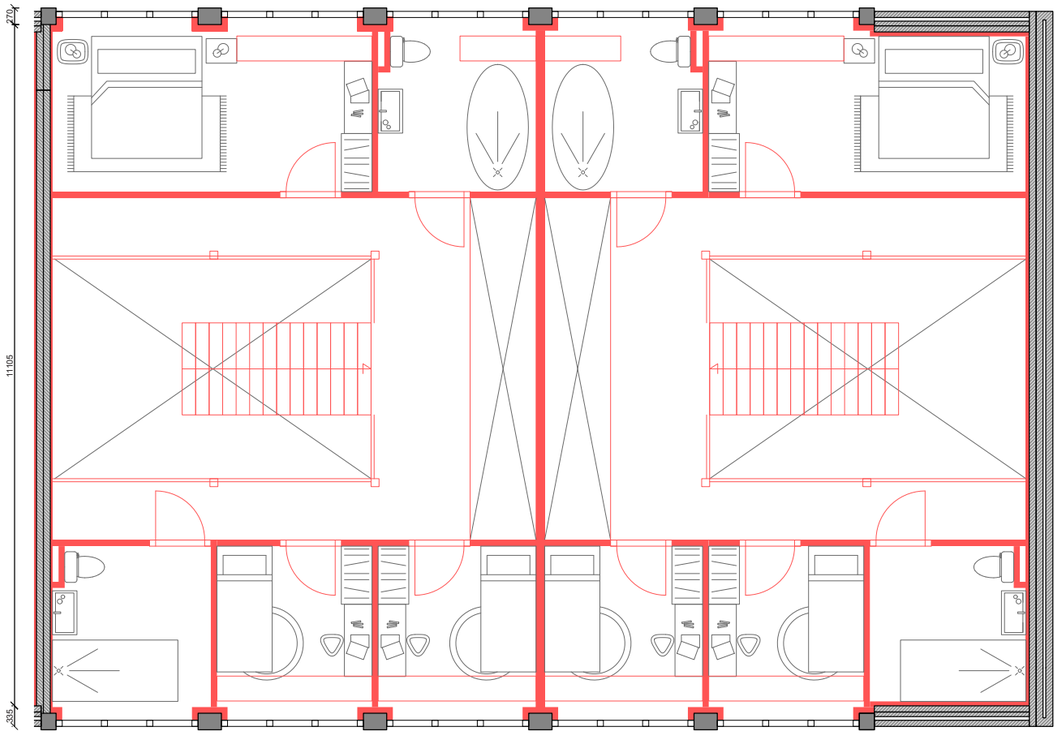
	livability	notes
size outdoor space	★★★★	*courtyard, outside buffer, or balconies*
added daylight		*n/a*
connection with garden	★★★★	*shared spaces facing garden*
south facade	★★★★	*shared space facing south*
semi private/ bufferzones	★★★★	*flexible walls, buffer between studio's*
connection with residents	★★★★★	*shared corridor/ garden / living spaces*
accessibility	★★★★★	*from corridor and/or garden*

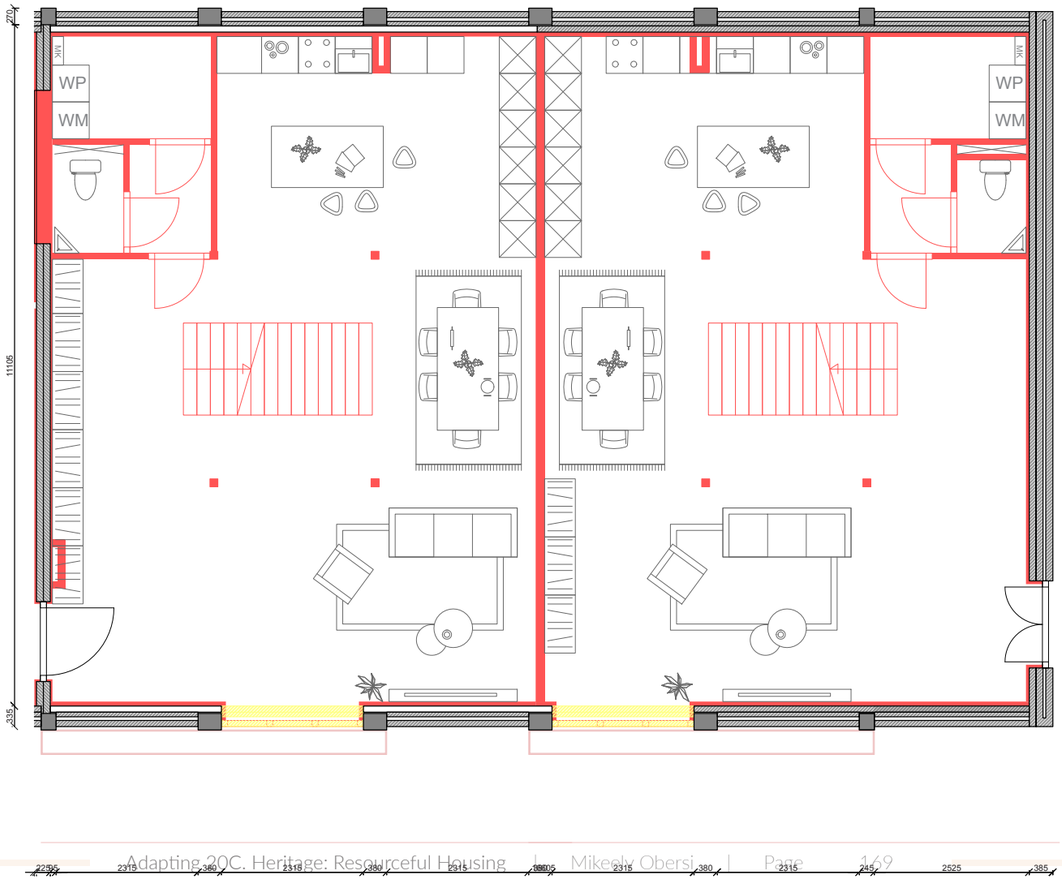


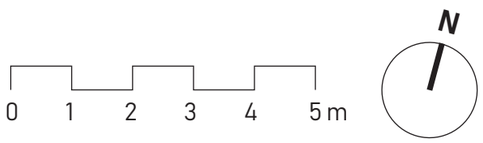
7.12 Entresol

Type 1



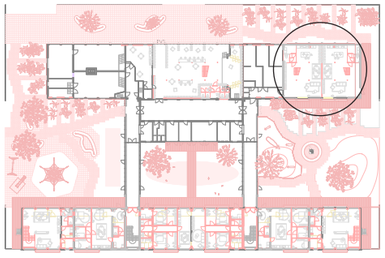


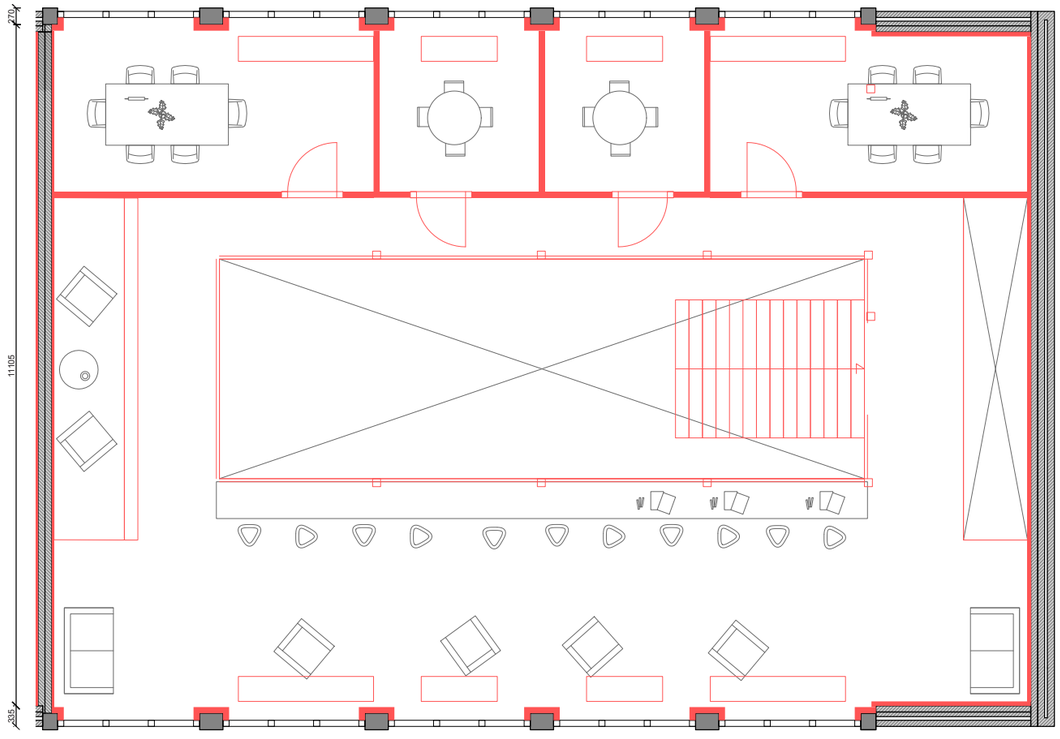


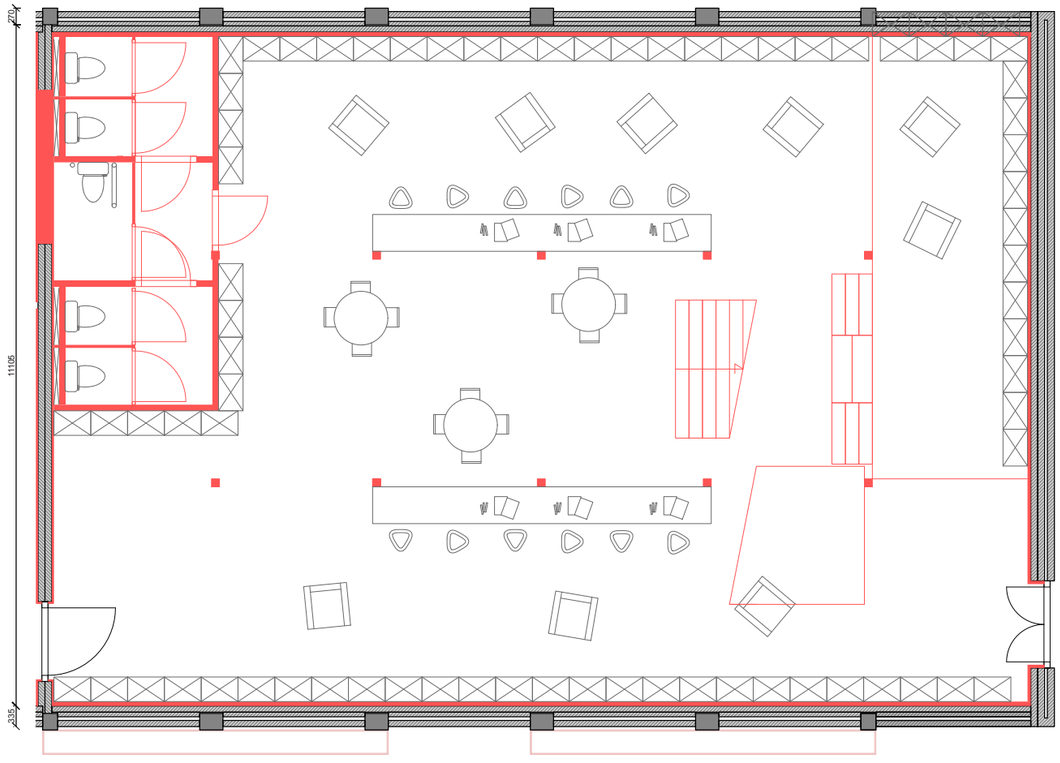


Entresol

Type 2







0 1 2 3 4 5 m

N

Total volumes per “fabric” layer

total volume old school = 122 m3

Add entresol **h= m**		**Remove entresol** **h= m**
Interior		**Interior**
Walls	28,3 m3	N/A
Insulation	**Thermal insulation:** walls = 10,4 m3 floor = 14,1 m3 roof = 35,3 m3 **Acoustic:** walls = 4,18 m3	N/A
Floors	**Magnesite flooring:** 14,9 m3 **wooden floor structure:** 9,79 m3	N/A
Stairs	0,83 m3	N/A
Railing	0,65 m3	N/A
Doors	16 doors = 2,33 m3	N/A
Exterior		**Exterior**
Walls	1,10 m3	N/A
Windows	12 wooden frame window with HR+++ glass = 2,30 m3	10 windows wooden frames and single glazing = 1,70 m3
Total	**91,85 m3 (without balcony)**	**23,7 m3**

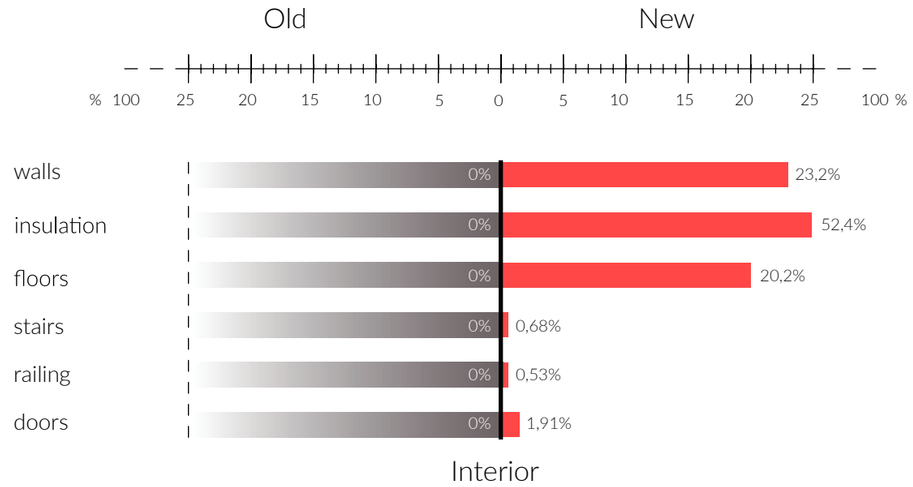
Add library **h= m**		**Remove library** **h= m**
Interior		**Interior**
Walls	12,1 m3	N/A
Insulation	**Thermal insulation:** walls = 10,8 m3 floor = 14,1 m3 roof = 35,3 m3 **Acoustic:** walls = 4,18 m3	N/A
Floors	**Magnesite flooring:** 20,8 m3 **wooden floor structure:** 10,4 m3	N/A
Stairs	0,62 m3	N/A
Railing	0,59 m3	N/A
Doors	8 doors = 1,10 m3	N/A
Exterior		**Exterior**
Windows	12 wooden frame window with HR+++ glass = 1,92 m3	10 windows wooden frames and single glazing = 1,70 m3 m3
Total	**91,85 m3 (without balcony)**	**23,7 m3**

