LAYERS OF LEARNING:

timber topping-up as a framework for collective making and urban resilience

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Graduation Report

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Abstract

Amsterdam's housing shortage, combined with spatial, ecological, and heritage constraints, has increased interest in timber topping-up as a strategy for urban densification without demolition. While technically promising, most topping-up projects prioritise efficiency and market logic, often neglecting resident agency and long-term social resilience. This graduation project investigates how timber topping-up can function not only as a construction strategy, but as a socio-material framework for collective learning, participation, and adaptation.

Using a research-by-design approach, the project combines site analysis, policy review, precedent studies, and community input. Case studies are critically analysed to examine relationships between resident agency, adaptability, reversibility, and construction accessibility. These insights inform a design framework grounded in participatory timber construction.

Applied to a case study in Kattenburg, Amsterdam, the project proposes a 50% topping-up intervention that integrates new housing with shared and productive spaces. Through a modular, legible timber system that supports incremental change, the design demonstrates how topping-up can contribute to socially and climate-resilient urban transformation.

Keywords: timber; topping-up; participatory housing; resident agency; adaptable architecture; urban densification.

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1.0 Introduction

1.1 Problem statement

Amsterdam, like many European cities, is currently facing an acute housing shortage while simultaneously operating under increasing spatial, environmental, and regulatory constraints. In the Netherlands, housing demand has significantly outpaced supply for years, creating strong pressure for new forms of urban growth that avoid extensive land consumption and large-scale demolition. At the same time, the building sector plays a major role in climate change, accounting for a substantial share of global greenhouse gas emissions, with both operational and embodied emissions becoming increasingly relevant in contemporary debates (IPCC, 2022). Rather than continuing expansion through greenfield development, the transformation and intensification of existing urban fabric has become a critical strategy for sustainable urban development.

FIG 01. Housing protest in Amsterdam drawing attention to the housing crisis

Within this context, timber topping-up, understood as the addition of lightweight timber structures above existing buildings, has emerged as a promising architectural approach. By using existing structures as support systems, topping-up can increase housing supply while extending building lifespans and reducing material consumption associated with demolition and reconstruction. Moreover, timber systems have gained increasing attention due to their lower embodied carbon compared to conventional concrete and steel systems and their potential to store biogenic carbon (IPCC, 2022; Robati et al., 2022).

However, current topping-up practices often prioritise technical efficiency and market-oriented optimisation. Housing production frequently remains a top-down process where residents occupy spaces designed for them rather than actively participating in shaping them. Such approaches risk reproducing forms of urban development that increase housing quantity without necessarily strengthening social cohesion, local knowledge, or residents' capacity to adapt their environments over time. As argued by Turner (1976), housing should not merely be understood as a finished product but as a process through which people gain control over and meaning from their environments.

The central problem addressed in this research is therefore not only how to create additional housing capacity sustainably, but how urban densification through timber topping-up can become a mechanism that simultaneously supports social participation, collective agency, and long-term urban resilience.

1.2 Relevance

This research is relevant to both the architectural discipline and society because it addresses the interrelated challenges of environmental sustainability, housing provision, and social resilience. The construction sector is under increasing pressure to reduce its environmental impact while simultaneously responding to growing demands for housing in urban areas. Existing building stock represents a significant opportunity in this transition. Extending the lifespan and adaptive capacity of buildings through interventions such as topping-up aligns with circular approaches that prioritise retention and transformation over demolition and replacement (Lützkendorf & Balouktsi, 2022).

Timber construction has gained increasing recognition as a potentially lower-carbon alternative to conventional construction systems due to its reduced embodied emissions, capacity for carbon storage, and possibilities for prefabrication and dry assembly (IPCC, 2022). Beyond environmental considerations, lightweight timber systems can also reduce construction time, minimise disturbance to existing residents, and facilitate reversible or adaptable building strategies.

The relevance of this research extends beyond material performance alone. Contemporary urban conditions are characterised by increasing social fragmentation, housing precarity, and growing separation between users and the processes through which spaces are produced. Scholars such as Jane Jacobs (1961) argued that vibrant and resilient cities depend not solely on physical infrastructure, but on everyday social interactions, collective stewardship, and opportunities for participation. Likewise, Habraken (1972) challenged the notion of housing as a fixed and complete object, proposing instead systems that enable users to participate in shaping and adapting their environments over time.

By investigating timber topping-up as both a technical and social framework, this research contributes to discussions on how architecture can move from delivering spaces for residents toward creating frameworks through which residents actively participate in the ongoing production and transformation of their living environments.