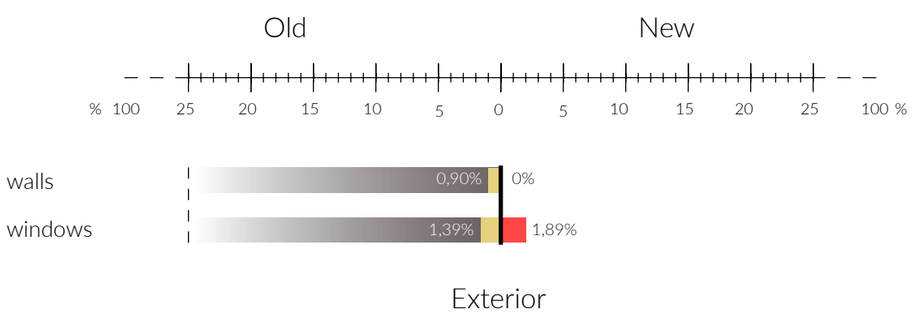
ENTRESOL

Type 1

Kept
Removed
Added

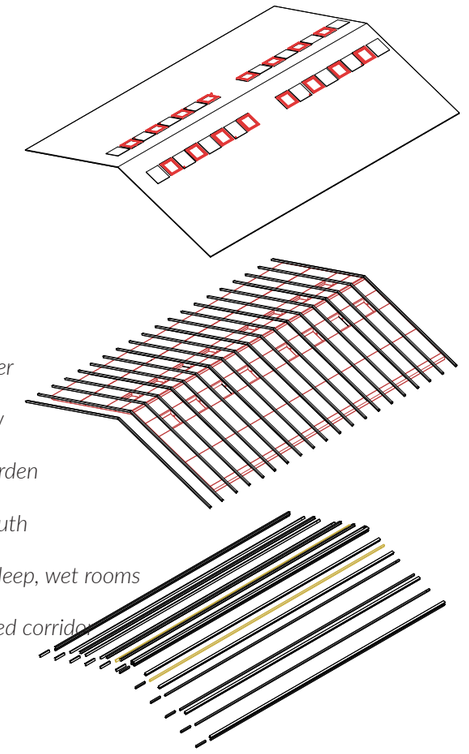
Material volume percentages

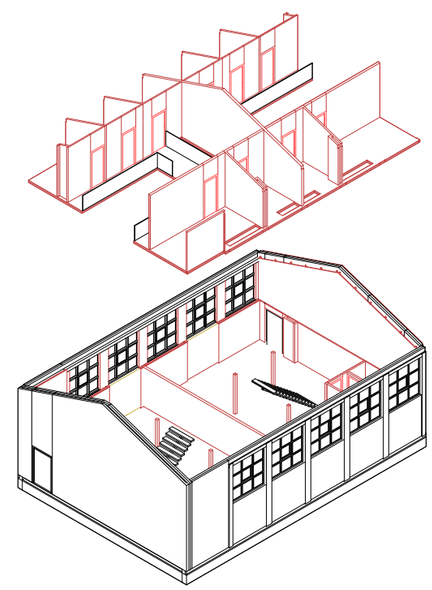




Livability

	livability	notes
size outdoor space	★★★	*courtyard, outside buffer*
added daylight	★★★★★	*sky lights, extra window*
connection with garden	★★★	*extra window facing garden*
south facade	★★★	*extra window facing south*
semi private/ bufferzones	★★★★★	*buffer between living, sleep, wet rooms*
connection with residents	★★	*shared garden, no shared corridor*
accessibility	★★★★	*from garden/corridor*



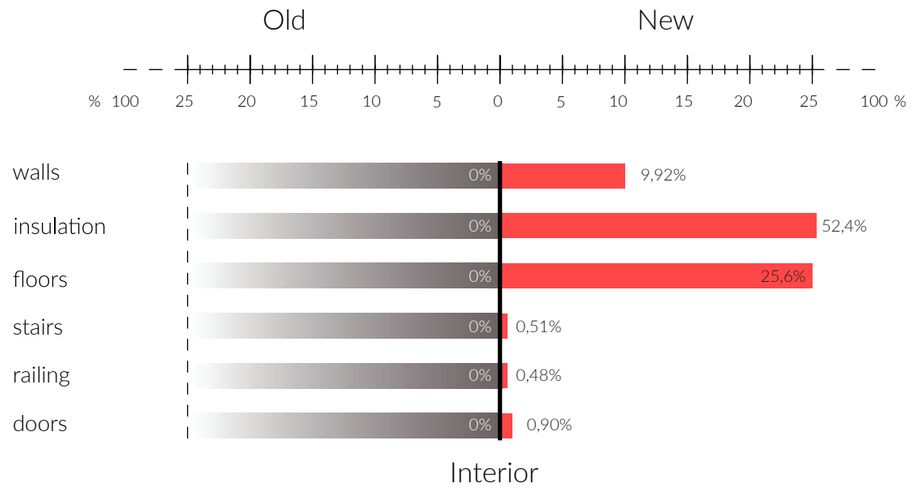


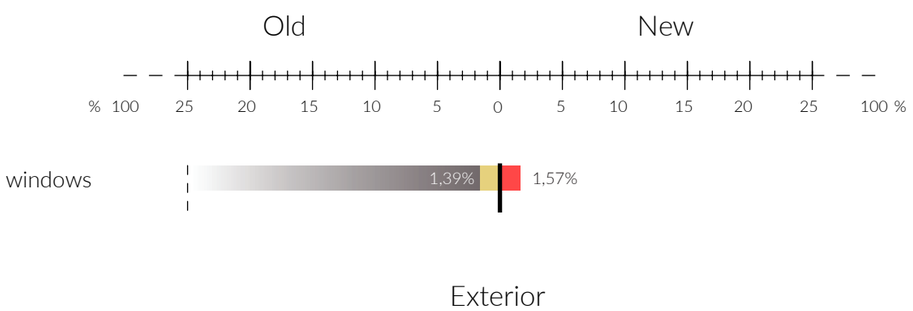
ENTRESOL

Type 2

Kept
Removed
Added

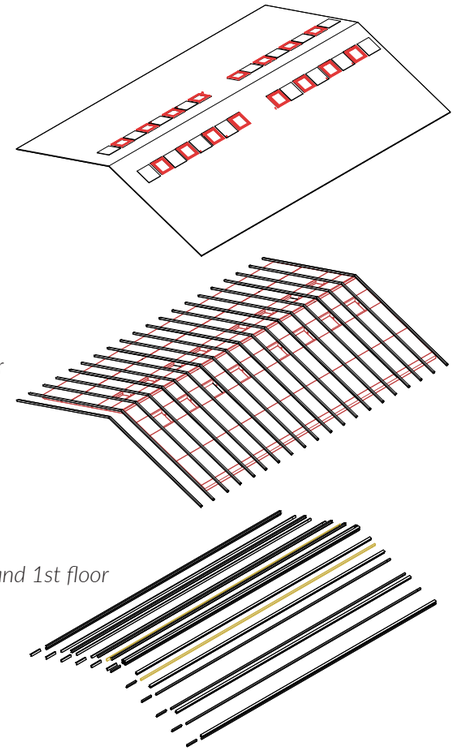
Material volume percentages

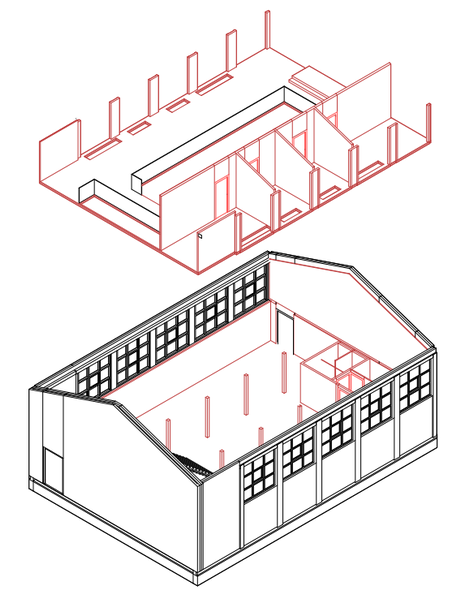




Livability

	livability	notes
size outdoor space	★★★	*courtyard, outside buffer*
added daylight	★★★★	*sky lights*
connection with garden	★★	*only first floor*
south facade	★★	*only 1st floor*
semi private/ bufferzones	★★★★	*buffer between ground and 1st floor*
connection with residents	★★★★★	*public function*
accessibility	★★★★★	*from garden/corridor*





7.13 Chosen variants

Volume percentages

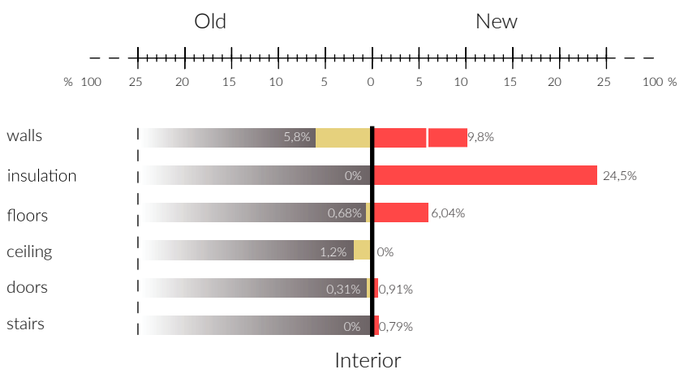
Old and new

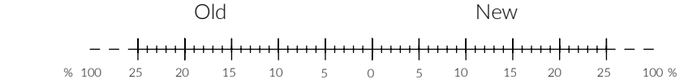
Kept

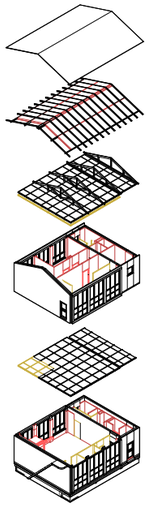
Removed

Added

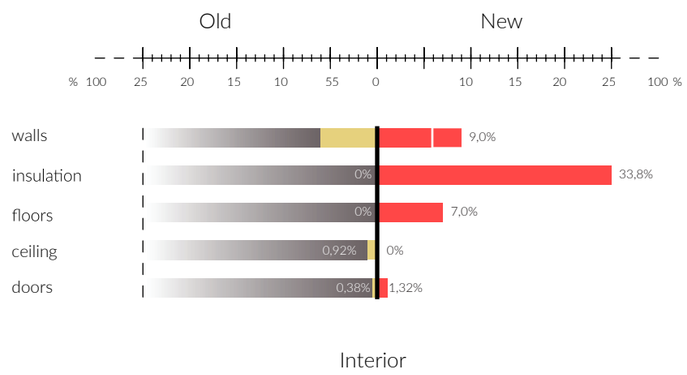
Maisonette type 1

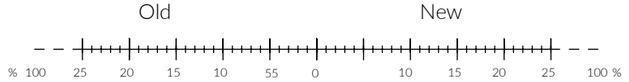


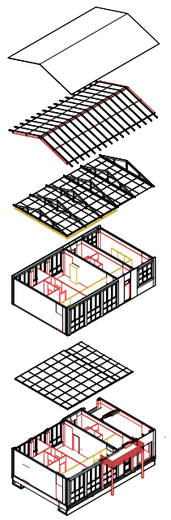




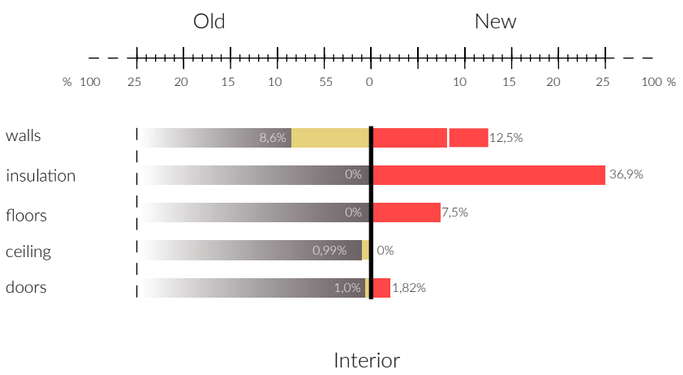
Apartment type 1

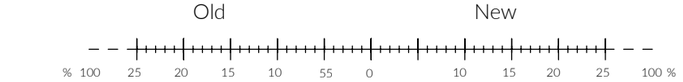


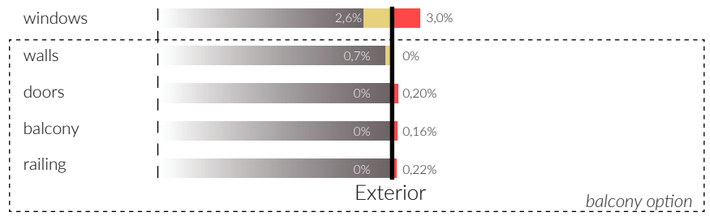


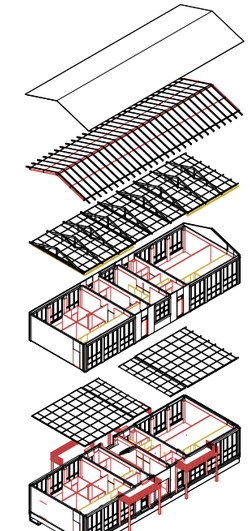


Studio type 3



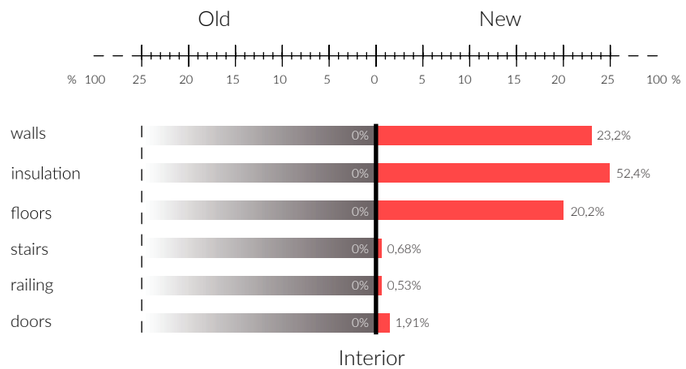


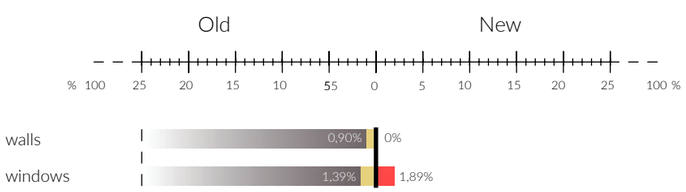




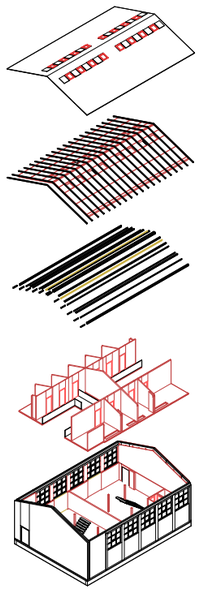
Chosen variants

Entresol type 1

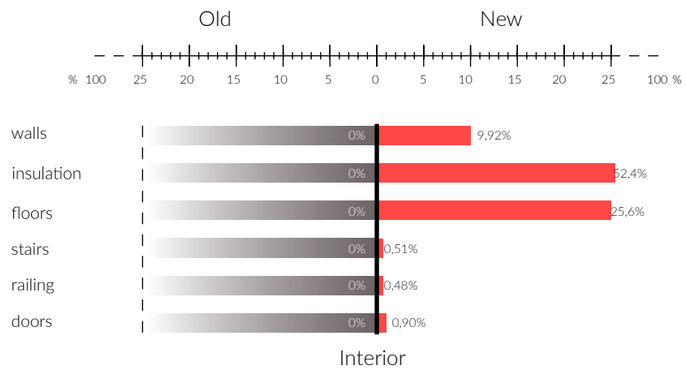


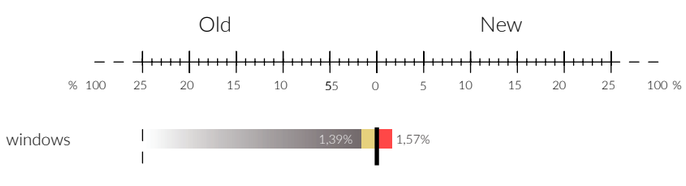


Exterior

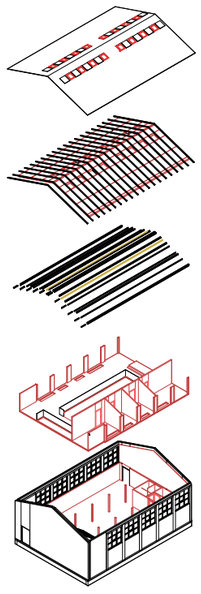


Entresol type 2





Exterior



7.14 Calculations for CO_2 footprint building

Add maisonette 1 **h= m**		**Remove maisonette 1** **h= m**	**New or second hand materials**	**Total materials for 2 units**
Interior		**Interior**		
Walls	13,6 m3	8,1 m3	5,5 m3	**11 m3**
Insulation	**Thermal insulation:** walls = 3,46 + 3,83 m3 = 7,29 m3 floor = 7,20 m3 roof = 16,2 m3 **Acoustic:** walls = 3,4 m3	N/A	walls/ acoustic rockwool= 10,69 m3 floor PIR = 7,20 Roof glass wool = 16,2 m3	**walls rockwool= 21,38 m3** **floor PIR = 14,4 m3** **Roof glass wool = 32,4 m3**
Floors	Magnesite flooring: 8,4 m3	**remove floor for new stairwells:** 0,94 m2	wood fiber 8,4 m3	**16,8 m3**
Ceiling	N/A	remove ceiling: 1,62 m3		
Doors	9 doors = 1,27 m3	3 doors = 0,43 m3	wood: 0,84 m3	**1,68 m3**
Stairs	1 staircase = 1,1 m3	N/A	1,1 m3	**2,2 m3**
Exterior		**Exterior**		
Windows	15 wooden frame window with HR+++ glass = 2,88 m3 + 0,53 m3 = 3,41 m3	15 windows wooden frames and single glazing = 2,88 m3	triple glazing: 0,53m3	**1,06 m3**
Total	**61,7 m3**	**14,2 m3**		

Add apartment type 1 **h= m**		**Remove apartment type 1** **h= m**	**New or second hand materials**	**Total materials for 2 units**
Interior		**Interior**		
Walls	13,8 m3	8,37 m3	5,43 m3	**10,86 m3**
Insulation	**Thermal insulation:** walls = 4,70 m3 floor = 8,9 m3 roof = 21,1 m3 **Acoustic:** walls = 6,61 m3 floor = 10,4 m3	N/A	walls/ acoustic rockwool= 21,71 m3 floor PIR = 8,9 -1,62 (insulation stairwell already in studio calculation) = 7,28 m3 Roof glass wool = 21,1 m3	**walls/ acoustic rockwool= 43,42 m3** **floor PIR = 14,56 m3** **Roof glass wool = 42,2 m3**
Floors	Magnesite flooring: 10,7 m3	N/A	wood fiber 8,4 m3 - 1,63 m3 (of same flooring as studio in staircase) = 6,77 m3	**13,54 m3**
Ceiling	N/A	remove ceiling: 1,41 m3		
Doors	14 doors = 2,02 m3	4 doors = 0,58 m3	wood = 1,44 m3	**2,88 m3**
Exterior		**Exterior**		
Walls	N/A	0,50 m3		
Windows	19 wooden frame window with HR+++ glass = 2,97 m3 + 0,516 + 0,0141 + 0,1264 m3 = 3,63 m3	19 windows wooden frames and single glazing = 2,97 m3	triple glazing= 0,66 m3	**1,32 m3**
Doors	1 door = 0,14 m3	N/A	wood = 0,14 m3	**0,28 m3**
Balcony	**Balcony structure and floor:** 0,825 m3 **Railing**: 0,055 m3	N/A	wood structure 0,825 m3	**1,65 m3**
Total	**91,85 m3 (without balcony)**	**23,7 m3**		

Add studio type 3 **h= m**		**Remove studio type 3** **h= m**	**New or second hand materials**
Interior		**Interior**	
Walls	35,7 m3	24,4 m3	**walls timber frame = 11,3 m3 - 2 m3 (exterior wall removed) = 9,3 m3**
Insulation	**Thermal insulation:** walls = 9,90 m3 floor = 17,9 m3 roof = 41,8 m3 **Acoustic:** walls = 14,8 m3 floor = 20,9 m3	N/A	**walls/ acoustic rockwool = 45,6 m3** **floor PIR = 17,9 m3** **Roof glass wool = 41,8 m3**
Floors	Magnesite flooring: 21,5 m3	N/A	**wood fiber= 21,5 m3**
Ceiling	N/A	remove ceiling: 2,83 m3	
Doors	36 doors = 5,2 m3	20 doors = 2,85 m3	**wood: 2,35 m3**
Exterior		**Exterior**	
Windows	34 wooden frame window with HR+++ glass =7,33 + 1,32= 8,65	34 windows wooden frames and single glazing = 7,33 m3	**triple glazing = 1,32 m3**
Option for four balconies			
Walls	N/A	0,50 m3 x 4 = 2,0 m3	
Doors	4 doors = 0,14 m3 x 4 = 0,56 m3	N/A	**wood: 0,56 m3**
Balcony	**Balcony structure and floor:** 0,825 m3 x 4 = 3,30 m3 **Railing**: 0,055 m3 x 4 = 0,22 m3	N/A	**wood structure = 3,30 m3**
Total	**91,85 m3 (without balcony)**	**23,7 m3**	

Add entresol h= m		**Remove entresol h= m**	**New or second hand materials**
Interior		**Interior**	
Walls	28,3 m3	N/A	**timber frame : 28,3 m3 - 1,1 m3 (exterior removed wall) = 27,2 m3**
Insulation	Thermal insulation: walls = 10,4 m3 floor = 14,1 m3 roof = 35,3 m3 Acoustic: walls = 4,18 m3	N/A	**walls/ acoustic rockwool = 14,58 m3** **floor PIR = 14,1 m3** **Roof glass wool = 35,3 m3**
Floors	Magnesite flooring: 14,9 m3 wooden floor structure: 9,79 m3	N/A	**wood fiber flooring = 14,9 m3** **wooden floor structure = 9,79 m3**
Stairs	0,83 m3	N/A	**wood = 0,83m3**
Railing	0,65 m3	N/A	**railing glass = 0,65 m3**
Doors	16 doors = 2,33 m3	N/A	**wood = 2,33**
Exterior		**Exterior**	
Walls	1,10 m3	N/A	
Windows	12 wooden frame window with HR+++ glass = 2,30 m3	10 windows wooden frames and single glazing = 1,70 m3	**triple glazing = 0,6 m3**
Total	**91,85 m3 (without balcony)**	**23,7 m3**	

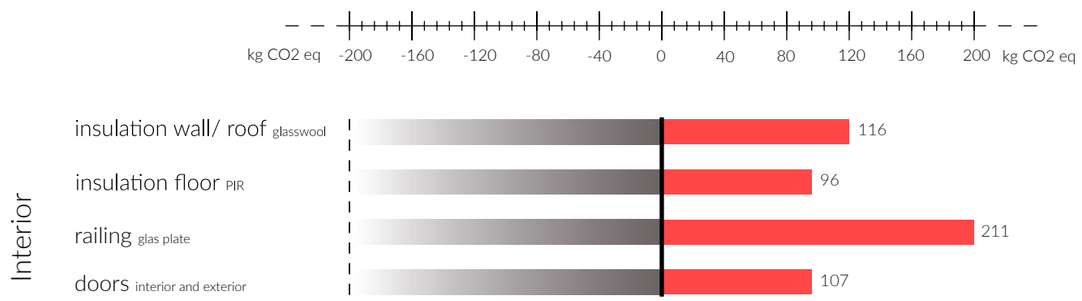
Add library h= m		**Remove library h= m**	**New or second hand materials**
Interior		**Interior**	
Walls	12,1 m3	N/A	**timber frame = 12,1 m3**
Insulation	Thermal insulation: walls = 10,8 m3 floor = 14,1 m3 roof = 35,3 m3 Acoustic: walls = 4,18 m3	N/A	**walls/ acoustic rockwool = 14,18 m3** **floor PIR = 14,1 m3** **Roof glass wool = 35,3 m3**
Floors	Magnesite flooring: 20,8 m3 wooden floor structure: 10,4 m3	N/A	**wood fiber flooring= 20,8 m3** **wooden floor structure = 10,4 m3**
Stairs	0,62 m3	N/A	**wood = 0,62 m3**
Railing	0,59 m3	N/A	**railing glass= 0,59 m3**
Doors	8 doors = 1,10 m3	N/A	**wood 1,1 m3**
Exterior		**Exterior**	
Windows	12 wooden frame window with HR+++ glass = 1,92 m3	10 windows wooden frames and single glazing = 1,70 m3	**triple glazing = 0,22 m3**
Total	**91,85 m3 (without balcony)**	**23,7 m3**	

Add total building h= m	**New or second hand materials**				**kg CO_2 eq**	
Interior	**material = Maisonette + Apartment + Studio + Entresol + Dwelling [m3] =**	**total [m3]**	**2nd hand materials**	**New materials**	**2nd hand materials**	**New materials**
Walls	solid wall : 11 + 10,86 + 9,3 + 27,2 + 12,1 m3 = 70, 46 m3 timber frame is 34% = 24,0 m3	24 m3		24 m3		**-15,936.0 kg CO_2 eq**
Insulation	walls/ acoustic glass wool = 21,38 + 43,42+ 45,6 + 14,58 + 14,18 m3 = floor PIR = 14,4 + 14,56+ 17,9 + 14,1 + 14,1 m3 = Roof glass wool = 32,4 + 42,2 + 41,8 + 35,3 + 35,3 m3 =	139 m3 75 m3 187 m3	139 m3 50 m3 187 m3	25 m3	**116 kg CO_2 eq** **96 kg CO_2 eq** **... (same transport as other glass wool)**	**2,332.5 kg CO_2 eq**
Floors	magnesite (wood fiber) flooring = 16,8 +13,54 + 21,5 + 14,9 + 20,8 m3 = glulam structure = 9,79 + 10,4 m3=	87,54 20,19		87,54 m3 20,19 m3		**-14,824.8 kg CO_2 eq** **-13,406.2 kg CO_2 eq**
Stairs	construction timber = 2,2 + 0,83 + 0,62 m3 =	3,65 m3		3,65 m3		**-2,482.0 kg CO_2 eq**
Railing	railing glass = 0,65 + 0,59 m3 =	1,24 m3	0,43 m3	0,81 m3	**211 kg CO_2 eq**	**3,709.8 kg CO_2 eq**
Doors	wood = 1,68 + 2,88 + 2,35 + 2,33 + 1,1 m3=	10,34 m3	10,34 m3		**107 kg CO_2 eq**	
Exterior						
Windows	triple glazing = 1,06 + 1,32 + 1,32 + 0,6 + 0,22 m3	4,52 m3		4,52 m3		**21,522.9 kg CO_2 eq**
Doors	wood = 0,28 + 0,56 m3 = 0,84 m3	0,84 m3	0,84 m3		**... (same transport as other doors)**	
Balcony	glulam structure = 1,65 + 3,30 m3 =	4,95 m3		4,95 m3		**-3,286.8 kg CO_2 eq**
Total		605 m3				