1.3 Objective and Motivation

The objective of this research is to investigate how the spatial and constructive logic of timber topping-up can enable residents to learn, build, and meaningfully shape their domestic environments, contributing to more socially and climate-resilient urban futures. Rather than viewing topping-up merely as an architectural or structural operation, this research aims to understand how timber additions can become platforms for participation, adaptation, and collective stewardship over time.

My motivation for this research stems from a personal motivation to rethink architecture as a practice of mediation, not the imposition of form onto passive users, but the facilitation of relationships between bodies, materials, knowledge, and collective life. Historically, the figure of the *arkhitekton*[1] was not a distant author but a master builder embedded in the material act of construction, someone who coordinated labour, craftsmanship, and knowledge directly on site. The modern conception of the architect as we know today, as this distant figure of authority removed from the material processes of construction; emerged around two centuries ago, shaped by industrialization, academic formalization, and capitalist modes of production. Today, this distance often mirrors broader separations in power and knowledge, reinforcing hierarchies between design and labour, thought and matter, capital and community.

Recasting the architect as a mediator is not nostalgic but future-oriented. Self-building and participatory construction enable residents to gain knowledge, confidence and environmental literacy, strengthening the sense of identity and belonging.

Timber lightweight, modular, and reversible nature makes it well-suited for buildings that can evolve through cycles of addition, repair, and transformation. Timber systems can support replicable construction logics that allow residents to learn through making and modify spaces over time, aligning ecological and social resilience by enabling buildings and communities to change gradually rather than being replaced wholesale.

In summary, the motivation behind this research is to explore how timber topping-up can operate as a social and material infrastructure for agency, creating new ecologies of participation and care within cities.

1. arkhitekton from the ancient Greek: a compound of arkhi- (chief) and tekton (builder or carpenter) referring to a master builder who was intimately involved in the act of making.

1.4 Research and design question

Research question

How can timber topping-up empower communities to collectively **learn, build**, and shape more **socially** and **climate-resilient** cities?

Design question

How can the **spatial** and **constructive logic** of a timber topping-up enable residents to collectively participate in the **making** of their homes, learning through building while retaining the ability to modify and adapt the architecture over time?

1.5 Scope

This study focuses specifically on timber topping-up strategies within the Amsterdam metropolitan region, using the 50% topping-up approach as the principal framework for investigation. This strategy refers to interventions in which additional built volume expands vertically and partially laterally while relying on the structural capacity of existing buildings. Amsterdam provides an appropriate context due to its combination of housing pressure, large stock of post-war housing, and increasing interest in densification strategies that minimise land consumption and urban expansion.

The research investigates timber not solely as a structural material but as a constructive system whose characteristics, such as lightweight construction, modularity, reversibility, and ease of assembly, may support alternative forms of participation and adaptation. The study therefore prioritises the relationship between construction systems and social processes rather than solely evaluating technical performance.

Participation within this research is understood primarily through spatial and constructive dimensions: how architectural systems can enable residents to incrementally build, adapt, and transform their environments over time. Broader socioeconomic aspects, including financing mechanisms, governance structures, and comprehensive economic feasibility analyses, remain outside the scope of this investigation. Likewise, legal, historical, and policy contexts are addressed only insofar as they directly influence architectural decisions and the design process.

The intention of this delimitation is not to reduce the complexity of housing production, but rather to establish a focused architectural lens through which the interaction between material systems, spatial organisation, and collective agency can be explored and tested through a site-specific design proposal.

2.0 Approach

2.1 Methods

The process began with the selection of the site, guided by three primary criteria: personal motivation, historical and morphological relevance, and alignment with the 50% topping-up approach designated for this typology in Amsterdam. The Amsterdam municipality topping-up document was analysed to understand ongoing strategies and feasibility parameters for different building types and neighbourhoods. A site visit was then conducted to gain a first-hand impression of the neighbourhood and identify spatial, social and material cues that supported the choice of location; these were recorded through photographs and notes.

FIG 02. Overview of Amsterdam's central area

After initial tutor and peer feedback, the research expanded toward understanding local needs and desires. Housing associations active in the area were contacted, eventually resulting in a conversation with the representative of the Housing Association of renters of Kattenburg. A survey was subsequently developed (first in English, later translated into Dutch) and shared with a few residents, to collect perspectives regarding needs, aspirations and preferences. Insights from this exchanges revealed potential programmatic opportunities and pointed to the value of resident participation in shaping the design brief.