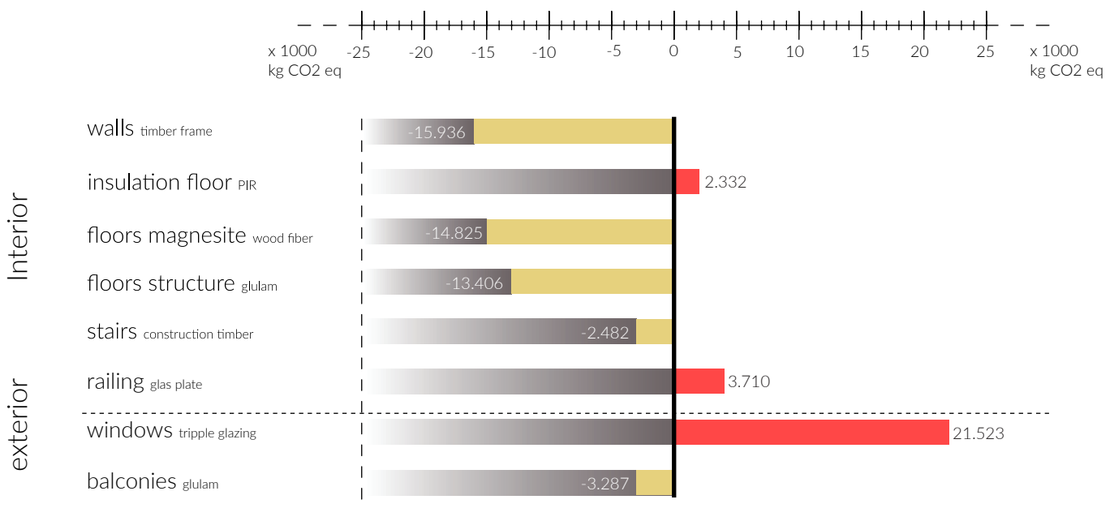
CO_2 FOOTPRINT

in kg CO_2 eq

second hand materials

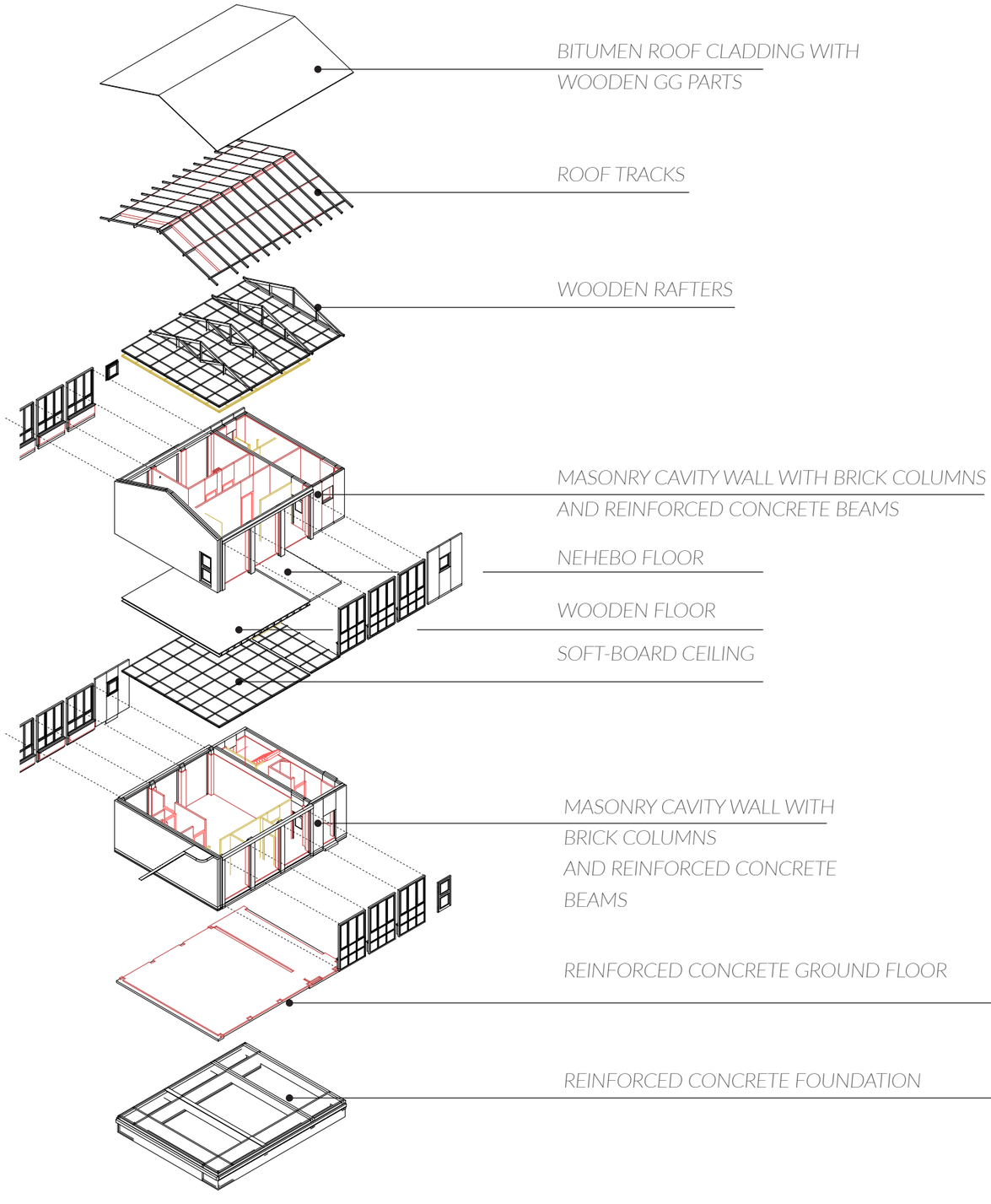


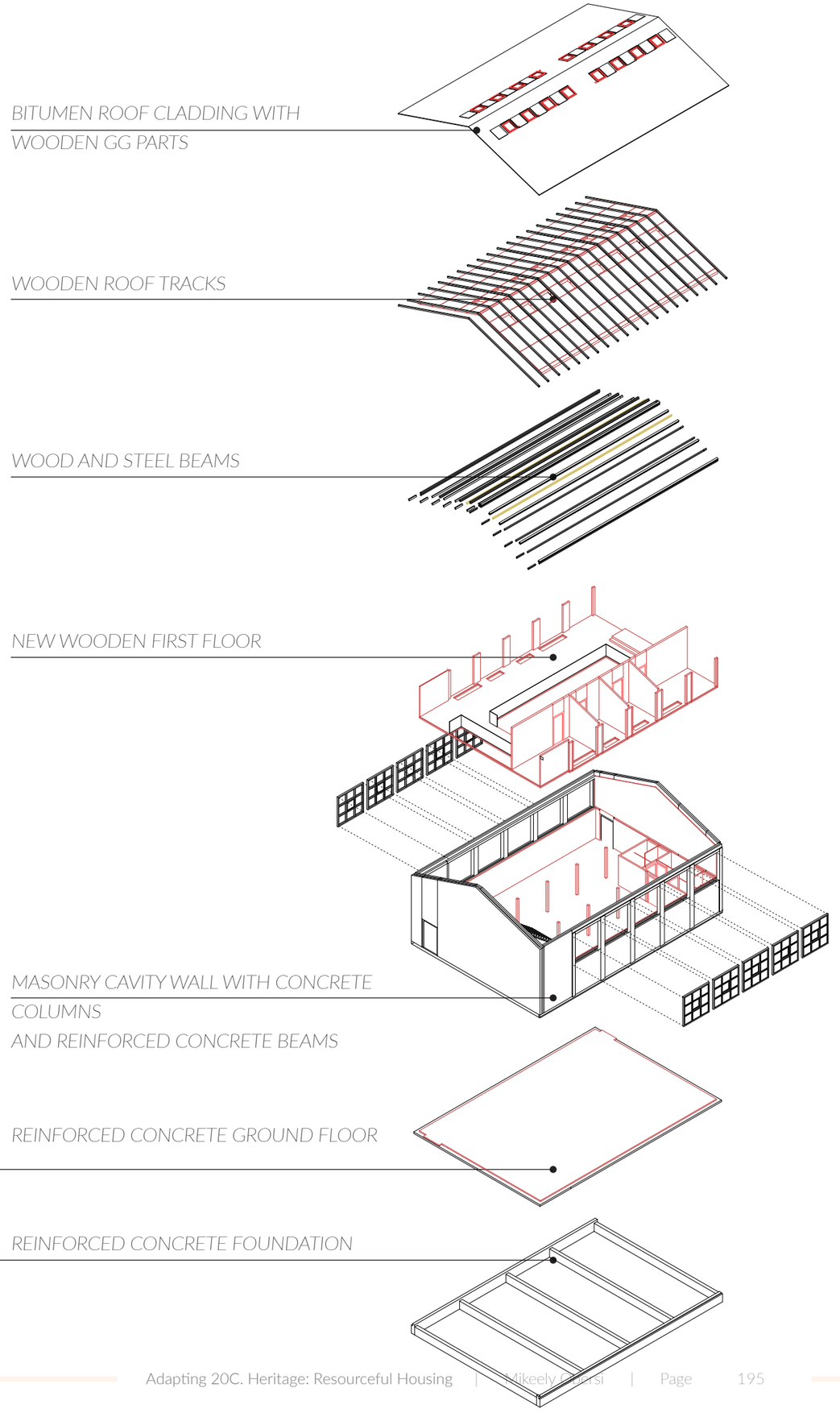
new materials



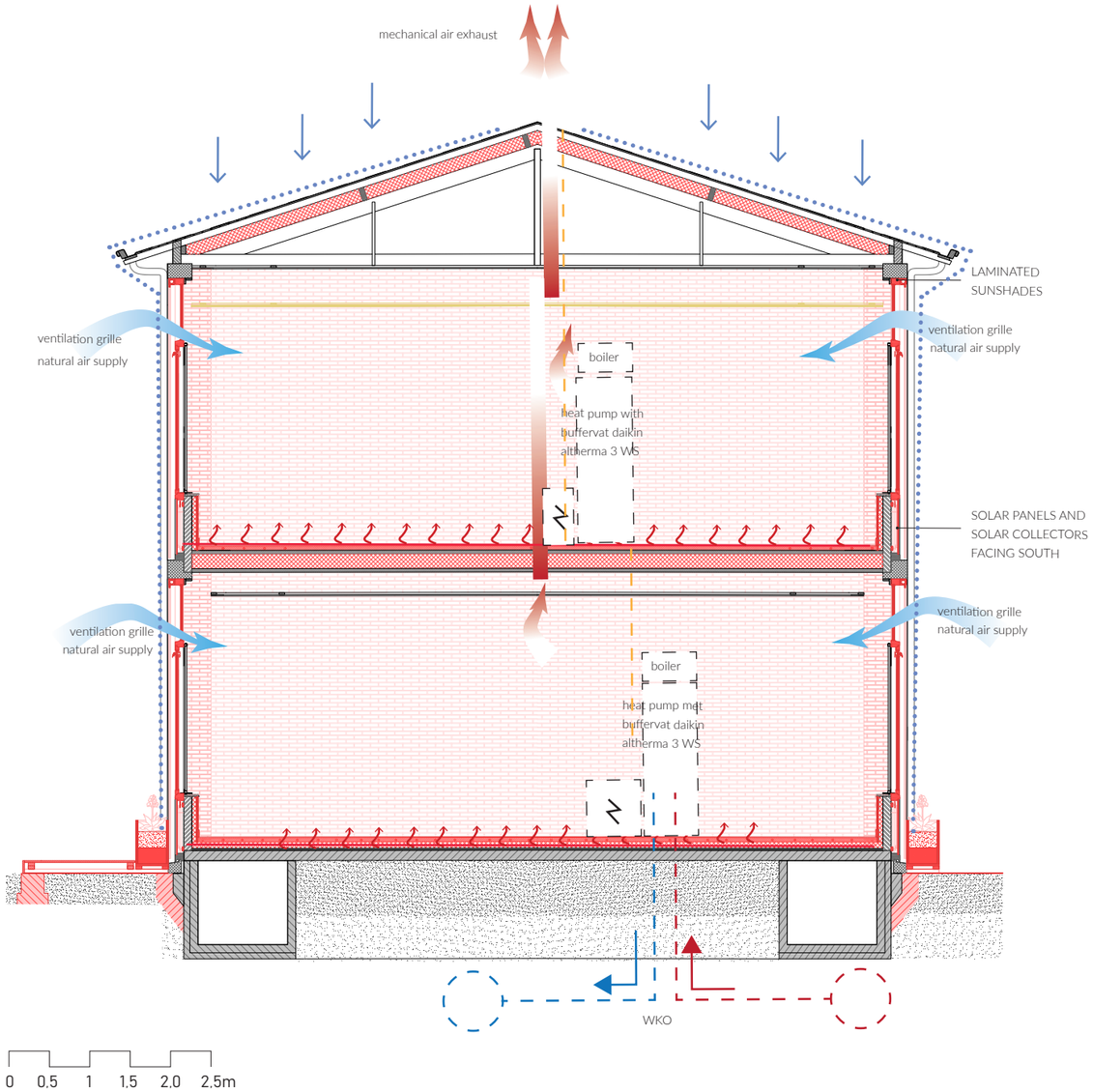
7.15 Structure

South and North block





7.16 Climate section 1:50



7.17 Materials building

railing staircases |
red steel and wood handles

↓

reuse : red color for balcony railing and wood texture for interior detailing and balcony structure

interior walls |
wood panels

interior walls |
panel joint

↓

reuse : current classroom walls for interior walls dwellings

interior walls |
movable wall panels

interior original walls |
white painted brick work

↓

reuse : brick look with

plot fencing |
steel painted green

↓

reuse : fencing that is removed on site for railing balconies -> change color to red to match with facade and indoor railing

outdoor pavement |
gray/green with vegetation growing

↓

keep outdoor pavement at parts
reuse: change pavement pattern for paths in courtyard

exterior walls |
red brick work

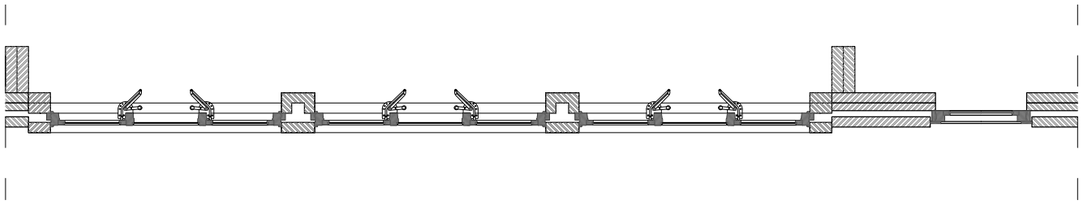
↓

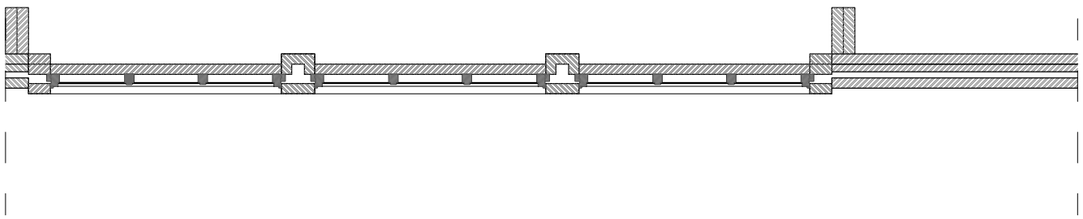
keep: exterior wall look by insulating inside

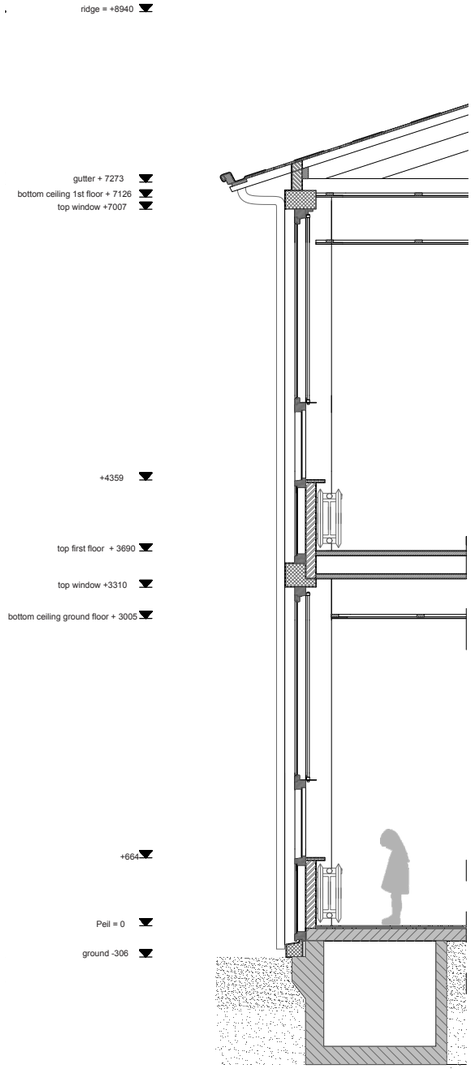
exterior multiplex facade panels |
blue color

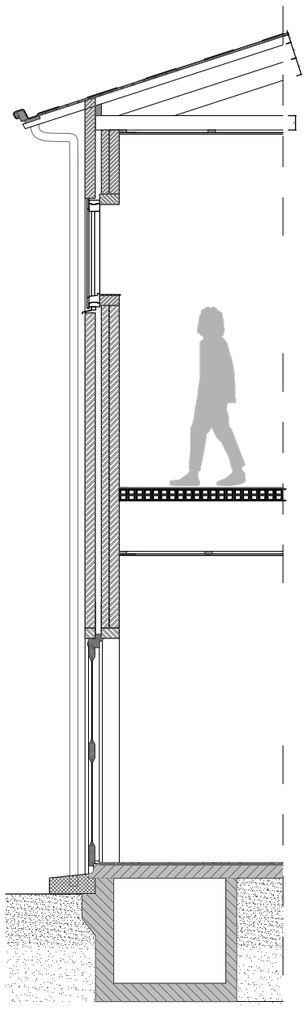
↓

change panels with solar panels (blue color)
reuse the blue color to keep the original look



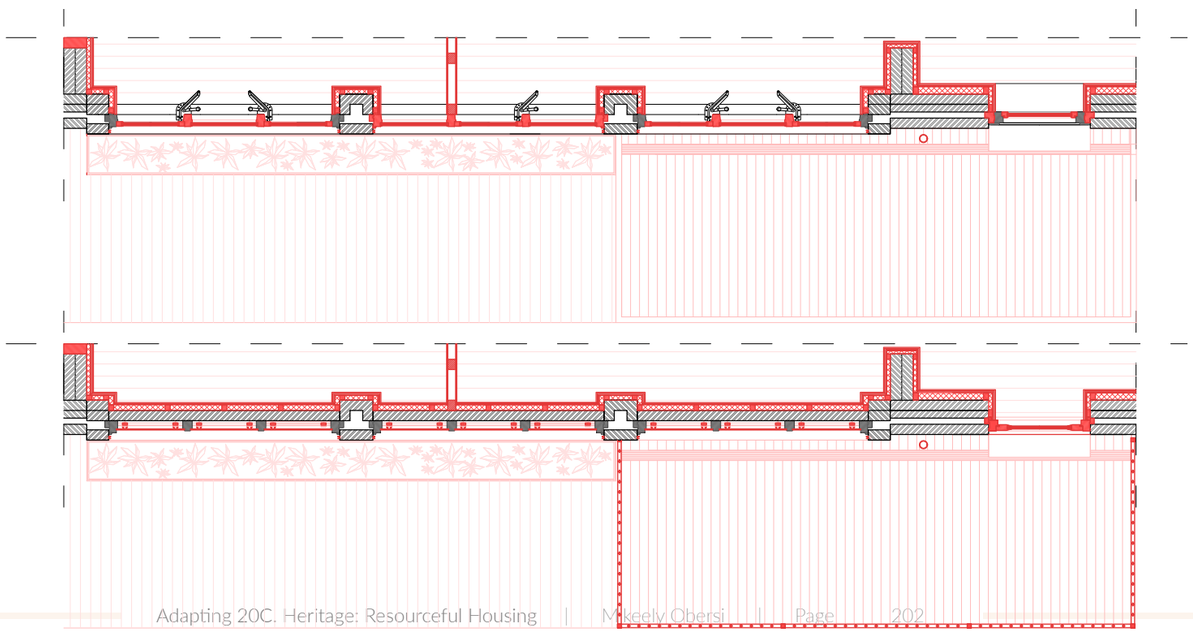


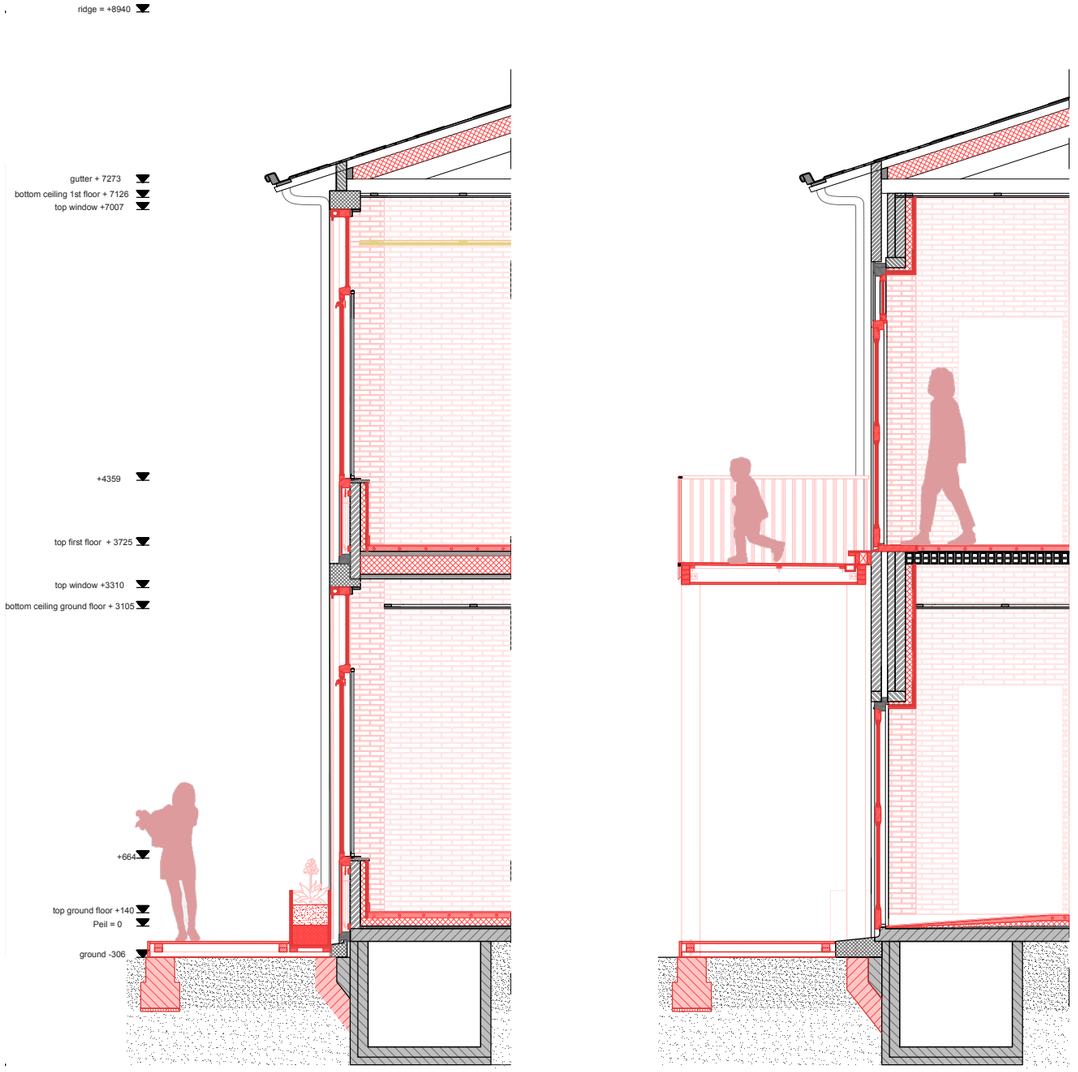




7.18 Southblock

Facade 1:20 Old



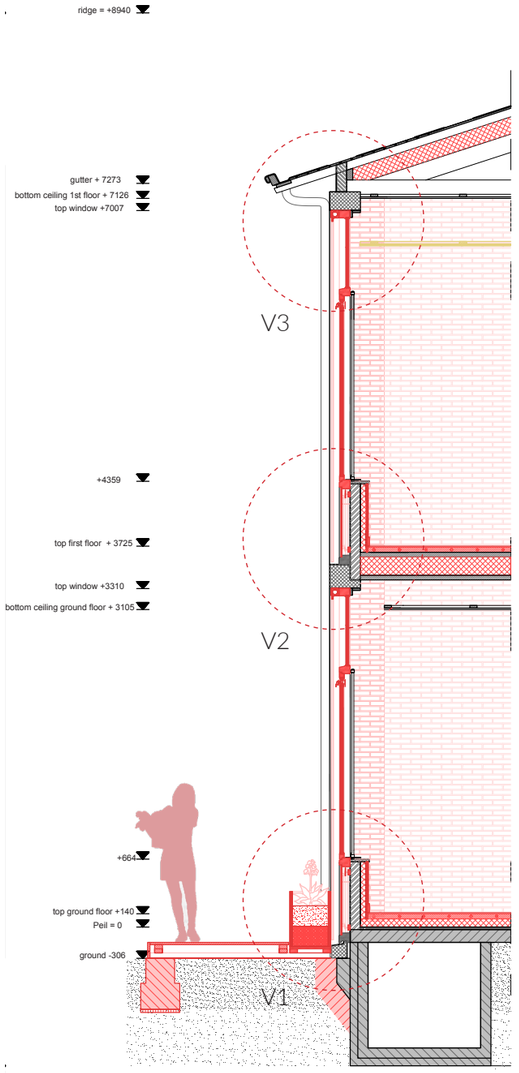


Southblock

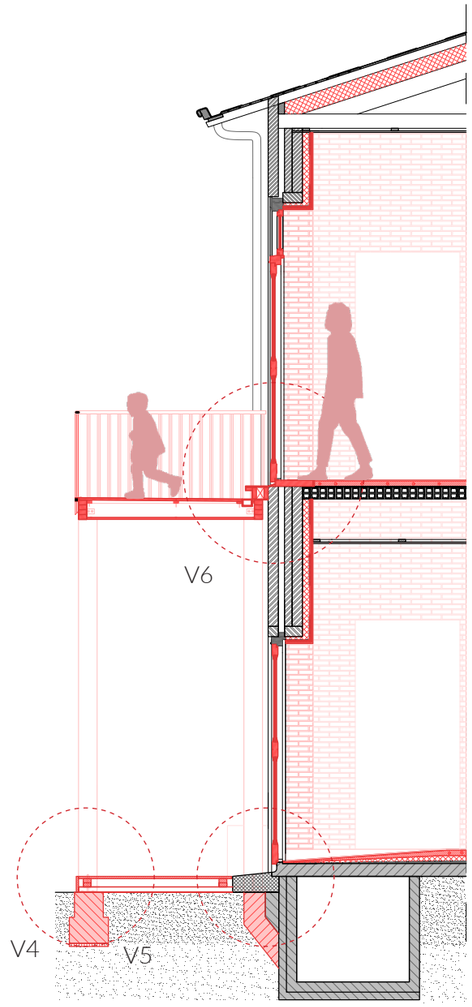
Facade 1:20 New

SECTION C

SECTION D

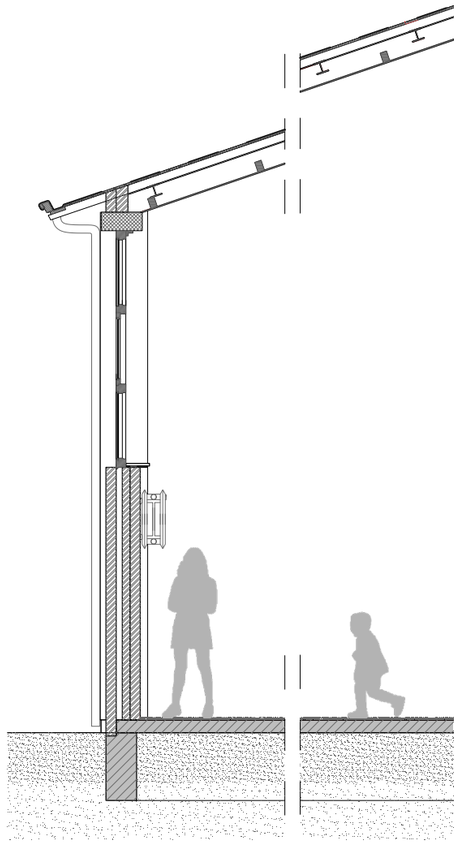


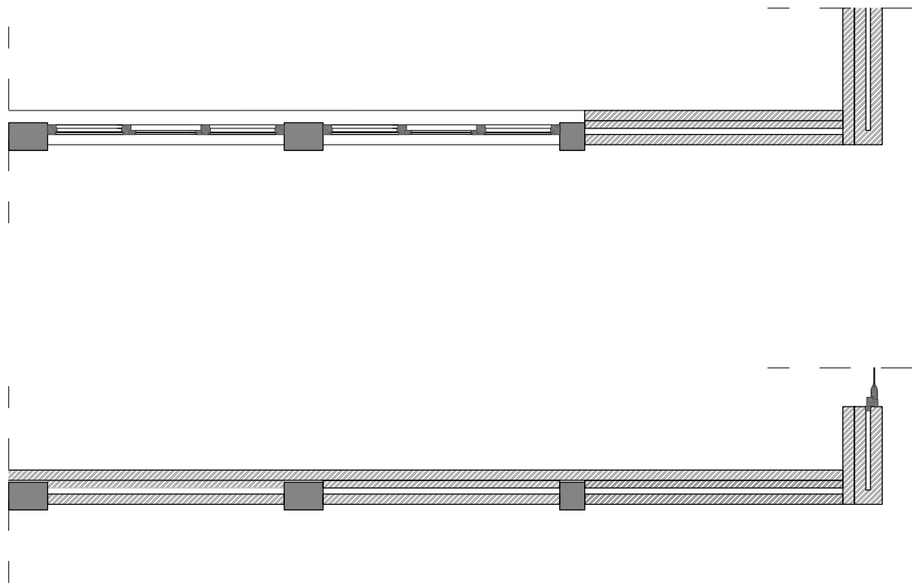
SECTION A



SECTION B

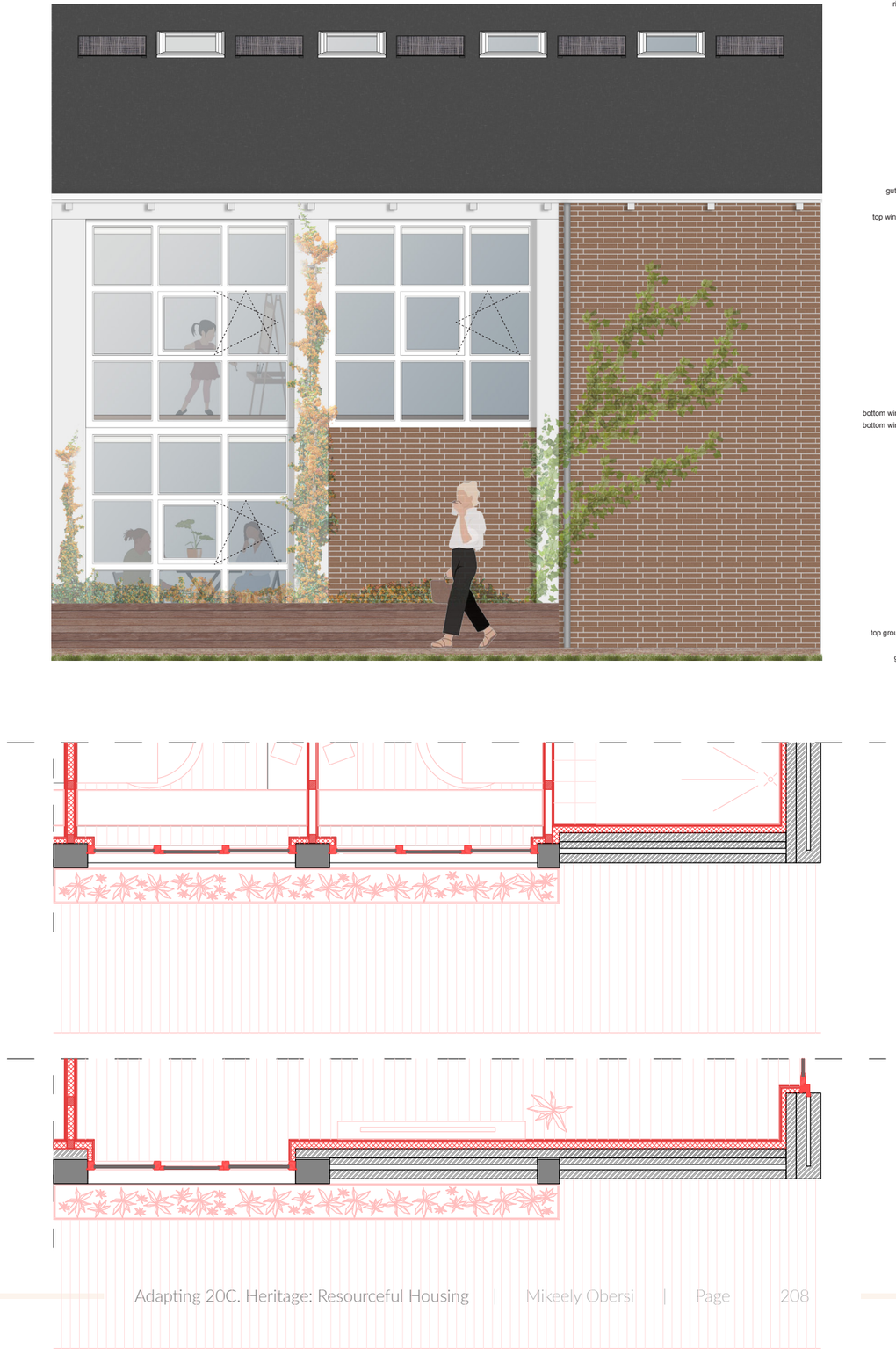
Southblock
Facade 1:20 New

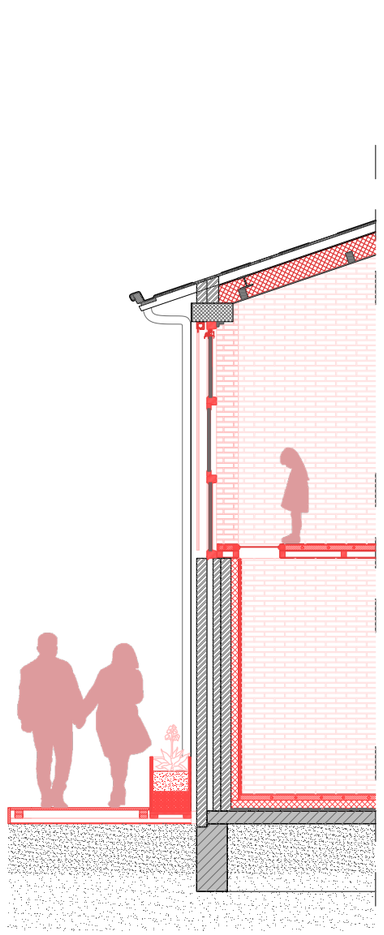


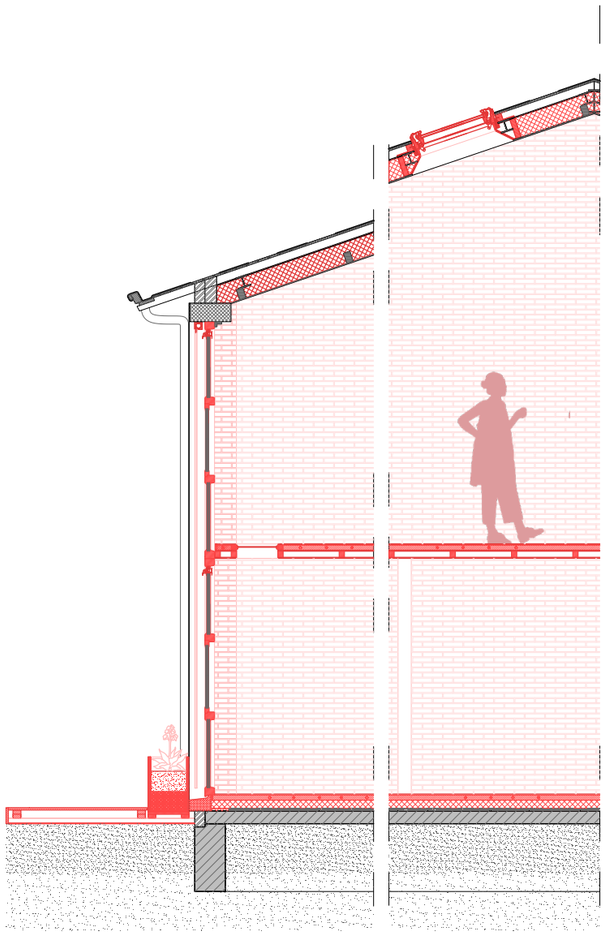


7.19 Northblock

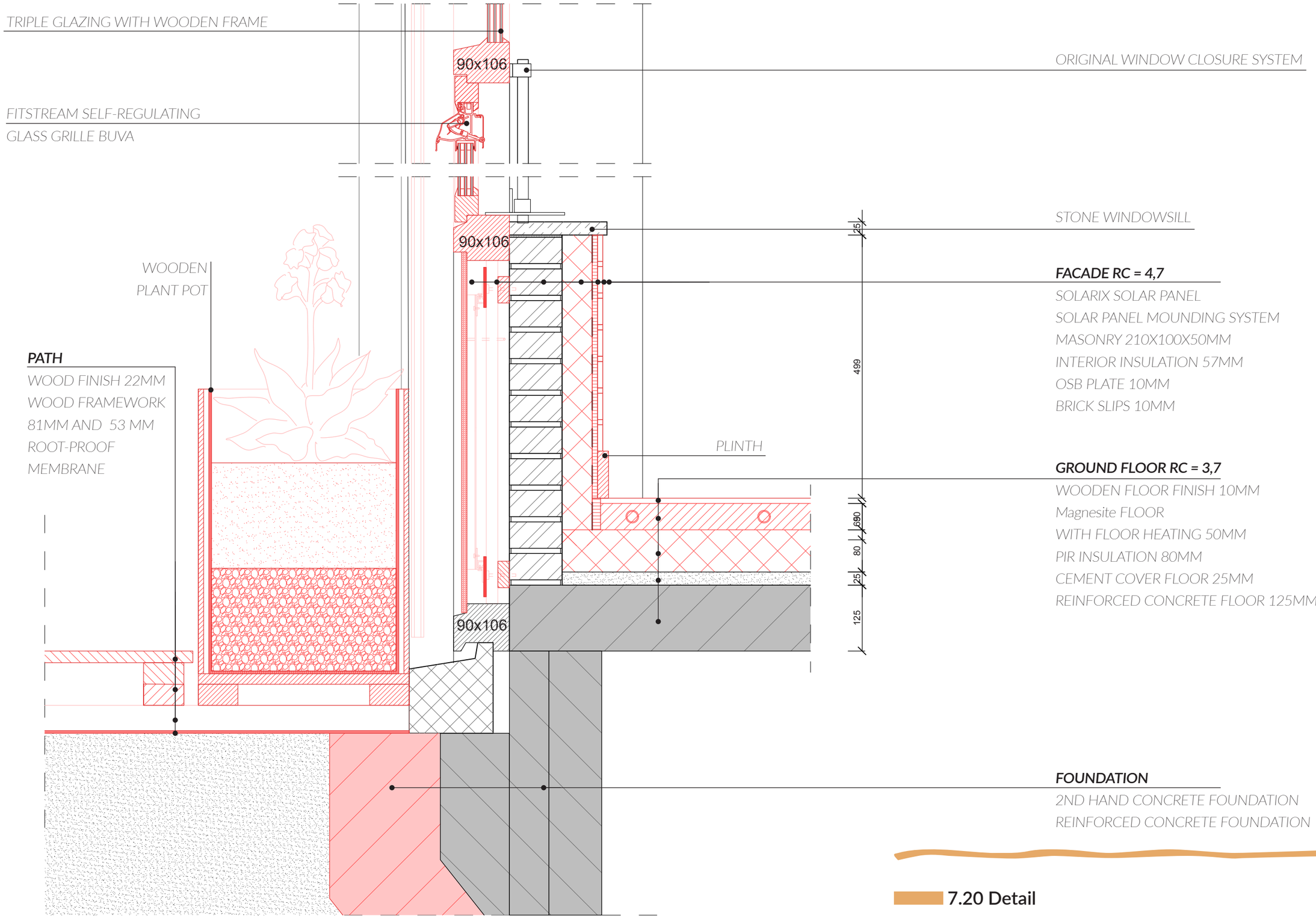
Facade 1:20 Old





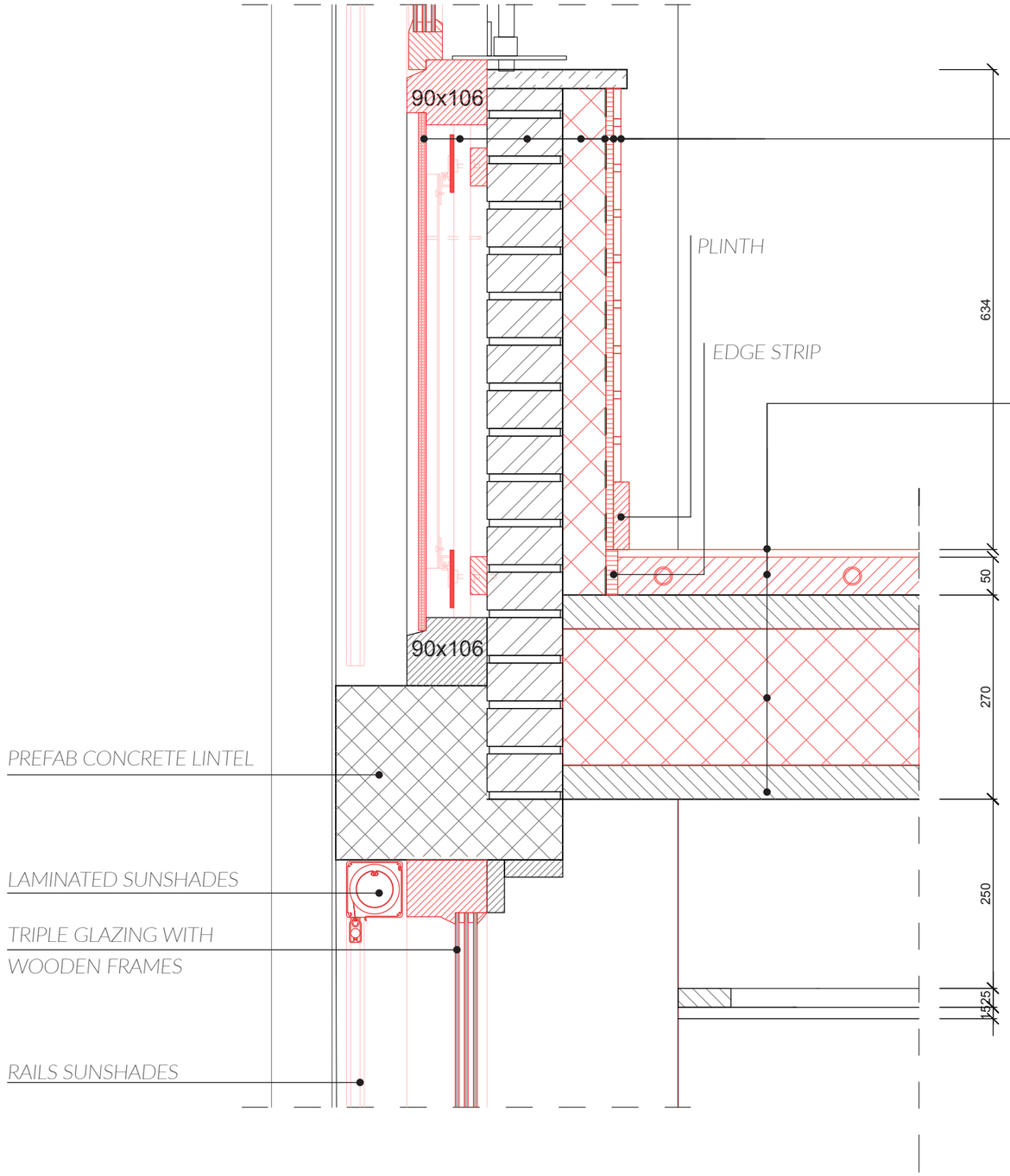


Northblock
Facade 1:20 New



7.20 Detail

V1



FACADE RC = 4.7

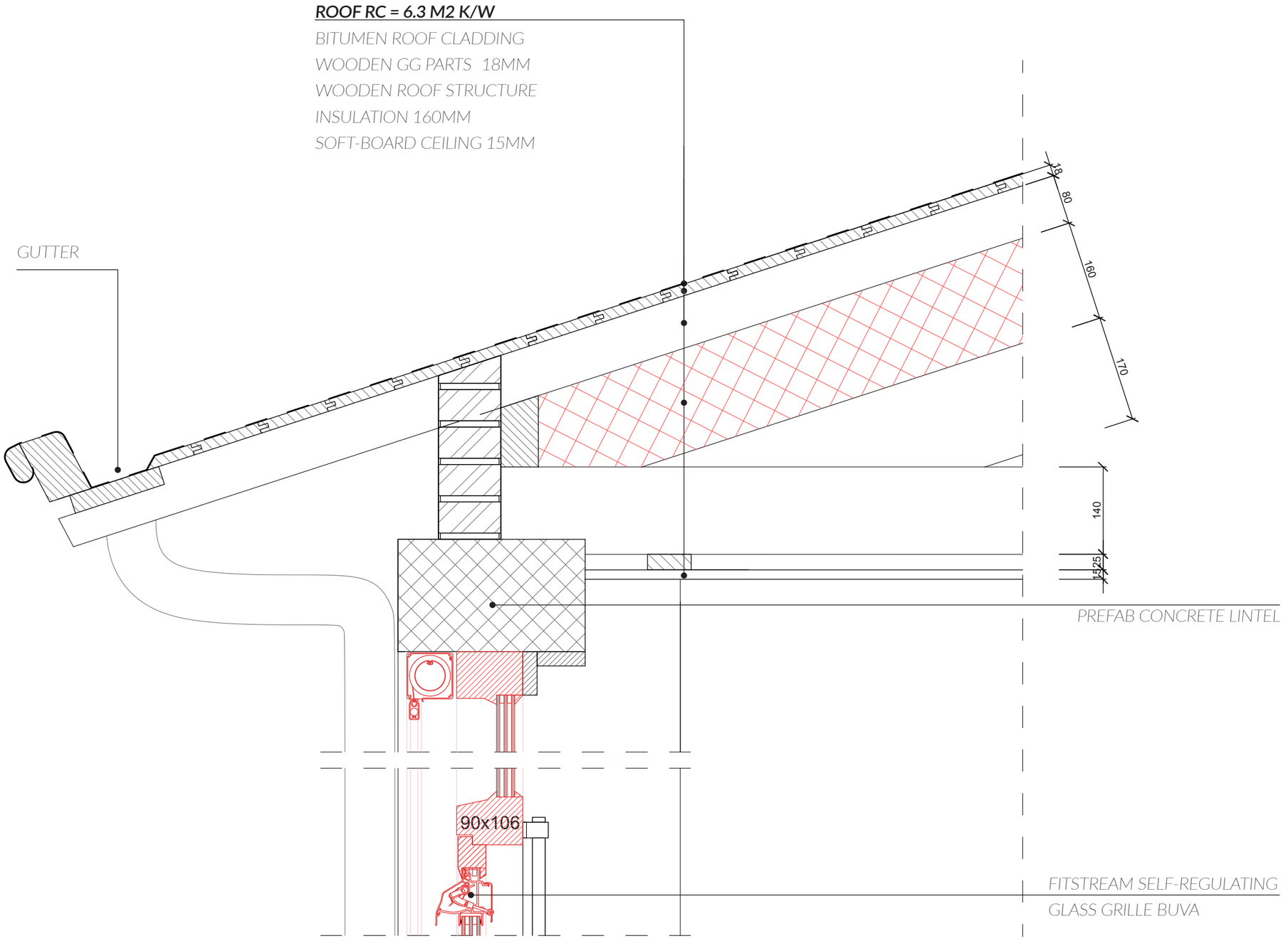
SOLARIX SOLAR PANEL
SOLAR PANEL MOUNDING SYSTEM
MASONRY 210X100X50MM
INTERIOR INSULATION 57MM
OSB PLATE 10MM
BRICK SLIPS 10MM

1ST FLOOR

WOODEN FLOOR FINISH 10MM
MAGNESITE FLOOR WITH FLOOR HEATING 50 MM
WOODEN FLOOR 270 MM
WITH INSULATION 180 MM

Detail

V2


ROOF RC = 6.3 M2 K/W
BITUMEN ROOF CLADDING