Case studies projects will be analysed to understand constructive logic, assembly principles and long-term adaptability. A comparative critical analysis of these case studies will be done to understand possible correlation and trade-offs between design principles, acting as a guide for the architectural design process.

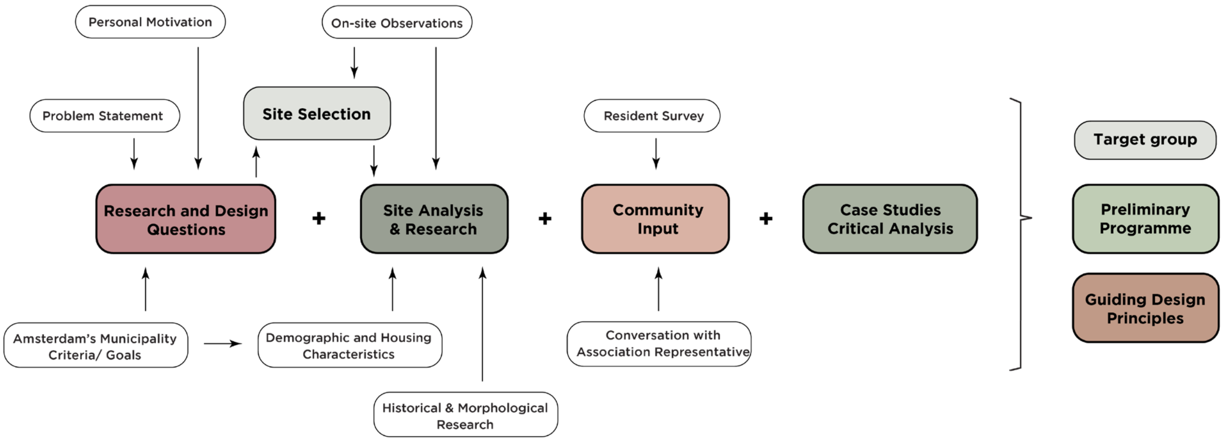


FIG 03. Methodological approach diagram

Based on historical analysis, initial site impressions, and early community feedback, first design iterations have begun. In parallel, the investigation of timber constructive systems that enable self-buildability, modular adaptability, and gradual transformation will be done. The findings from this technical research will feed directly into ongoing design iterations, creating a feedback loop between (a) spatial design explorations, and (b) constructive and structural strategies. Design development will therefore proceed dynamically rather than linearly, incorporating evolving information rather than treating research and design as separate phases.

Throughout the project, physical and digital modelling will be used to test joinery, modularity, structural dependency on the existing building and spatial usability. The overall method is therefore deliberately iterative, combining research with design in repeated cycles of testing, feedback and adjustment.

2.2 Theoretical framework

This project is grounded in two complementary theoretical positions that together frame topping-up as both a spatial and socio-material practice.

The first position draws on theories of architecture as mediation, which challenge the notion of the architect as a singular author and instead position architectural practice as a relational process. Within this framework, architecture operates as an interface between social actors, material systems, and ecological constraints. Topping-up is therefore understood not simply as a technical strategy for densification, but as a spatial negotiation that can redistribute agency, reconfigure power relations, and enable more just forms of urban transformation. This perspective aligns with discourses on spatial justice and participatory design, framing housing not as a finished product but as an evolving condition shaped through use, adaptation, and collective involvement.

A relevant body of knowledge for this research can be found in the *mutirão* movements in Brazil, which provide a concrete example of participatory and collectively organised housing production. *Mutirão* refers to a self-managed construction process in which future residents collectively build their own housing with technical support from architects and access to public funding. Beyond a construction method, *mutirão* operates as a political and social framework, rooted in collective organisation and often supported by militant forms of civic engagement.

What distinguishes mutirão from conventional housing production is that **it produces housing for direct use rather than market exchange**, fundamentally altering the relationship between inhabitants and the built environment. In this model, architecture is not delivered as a finished product but emerges through a process of negotiation, learning and shared labour. The resulting spaces often carry a different spatial and social **quality**, shaped by the needs, knowledge and agency of those who inhabit them.

The *mutirão* can be understood as an alliance between three main actors: architects, technical experts, and organised community members.

FIG 04. Mutirão actors diagram: relationship between community members, architects and technicians

This structure resonates strongly with the concept of architecture as mediation, where the architect's role shifts from author to facilitator of relationships between different forms of knowledge and action. The architect contributes technical expertise, but decisions are distributed across the collective, allowing design to evolve through participation rather than prescription.