WOODEN GG PARTS 18MM
WOODEN ROOF STRUCTURE
INSULATION 160MM
SOFT-BOARD CEILING 15MM
GUTTER
18
80
160
170
140
1525
PREFAB CONCRETE LINTEL
90x106
FITSTREAM SELF-REGULATING
GLASS GRILLE BUVA

Detail

V3

FACADE RC = 4,7

MASONRY 210X100X50 MM
AIR CAVITY 60 MM
MASONRY 210X74X50 MM
MASONRY 210 X100X50 MM
INTERIOR INSULATION 73 MM
VAPOR RESISTANT LAYER
WOODEN FRAMEWORK
10MM
OSB PLATE 10MM
BRICK SLIPS 10

PATH

WOOD FINISH 22MM
WOOD FRAMEWORK
81MM AND 53 MM
ROOT-PROOF MEMBRANE

90x106

WOODEN DOOR WITH
TRIPLE GLAZING

LAMINATED COLOMN
182X182X 3647MM

22
81
53

GROUND FLOOR RC = 3,7

WOODEN FLOOR FINISH 10MM
Magnesite FLOOR
WITH FLOOR HEATING 50MM
PIR INSULATION 80MM
CEMENT COVER FLOOR 25MM
REINFORCED CONCRETE FLOOR 125MM

FOUNDATION

SHALLOW FOUNDATION
2ND HAND CONCRETE FOUNDATION
REINFORCED CONCRETE FOUNDATION

Detail

V4 & V5

Detail

V6

BALCONY

WOODEN FLOOR FINISH WITH SLOPE 10MM
WOOD FRAMES WITH HEIGHT DEPENDING ON SLOPE
LAMINATED BEAMS 80X190X5000 MM & 80X157X1640 MM
WOOD FINISH UNDER BEAMS 20MM
LAMINATED COLUMN 182X182X 3647MM

RAILING (REUSED FENCING)

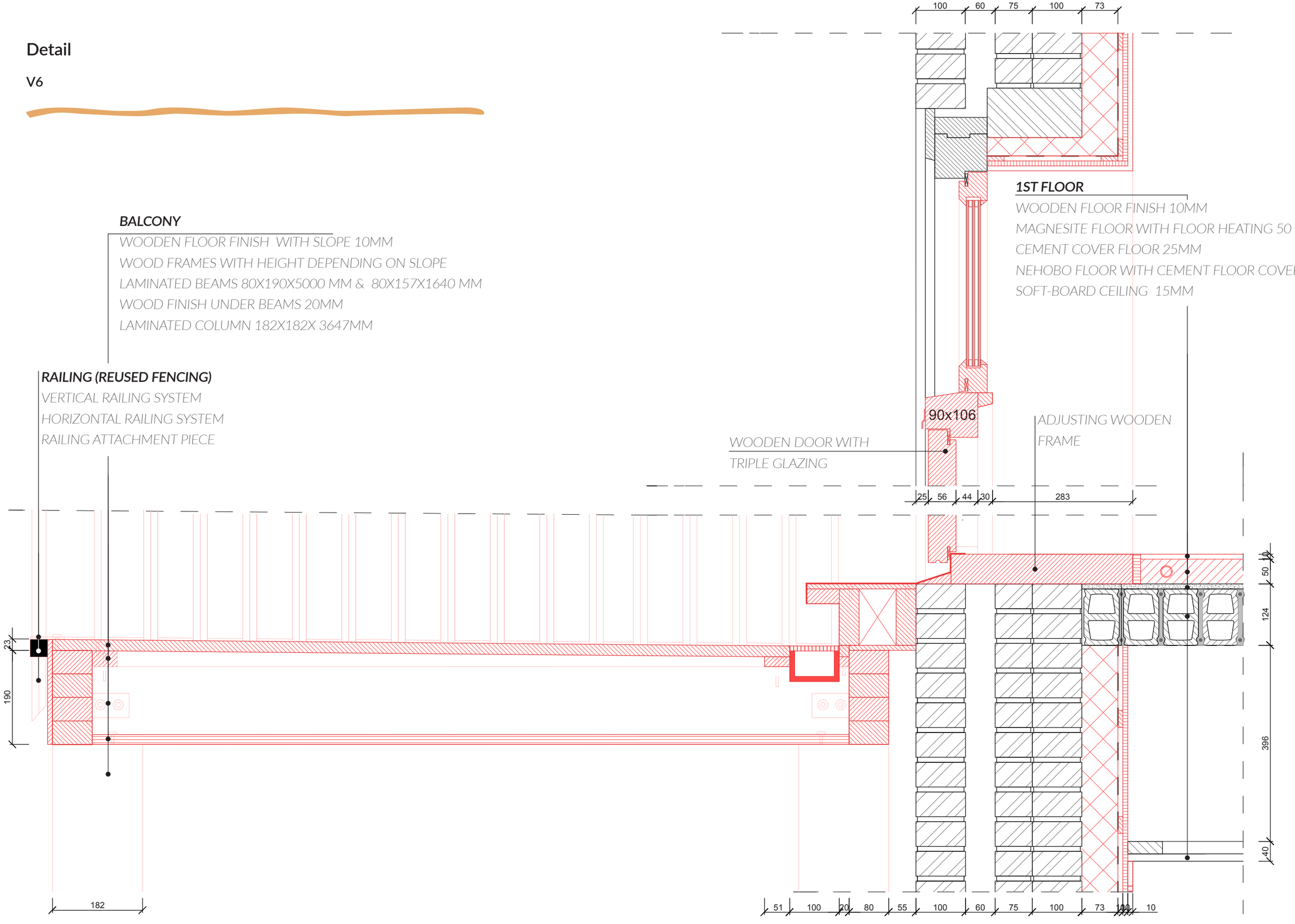
VERTICAL RAILING SYSTEM
HORIZONTAL RAILING SYSTEM
RAILING ATTACHMENT PIECE

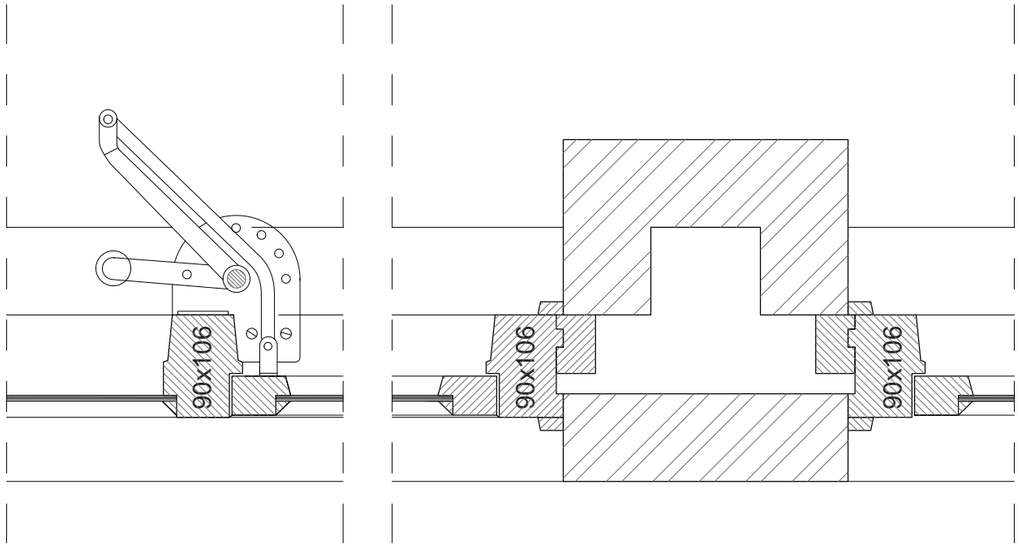
1ST FLOOR

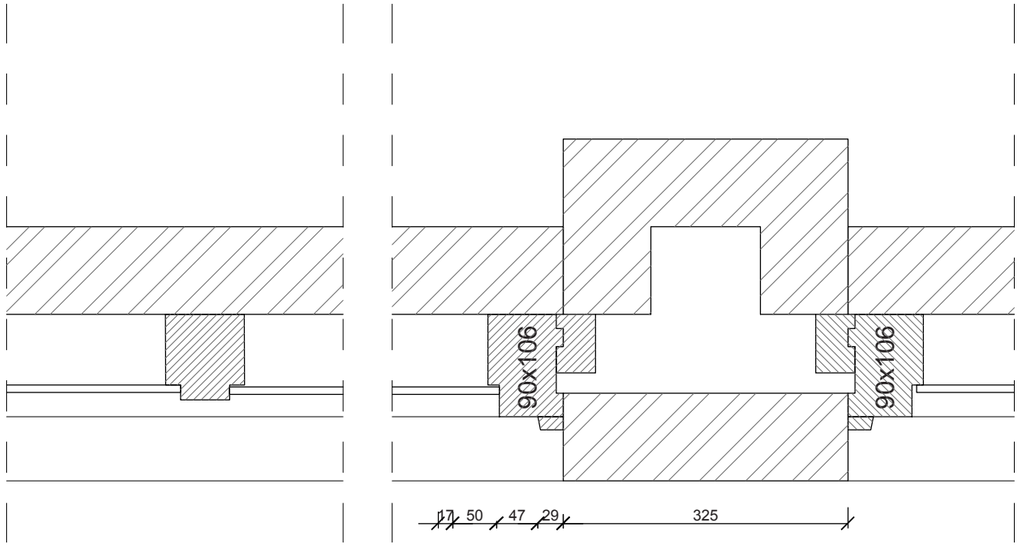
WOODEN FLOOR FINISH 10MM
MAGNESITE FLOOR WITH FLOOR HEATING 50 MM
CEMENT COVER FLOOR 25MM
NEHOBO FLOOR WITH CEMENT FLOOR COVER 124MM
SOFT-BOARD CEILING 15MM

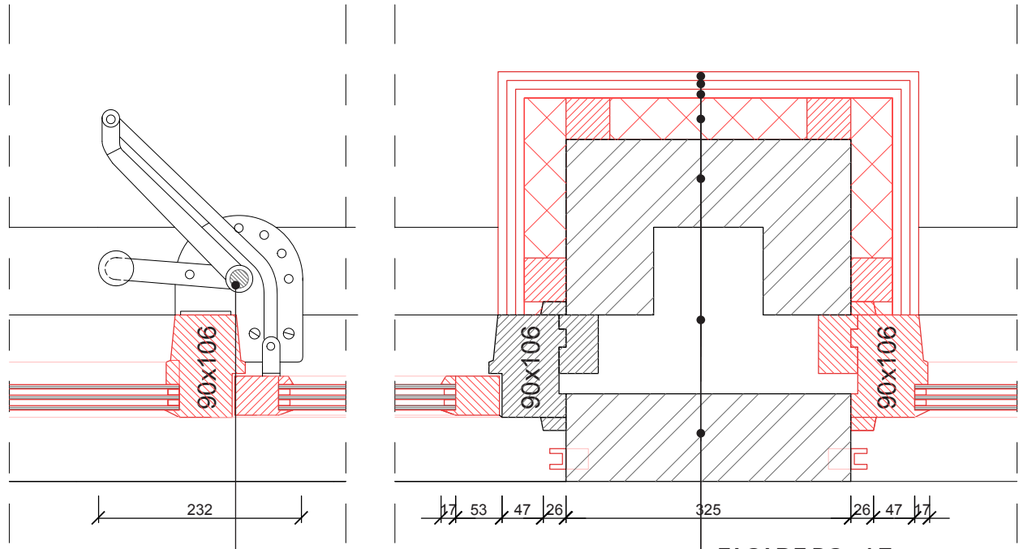
WOODEN DOOR WITH TRIPLE GLAZING

ADJUSTING WOODEN FRAME









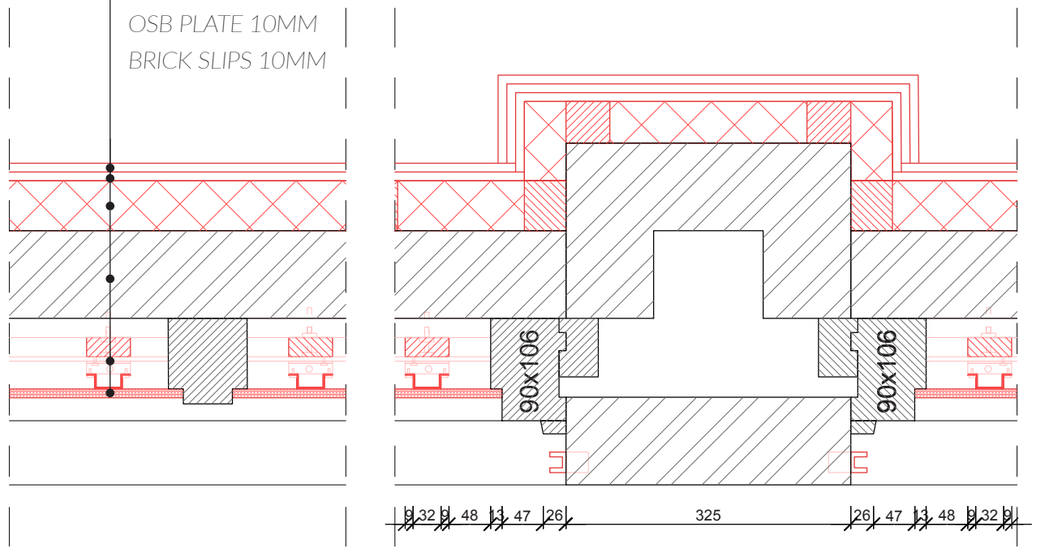
ORIGINAL WINDOW
CLOSURE SYSTEM

FACADE RC= 4,7

SOLARIX SOLAR PANEL
SOLAR PANEL MOUNDING SYSTEM
MASONRY 210X100X50MM
INTERIOR INSULATION 57MM
OSB PLATE 10MM
BRICK SLIPS 10MM

FACADE RC= 4,7

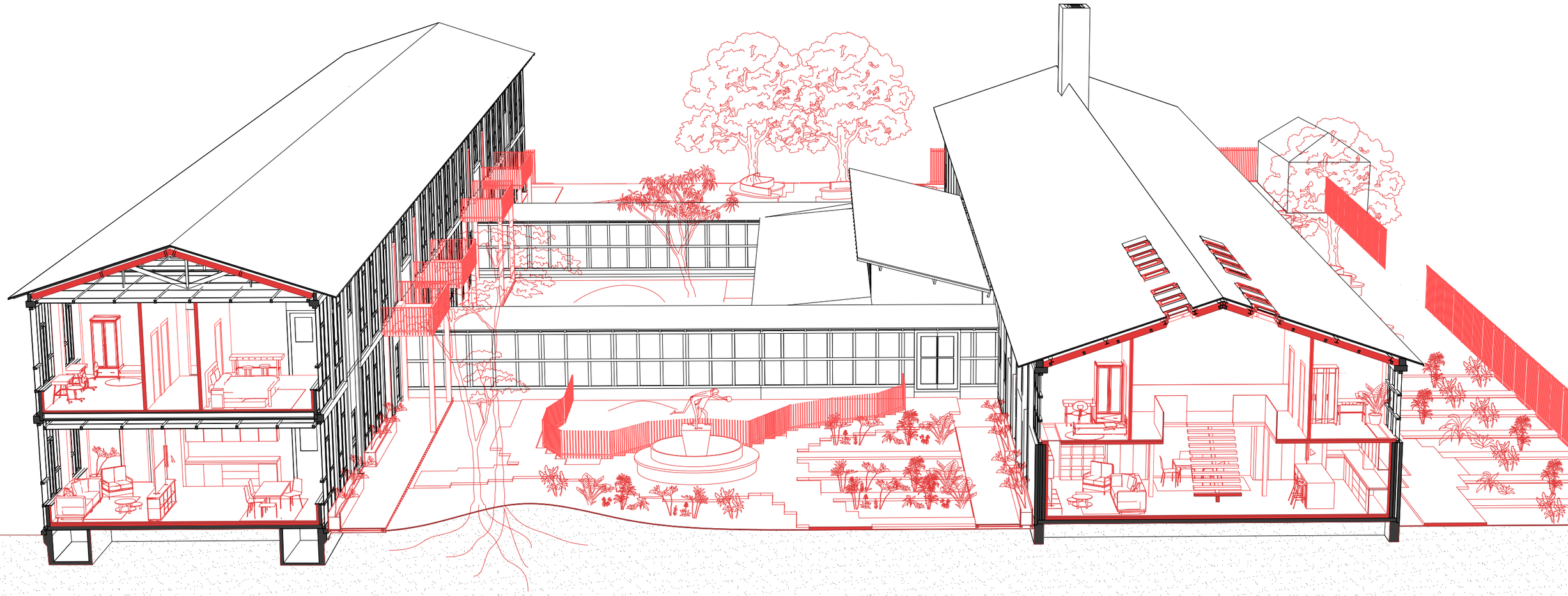
BRICK SLIPS 10MM
OSB PLATE 10MM
WOODEN FRAMEWORK 10MM
VAPOR RESISTANT LAYER
INTERIOR INSULATION 47,5 MM
MASONRY 210X100X50
AIR CAVITY 80 MM
MASONRY 210 X100X50 MM



Detail

H1 & H2

7.21 Impression Section



Chapter 8: Mandatory Reflection

8.1 What is the relation between your graduation project topic, your master track: Adapting 20C Heritage: Resourceful Housing, and your master program (MSc AUBS)?

The graduation (project) topic looks at the most resourceful way to adapt a building into housing while preserving its cultural value, this is directly linked to the studio's title "Adapting 20C. Heritage: Resourceful Housing". Furthermore, this heritage studio links two challenges: circular economy and housing crisis.

The graduation topic focuses on adaptive reuse of school buildings with the preliminary research looking at the typological evolution between school and housing. The topic of adaptive reuse is a way of dealing with the first challenge mentioned above "the circular economy". The building industry contributes the most to natural recourse depletion, greenhouse effect, and climate change (Le et al, 2021; Zimmermann et al, 2020). When it comes to demolition and rebuilding a new building, studies show that retrofitting, refurbishing, or repurposing a building has a less environmental impact and is mostly the economical choice (Bahadır et al, 2022; Sánchez et al, 2023; Zimmermann et al, 2020).

Furthermore, the challenge "housing crisis" mentioned above asks for more housing, better energy performance and diversified typologies. Therefore, in the preliminary research a comparative case study was done by looking at the various interventions focusing on the interior and exterior building fabric and the function. Which lead to an overview of interventions on these levels and the typologies realized per case. Additionally, during the design phase, various typologies were drawn out and compared on the removed and added volumes. Also, the CO2 footprint of these layers was shown to understand the resourcefulness of these interventions. This was manly done for layers where new materials were going to be used instead of being sourced as second hand. For example, the insulation layer required the greatest amount of material to be added. In order to illustrate their CO2 footprint, various insulating materials, including PIR and Rockwool, were compared.

Lastly the chosen design case is a post-war school building built in 1955, which aligns with the studio's focus on a 20th century building.

In conclusion, the preliminary research and design have a good correlation with the two challenges that were mentioned in the graduation studio.

8.2 How did your research influence your design/recommendations and how did the design/recommendations influence your research?

8.2.1 Relation between design and research

The prior research done before P2 was useful to help identify interventions belonging to the three key features: interior building fabric, exterior building fabric, and function. During the preliminary research, a general research and an in-depth research was done. The general research was a broad research on ten cases that resulted into these cases being classified as "Repurpose", "Regenerate" "Restructure" or "Restore". Furthermore, the general research also showed the most common to the least common interventions and showed the typologies that have been realized. The results of the in-depth research together with the general comparative research have shown the impact the interior building fabric has. This led to the design taking a repurpose approach. From the general comparative case study, the repurpose approach resulted into three typologies being created, therefore this prior research led to these three typologies to be tested in the design.

The research influences the design recommendation by showing which variants for the three typologies are the most resourceful (based on calculations) and which one is best suited when it comes to livability. These factors helped with the choice of the best suitable options.

Livability however is a broad term, and the importance differs per dwelling that has been designed (Mantingh et al, 2021; Raadsinformatie Den Haag, 2011). For example, the entresol dwelling realized in the north block faces a problem, specifically, the lack of lighting and the connection with the outside. These two aspects are important when creating a livable dwelling, but due to this, a not so common dwelling quality is created. For example, to deal with the lack of lighting, the design uses skylights to allow light to enter the middle of the building, and glass on the floor to let light from the first floor to seep though from the walls to the ground floor. However, when it comes to the south block the livability focus is set on connection with the residents and creating semi-private areas, due to the big windows that phase the outside.

When it comes to the problem statement, on one side the less recourses added the better the building contributes to greenhouse effect, but on the other side livability has to be created in dwellings that is different than the quality in schools. Such as the livability quality in creating privacy and more daylight. Schools and dwellings have a difference in quality mostly the difference between the relationship between the inside and outside.

When it comes to the scores on achieving a livable quality by making a good floor plan, the northblock scored lower due to difficulties with the existing envelope, while for the southblock achieving livability was easier due to the existing envelope already having qualities that can be used for a dwelling. In the southblock more was able to fit in the existing envelope, so living quality was easier to achieve.

The design eventually influenced my research because it showed that other factors are important relating to the choosing of a variant. This means that the variant with the least

resources is not automatically the most suitable option. Also, the comprehensive effects of each intervention in terms of volume and CO2 footprints across each typology were also demonstrated in the design phase, which were not able to be investigated in the preliminary P2 research. These effects can also be applicable to other school buildings that are being transformed into maisonettes, studios, apartments and entresols.

The calculated percentages for the added and removed materials were calculated after the making of the floorplans, because the floorplans were first designed based on creating livable quality. After the creating of different livable qualities, various variants were realized and then calculated how much added and removed materials there is based on various design choices. Even though the added and removed scores of the maisonettes were similar, small differences were seen in the added walls and insulation, which resulted into the preferred floorplan based of better livable quality to be slightly a lower number then the other not preferred variant.

8.2.2 Comparing the added and removed materials from the design case Rendorpschool with the research case Amundsenhof

When comparing the added and removed volumes of Rendorpschool with the research case Amundsenhof, one must note that the volume percentages of Amundsenhof are from the whole building, while for Rendorpschool the percentages are based on the different typologies (figure 59). One can conclude that the total added percentage for the maisonettes of Rendorpschool is 44,5% which is lower than the 65% in Amundsenhof, and for the removed volumes of 10,06 also lower than the 18,27 % in Amundsenhof. For the apartments there is also a lower added percentage of 54% compared to the 65% of Amundsenhof. This is mainly due to the lower added percentage on the exterior, since the insulation in de design case is added on the inside and not the outside. For the removed percentage there is also a lower percentage of 9% compared to the 18,27% in Amundsenhof, this is due to the greater number of walls removed in Amundsenhof. However, for the studios the added percentage of Rendorpschool is 62% which almost 65%, but the removed percentage of 14% is lower than the 18% of Amundsenhof.