Importantly, the *mutirões* challenges not only how housing is built, but also the underlying relations of production. It questions who controls resources, who produces space, and for whom architecture is made. In doing so, it reframes housing as a collective right and a shared process rather than a commodified product. This aligns with the project's interest in spatial justice, suggesting that the empowerment of residents is not only a social ambition but also a structural condition embedded in the design and construction process. a structural condition embedded in the design and construction process.

While the socio-political conditions of Brazil differ significantly from those of Amsterdam, the *mutirão* model offers transferable lessons regarding collective agency, learning through building, and the integration of design with construction practices. In this research, these lessons are not applied directly, but interpreted as principles that can inform the development of timber topping-up systems capable of supporting participation, adaptability, and long-term stewardship within a different context.

FIG 05. Collective self-construction process in Brazilian mutirão housing projects

The second position engages with research on adaptable, modular, and participatory timber construction, drawing from precedents in self-build housing, incremental growth models, and open-ended building systems. These studies foreground construction as a process rather than a fixed outcome, emphasizing legibility, reversibility, and the capacity for gradual transformation over time. Timber, in this context, is not only considered for its environmental performance, but also for its pedagogical and social potential: as a material that enables learning, repair, and modification by non-experts.

Together, these theoretical strands establish a critical lens through which the project is developed and evaluated. A successful topping-up intervention is thus defined not only by structural efficiency or environmental responsibility, but by its ability to mediate between permanence and change, expert knowledge and resident participation, and design intention and long-term appropriation.

3.0 Learning Through Building

3.1 Timber as a workable material

The possibility for residents to participate in the construction of their homes depends not only on social organization, but also on the material and constructive logic of the building system itself. Certain materials require specialized labour, heavy machinery, or irreversible construction processes, reinforcing a separation between professionals and inhabitants. Lightweight timber construction relative lightness, modularity, dry assembly, and compatibility with accessible hand and power tools make it particularly suitable for participatory and incremental forms of construction.

Timber construction can often be assembled through understandable and sequential operations such as measuring, cutting, screwing, insulating, and cladding. These processes can be learned progressively and carried out with limited construction experience. As a result, timber systems have historically been associated with self-build practices and adaptable forms of housing.

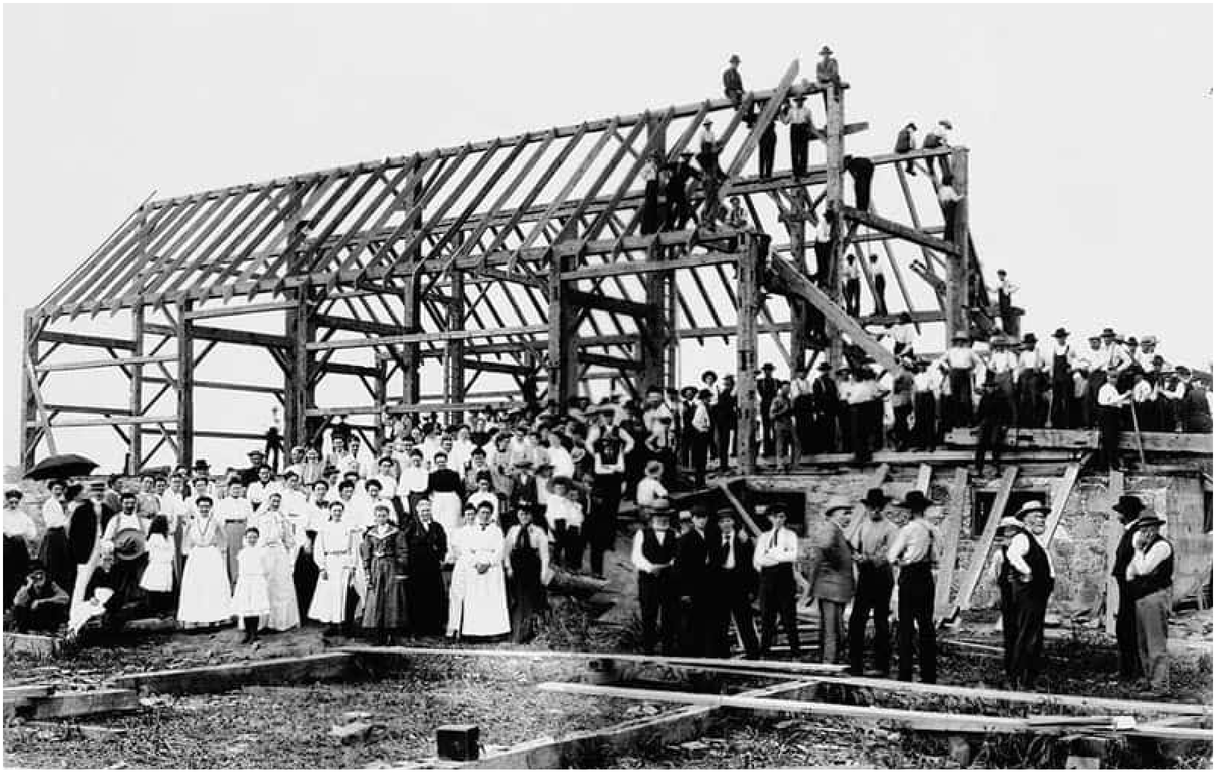


FIG 06. Collective timber construction of a barn in Ontario, Canada, during the 20th century

This relationship between timber and participation is clearly illustrated in the Segal self-build method, proposing a simplified timber construction system specifically intended for non-professionals. The method used standardized dimensions around commercially available timber sections, and relied on bolted and screwed connections capable of tolerating small inaccuracies during assembly (Segal, 2002). Rather than removing the architect's role, the system redefined it: the architect became responsible for designing supportive frameworks, dimensions, and rules that could enable participation without compromising safety or spatial quality.

The physical properties of timber further support this accessibility since, timber elements are generally lighter than equivalent concrete or masonry components, allowing smaller teams to transport and assemble elements with limited equipment. This becomes especially relevant in the context of this graduation project, where logistical constraints such as elevator dimensions and circulation widths influence the scale and handling of building components.

Timber construction is also compatible with reversible and adaptable forms of assembly. Mechanically fixed components can often be repaired, replaced, or upgraded more easily than monolithic systems. This aligns with Open Building approaches, where buildings are understood as layered systems capable of evolving over time (Habraken, 1972). Timber therefore supports an understanding of housing not as a fixed object, but as an adaptable framework that can accommodate change and resident participation over time.

3.2 Pedagogical value

Beyond its technical and environmental qualities, timber also possesses important pedagogical characteristics. Building with timber allows construction processes to become physically understandable through direct engagement with material, tools, joints, and assembly sequences. Knowledge emerges not only through drawings or instructions, but through making itself.

Architectural education has long recognized this pedagogical potential. Design-build studios and fabrication workshops frequently employ timber because of its accessibility, versatility, and manageable construction processes. According to Teaching with Wood, timber is particularly suited for educational environments because it enables experimentation at multiple scales while remaining relatively simple to handle and assemble (Peltokorpi & Heikkinen, 2024). Through handling timber components, participants can directly understand structural logic, tolerances, sequencing, and material behaviour.

In participatory housing contexts, this embodied form of learning becomes especially significant. When residents contribute to the construction of façades, partitions, or interior elements, they develop familiarity with the systems shaping their homes. This constructive literacy can increase the capacity for future maintenance, repair, and adaptation, reducing dependence on external expertise for minor modifications over time.

The educational potential of timber is reinforced by the visibility and legibility of its construction systems. Timber frames, joints, and layered assemblies often remain partially visible during and after construction, making the logic of assembly easier to comprehend. In contrast to concealed or monolithic systems, timber construction frequently reveals how elements are connected and organized.