On the other hand, both the entresol and library typologies have 101% and 91% of added materials and close to none removed materials. This is a significant difference with Amundsenhof and the other typologies due to the existing envelop of the gym being a bigger task to create livable quality, with the result of a lot of materials being added.

Furthermore, by looking at the average percentage of the Rendorpschool with all the units of each typology the total added percentage is 64% which is one% less than Amundsenhof, while the total removed percentage is 8% which is 10% less than Amundsenhof.

All and all even though the goal was to classify Rendorpschool as a repurpose approach, one can conclude that when looking at the typologies separate, the southblock with the maisonette, apartment, and studio typologies, was in ratio not so different then the regenerate approach visible in Amundsenhof, due to the additional building of Amundsenhof not being calculated.

However, for the northblock due to extreme amounts of added materials the northblock could be classified as regenerate. Lastly the total added percentage of the Rendorpschool is like the Amundsenhof, while the removed percentage is way lower, and due to the Amundsenhof calculation not including the additional new building, Rendorpschool can indeed be classified as a Repurpose approach. Also, in the case of Rendorpschool all the removed materials are reused in the building, adding another reason for this school to be e repurpose approach. This also means that even though the exterior is preserved as much as possible, the interior is still modified making the southblock of the Rendorpschool in grid position 2-3 on the horizontal axis.

Case/ typology	Interior Added	Interior Removed	Exterior Added	Exterior Removed
case 5: Amundsenhof	+50,32%	-17,94%	+14,61%	-0,33%
Design case: Rendorpschool				
Maisonette	+42,04%	-7,99%	+2,45%	-2,07%
Apartments	+51,12 %	-6,8%	+3,04%	-2,27%
Studios	+58,72 %	-10,59 %	+3,58%	-3,3%
Entresols	+98,92 %	-0%	+1,89%	+1,89%
Library	+89,81%	-0%	+1,57 %	-1,39%
Average of the whole of Rendorpschool	+62%	-5,7%	+2,6%	-2,2%

Figure 59 - Summary added and removed materials in percentages of research case 5 Amundsenhof and the design case Rendorpschool.

8.3 How do you assess the value of your way of working (your approach, your used methods, used methodology)?

8.3.1 Preliminary research

For the preliminary research done before P2 the general comparative case study was done on solely ten cases and could be even more valuable if expended with a larger amount. However, even with only ten cases, the case study research did bring insight in the types of interventions that are done in school transformations. Furthermore, this comparative case study also showed the dwelling typologies that are used, and that even with all cases being monuments, interventions must be made to qualify with the housing protocols given by the Netherlands. Also, for the in-depth preliminary research, the "black/yellow/red" method was used on solely one case, which represents one scenario. This led to the design to work more with scenarios and variants, and by applying this "black/yellow/red" method, the differences between the typologies became visible. Therefore, not only could the prior research be more valuable, but the design also made this prior research more valuable.

Regarding the research through design part, it can be concluded that the approach, methods and methodology used are quite valuable. Because next to looking at the three typologies, also variants of these three typologies were looked at. The "black/yellow/red" method was used when making these variants in combination with the livability and resourcefulness. This method also helped with visualizing all the removed and added parts. However, it also helped with the classification of the building fabric layers to help with further calculations.

8.3.2 Looking back to the table of cultural values of Rendorpschool

When it comes to the table of cultural values shown in figure 58 on page 111, the historic-artistic and historic-conceptual values were preserved as much as possible. The H-school Architecture style was kept by preserving the existing envelope including staircases, and only adding some doors to access newly constructed balconies. The balconies that were now included into the new design are not directly attached to the existing structure but are a separate wooden structure. The low parapets, brick façade, saddle rood, stout chimney were also attributes that were preserved. Reusing the removed interior brick material will allow it to remain in the Rendorpschool's lifetime, as brick is a distinctive feature of the H-school. Even though from the inside the brick wall was no longer seen, the original look was mimicked with white brick strips. The concept of "licht and lucht" was also considered in the architecture, as demonstrated by the preservation of large windows and the addition of ventilation grills to provide ventilation type C for the dwellings.

Additionally, large classroom areas were preserved wherever possible, such as the ground floor of the maisonettes. Also retained were the original window closure mechanisms. However, the inside of the northblock was completely renovated to the original gymnasium because it was more difficult to provide lighting and a link to the exterior of the gym due to the gym's

envelope. As a result, the entresols' cultural significance was not entirely retained inside.

The courtyards with pavements serving as children's gathering places are another feature of the H-school. These courtyards were created with the intention of repurposing the pavements in novel ways, so generating an area for interaction among the building's new occupants. Originally intended to serve as an outdoor classroom, the middle courtyard had a special and practical purpose. By designing a wadi that will fulfill a special and practical purpose for the building's current use, this idea was also maintained. In addition, this wadi fulfills a deviant purpose in contrast to the square, playgrounds, and additional green space in the other courtyards.

Since urban planning was also mentioned to be of great value, the building's shape and school's significance as a neighborhood center were preserved by not modifying the building block. The verdancy of trees, front gardens, courtyards, and parks are other attributes that have been highlighted as valuable. The square and parks have been extended to the Rendorpschool courtyards in order to preserve the school as a neighborhood center. Subsequently, front gardens for the dwellings and additional greenery were added to these expanded courtyards.

Finally, the existing attributes, such as the colors of the window frames and parapets, were preserved as much as possible in order to preserve aesthetic values, which are composed of conceptual and evidential values. The addition of the balcony on its own separate structure preserved the school's structure as well. Nonetheless, compromises were made by modifying the windows' horizontal lines to give the new residents a human-scale connection to the outside. The addition of balconies, which were necessary to create outdoor space for first-floor dwellings, was yet another compromise. Overall, when designing, the cultural significance was carefully considered and preserved as much as possible. However, where compromises were necessary to create livable space, the aesthetic values and attributes were mimicked.

8.3.3 Further understanding on the "how and why"

Understanding how to conduct this research posed challenges, mainly because of the limited research and literature on transforming schools into houses. However, this lack of information has led to a comparative case study to be done to fill in this gap. Secondly, when it came to the in-depth research it was complex to try to find a method or a way to broaden the subjective classification method of Ibelings and Diederendirrix (Ibelings & Diederendirrix, 2018). In the beginning when trying to do it their way, it was noticeable how positioning these cases on the axes require more knowledge of these cases. So, with some weeks of thinking and redefining the definition given by Ibelings and Diederendirrix a more scientifically way of classifying cases was developed (figures 42, 43, and 44 on page 82 and 83). This eventually led in combination with the conclusions of the in-depth research to a design project.

The "how" of the design project in the beginning was quite understandable, but as the weeks passed questions arose such as "how will livability in the floor plans be visualized and created".

Therefore, the term livability in dwellings had to be understood and read about to help with designing. Adding the “black/yellow/red” method to each variant of each typology could show the actual impact of each intervention linked to these “livable” dwellings. Furthermore, the “why” was already clear from the beginning. It was known that the reason to do these variants and calculations were to not only see the impact of certain design choices per typology, but to assess the best suitable option and combination for the Rendorpschool.

Originally the idea was to only realize housing in the building, but site analyses in combination with the space dimensions and orientation led to certain spaces being transformed into public functions.

8.4 How do you assess the academic and societal value, scope and implication of your graduation project, including ethical aspects?

The objective of using these design intervention overviews done in the preliminary research is to determine whether they can serve as a new research and documentation tool for architects and researchers in the field of heritage and architecture. The school building interventions overviews may be useful for obtaining a concise, visual overview of all interventions and may serve as a starting point for evaluating the comparative qualities of the various interventions. It makes it simpler for designers to quickly understand what they are dealing with and a more effective way of communicating research.

This research does not only contribute to the societal impact of strategies to reuse a vacant building, but it can also contribute to other professionals having a tool to look at the interventions they can apply on school transformations into housing. Additionally, with the conclusions from the design phase, they can apply the results to their own school transformations and understand what impact their decisions have on the volume of the existing building and the impact on the environment. It can also help with choosing which typology to add to their building.

8.5 How do you assess the value of the transferability of your project results?

The theoretical framework developed by Ibelings and Diederendirrix was used in the research phase of this graduation project. To make this framework more academic and scientific, a grid and spectrum system was developed to assist in positioning the cases along the two axes. To improve the grid and spectrum system, the definitions provided by Ibelings and Diederendirrix were further expounded to ensure a clear and concise meaning of the features. Because this theoretical framework was made more objectively, it is possible to conclude that the overviews of interventions are applicable to other school buildings.

Furthermore, during the design phase, conclusions were reached regarding the impact of each typology (maisonette, apartment, studio, and entresol) on the building’s existing volume

as well as its environmental impact. This impact is visualized by showing the volumes added and removed in m3 and percentages, as well as the amount of CO2 that each building fabric layer could emit if used as a new material. The percentages were used to make it easier to compare the different typologies, and they can be used as a guideline for other architects when converting a school into housing.

Chapter 9: Personal Reflection

9.1 What skills did you acquire during this graduation project and in what way has the graduation project impacted your development as an architect?

During this graduation project a lot was learned in the preliminary research phase and in the design phase regarding the building heritage. Not only was knowledge acquired because of this being the first heritage course applied for, but also, heritage in general is a broad topic from which various valuable skills can be obtained that are of great value for a future architect.

In the Preliminary design phase, knowledge was gained on how to make research more scientific and how to create a clear and concise overview that can be used by others in the future. Therefore, beforehand, it was quite difficult to determine how this visualization would appear, but fortunately, it fell into place.

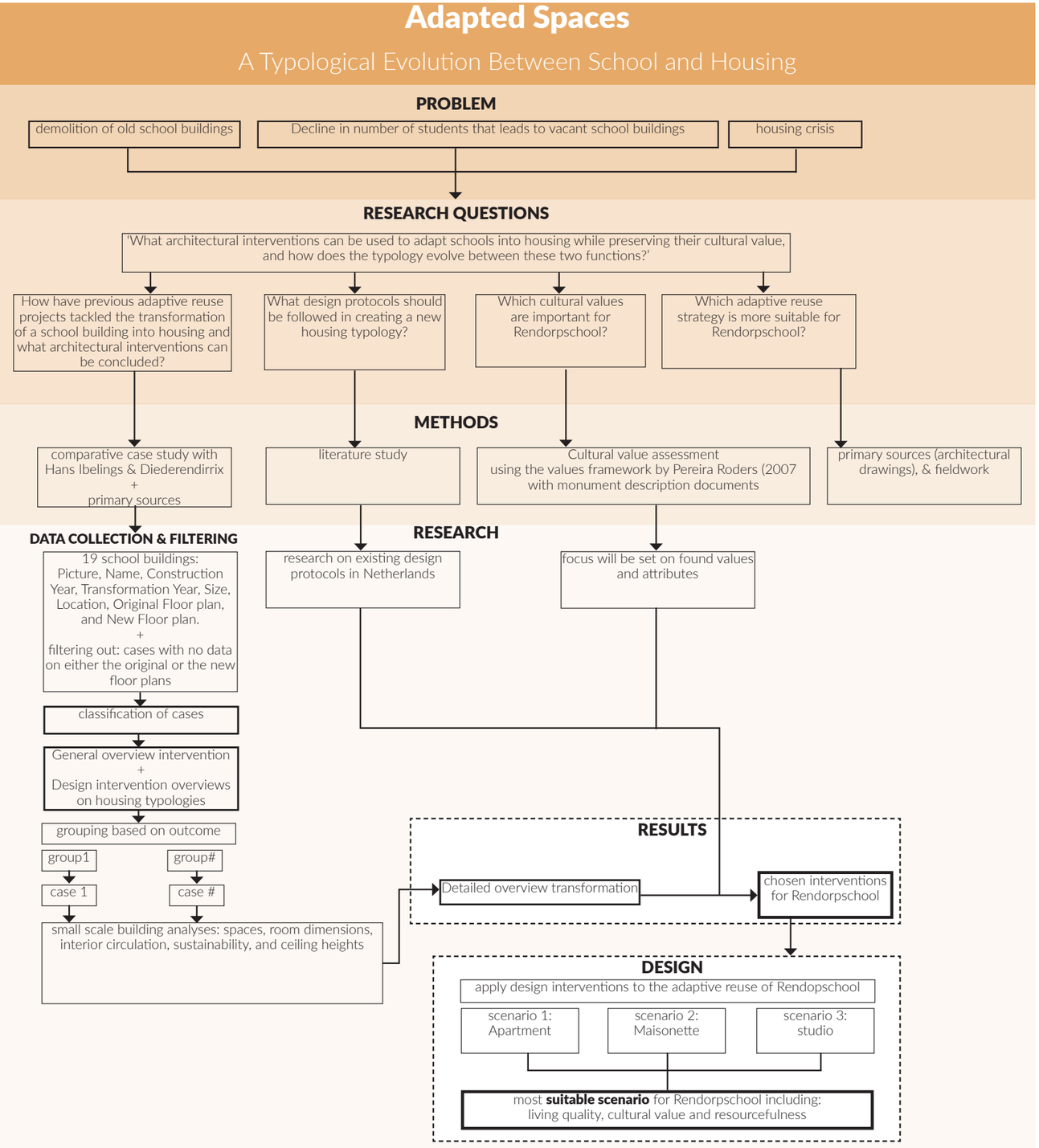
During the design phase, a significant amount of knowledge was acquired regarding the understanding of the historical significance of existing school buildings and their surrounding contexts, encompassing cultural, social, and urban factors. Additionally, familiarity with the feasibility of adaptive reuse options was gained through the exploration of variants and various typologies, facilitating the generation of creative design concepts that integrate the uniqueness of the Rendorpschool. Despite the functional requirements for the new residential use posing challenges, particularly in the gymnasium space where windows began at 2.5 meters, making it difficult to establish contact with the outside, valuable insights were obtained. Furthermore, substantial learning occurred in terms of sustainability and resourcefulness, focusing on reducing environmental impact and maximizing the utilization of existing materials and resources.

Lastly, by learning a new software instead of making all the plans in the usual utilized software Rhino, more software knowledge was obtained. The goal was to learn to work with AutoCAD to broaden the knowledge for future employment opportunities where such skills are needed in architectural firms. This objective was successfully realized between the P2 and P4 period.

All in all, these skills collectively contributed to my growth as an architect capable of re-imagining existing structures and spaces to meet the evolving needs of the communities while preserving architectural heritage and promoting sustainability.

Chapter 10: Appendices

Appendix 1 - Research process

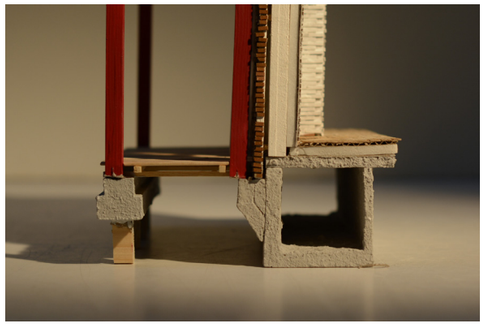


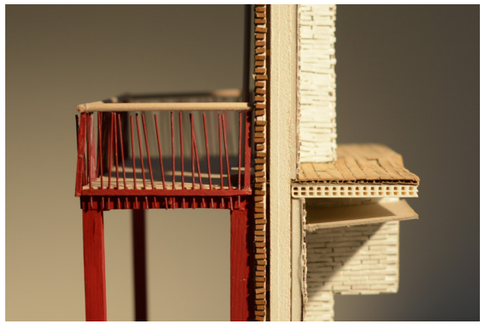
Appendix 2 - Pictures models

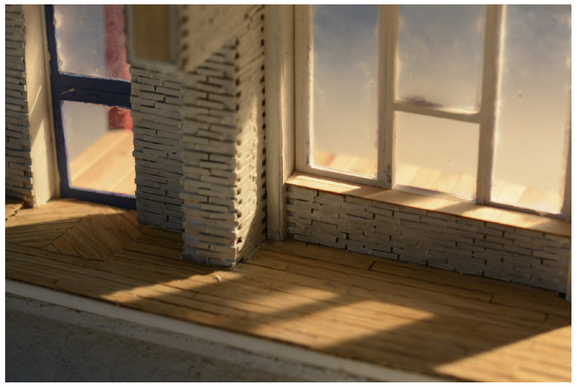
scale 1:50 North block entresol dwelling

scale 1:50 South block apartments type 1

scale 1:20 South block apartment type 1







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oMarge=-1&item_id=3365&selected_balkitem_id=531&UserQuery=

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Chapter 12: Figures list