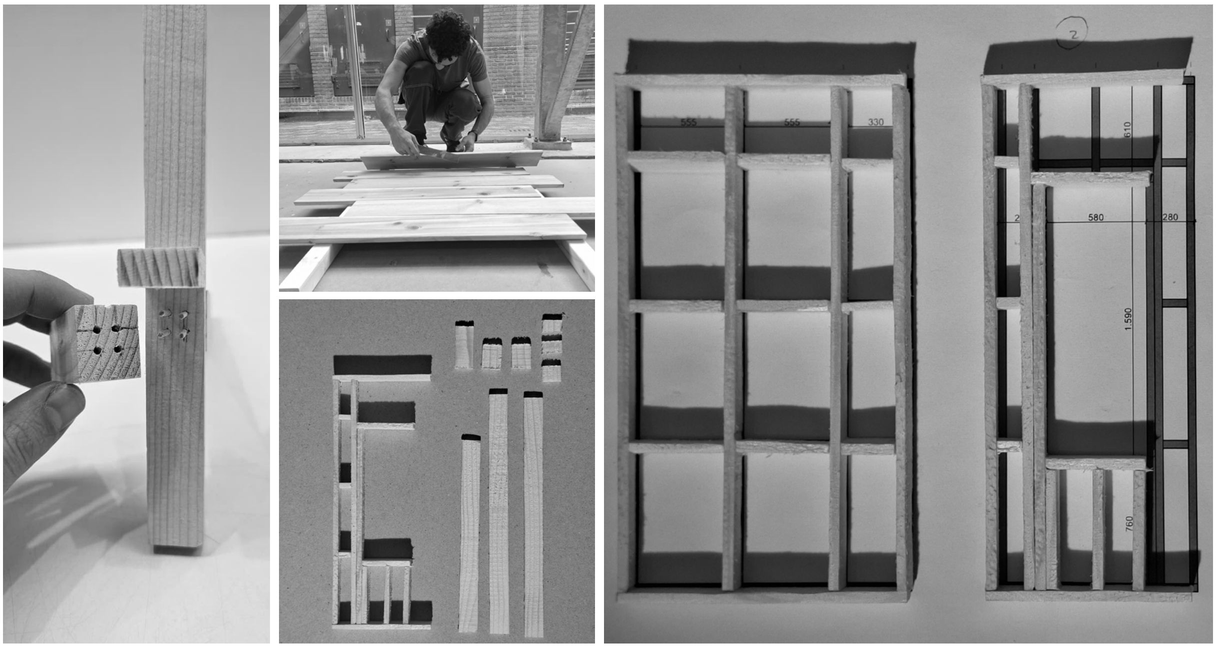


FIG 07. Development of physical models in different scales to understand construction/assembly process

Research on timber interiors also suggests that exposed wood surfaces may contribute positively to occupant wellbeing and comfort. Studies have associated timber environments with reduced stress responses and positive psychological effects, although these findings remain context-dependent (Burnard & Kutnar, 2015). Nevertheless, the tactile and visual qualities of timber can strengthen inhabitants' connection to their built environment.

Within this project, the proposed woodworking workshop extends this pedagogical dimension beyond construction itself. The workshop functions not only as a production space, but also as a collective learning infrastructure where residents can fabricate, repair, and adapt building components over time. Timber therefore becomes both the physical medium of construction and the medium through which technical knowledge circulates within the community.

3.3 Participatory Housing and Self-Build

Participatory and self-build housing models challenge conventional distinctions between architect, builder, and inhabitant. Rather than treating housing as a finished commodity delivered to passive users, these approaches understand dwelling as an ongoing process in which residents actively shape and transform their environment over time.

The degree to which participation becomes possible, however, depends heavily on the construction systems employed. Self-build housing requires systems capable of accommodating variation, learning, repair, and incremental adaptation. Timber construction is particularly compatible with these conditions due to its modular, layered, and relatively accessible nature.

Segal's system, for example, deliberately simplified construction through standardized dimensions and understandable assembly sequences, enabling people without formal training to engage in the building process (Segal, 2002). Participation therefore emerged not through the absence of design, but through carefully structured systems that lowered technical barriers.

Habraken (1972) argued that housing should distinguish between long-term collective supports and adaptable infill. In this view, architects define the durable structural and infrastructural systems, while residents retain the capacity to modify secondary elements according to changing needs over time.

Within this graduation project, participation is therefore understood as structured rather than total. Residents are not expected to construct the primary structure or specialized technical systems. Instead, participation focuses on lower-risk and adaptable layers such as façade modules, internal partitions, cladding systems, and finishes. The architect remains responsible for the structural framework and safety requirements, while residents engage with more accessible and modifiable components.

The project also draws inspiration from broader traditions of collective housing production, including the Brazilian mutirão movements, where future residents collectively participate in construction with technical support from architects and public institutions. In these cases, housing is understood not merely as a market commodity, but as a collectively produced social infrastructure. While materially different from lightweight timber construction, these precedents demonstrate how construction itself can become a process of learning, collective organization, and community formation.

Timber is therefore positioned within this research not only as a low-carbon material, but also as a social and pedagogical one. Its accessibility, adaptability, and legibility make it particularly suitable for housing models that seek to embed construction knowledge within communities and allow residents to actively participate in the ongoing transformation of their homes.

3.4 Identity and Appropriation

Housing is not experienced solely as shelter or infrastructure, but also as an extension of personal and collective identity. The ability to adapt, personalize, and appropriate domestic space plays an important role in how inhabitants develop emotional attachment and a sense of belonging toward their homes and communities. In many forms of standardized mass housing, however, opportunities for individual expression are often minimized in favour of efficiency, repetition, and control. As a result, residents frequently seek informal ways to personalize their environment through modifications to entrances, balconies, doors, plants, curtains, furniture, or decorative elements.

This tendency became particularly evident during site visits conducted as part of a previous design studio focused on circulation spaces in social housing for elderly residents. Despite the uniformity of the housing blocks, many residents had altered the area immediately surrounding their entrance doors through colours, signage, plants and ornaments. These small acts of personalization suggested an attempt to reclaim identity within otherwise repetitive collective environments. The threshold between the private dwelling and the shared corridor became an important space of expression and recognition.

FIG 08. Photos taken during a previous course ('bucky lab') excursion to elderly social housing projects

Such observations align with broader theories of housing appropriation and place attachment. According to Habraken (1972), inhabitants continuously adapt and transform their environment in order to align it with changing needs, lifestyles, and identities. Housing therefore cannot be understood as a static product, but rather as an evolving process shaped through use and inhabitation over time. Similarly, Turner (1976) argues that the value of housing lies not only in its physical form, but also in the degree of control inhabitants possess over decisions affecting their environment. The capacity to shape one's home contributes directly to autonomy, satisfaction, and identification with place.

Within participatory and self-build housing, this relationship becomes even stronger. When residents contribute physically to the making of their homes, architecture can become associated with memory, labour, and personal investment. Construction is no longer perceived as an external process carried out entirely by anonymous actors, but as something in which inhabitants actively participate. The dwelling therefore acquires both material and symbolic value beyond its market function.

This graduation project seeks to incorporate these ideas through a controlled yet adaptable façade system. Rather than delivering completely standardized façades, residents are able to configure portions of their dwelling envelope through a catalogue of components. Within predefined structural and environmental constraints, inhabitants may choose the arrangement of open, closed, or semi-open modules, as well as select among different cladding types, window configurations, and entrance elements. The intention is not to create unlimited individualization, but rather to allow forms of personal expression and appropriation within a coherent collective framework.

This capacity for adaptation extends beyond the façade itself and into the spatial organization of the dwelling. Residents are also given the possibility, within predefined rules and limits, to determine the relationship between indoor and outdoor space by defining the extent of their balconies, where a larger balcony area corresponds to a smaller enclosed dwelling area and vice versa. Similarly, the internal timber-frame partition system allows inhabitants to determine the internal spatial configuration according to their own needs, lifestyles, and household structures. Spaces can therefore be organized and modified over time according to changing family compositions, preferences, or future requirements. The project therefore shifts part of the architectural decision-making process from a fixed and predetermined outcome toward a framework where residents actively participate in shaping both the appearance and the spatial qualities of their homes.

This approach draws from Open Building principles, where long-term collective systems coexist with adaptable layers more directly controlled by inhabitants (Habraken, 1972). The façade becomes not only an environmental boundary, but also a medium through which residents express identity and establish attachment to place. Variation emerges through participation rather than through purely aesthetic differentiation imposed by the architect.

Customization can also contribute to social resilience by strengthening residents' emotional investment in their environment. Studies on place attachment suggest that environments allowing personalization and participation tend to support stronger feelings of belonging, stewardship, and community identification (Manzo & Perkins, 2006). In this sense, small acts of modification are not superficial aesthetic gestures, but mechanisms through which inhabitants establish agency and social connection within collective housing environments.

3.5 Collective Living Strategies

Collective housing is not defined solely by the presence of shared spaces, but by how architecture enables different forms of encounter, cooperation, privacy, and everyday interaction. Within cohousing and collective living models, shared facilities often operate as social infrastructures that support community formation through daily routines rather than through formal programmed activities alone.

Research on collective living highlights the importance of designing multiple socio-spatial scales within a community. Rather than organizing housing as a single homogeneous collective, successful cohousing projects often function through a hierarchy of more intimate and larger communal spaces, allowing residents to regulate different degrees of social interaction (Kuyper, 2025). In Centraal Wonen projects in the Netherlands, for example, communities are structured similarly to a "tree", where smaller groups branch into larger collective structures while maintaining horizontal social connections between them (Krabbendam, 2022, as cited in Kuyper, 2025). This multi-layered organization helps balance community and privacy while avoiding social isolation.

The design strategies explored in the collective living literature resonate strongly with the spatial organization proposed in this graduation project. Shared facilities such as the woodworking workshop, greenhouse, communal kitchen, laundry room, and shared terraces are distributed across different scales of interaction. Some spaces serve the entire community, while others relate more directly to smaller residential clusters. Rather than concentrating all communal functions into a single centralized room, the project creates a network of spaces capable of supporting both spontaneous and planned encounters.

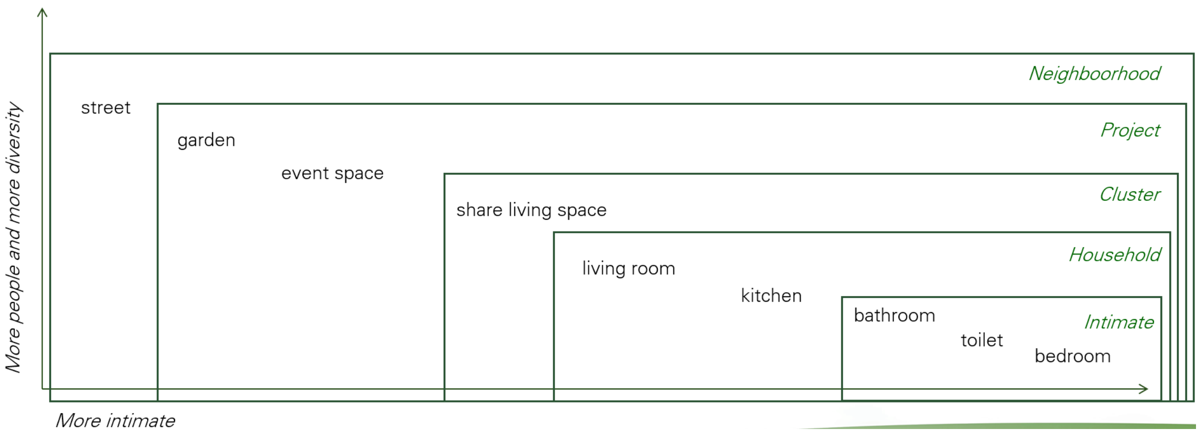


FIG 09. Hierarchy of socio-spatial scales in collective living environments

Particular attention is given to spaces connected to everyday domestic routines. According to Kuyper (2025), spaces associated with daily activities such as cooking, gardening, laundry, or informal work are especially effective in fostering repeated social interaction because they become integrated into residents' ordinary patterns of inhabitation. However, shared facilities only function successfully if they are genuinely attractive and useful. If residents already possess equivalent private amenities, collective spaces need to offer higher spatial quality, comfort, atmosphere, or social value in order to encourage use (Kuyper, 2025).

This idea directly informed the design of the communal terrace located on the upper corner of the building, where sunlight exposure is maximized. The greenhouse, shared kitchen, and collective outdoor spaces are conceived as desirable destinations rather than purely functional service areas. Environmental qualities such as sunlight, views, vegetation, and spatial generosity become important architectural tools in encouraging occupation and interaction. Kuyper (2025) similarly emphasizes the importance of designing for "sunny and shady spaces," arguing that environmental comfort strongly influences whether collective spaces become socially active.

At the same time, the literature repeatedly stresses that collective living requires a careful balance between social interaction and privacy. Privacy should not be understood as the absence of social contact, but rather as the ability to regulate access to oneself and one's group (Altman, 1972, as cited in Kuyper, 2025). Shared housing environments become socially successful not when interaction is imposed, but when residents maintain agency over participation. This balance becomes especially important in circulation spaces and transitional zones between the private dwelling and collective areas.

The project expands this collective logic beyond the residential scale through the redesign of the ground floor and the introduction of active plinths. New shops, coworking spaces, cafés, restaurants, and flexible event spaces create additional opportunities for social exchange not only among residents, but also between the building and the surrounding neighbourhood. Rather than functioning solely as an entrance or circulation layer, the ground floor becomes a socially productive interface capable of attracting different users and activities throughout the day. This introduces a broader socio-spatial scale of interaction, extending community life beyond the boundaries of the building itself.

Collective facilities within the project therefore support broader forms of resilience beyond housing efficiency alone. Spaces such as the woodworking workshop create opportunities for collective learning, skill-sharing, and participation in the ongoing transformation of the building, while publicly accessible functions on the ground floor strengthen connections with the wider urban context. Shared spaces are therefore not treated as secondary amenities added after the architectural concept, but as fundamental social infrastructures through which social bonds, mutual support networks, and community identity may gradually emerge over time.

The redesign of the ground floor also contributes to creating a more lively, active, and safer environment. A greater diversity of activities distributed throughout different times of the day increases occupation and visibility in public space, reducing the sense of anonymity often associated with inactive residential ground floors. By introducing everyday activities such as working, eating, shopping, and gathering, the project aims to encourage continuous presence and passive surveillance, reinforcing safety while contributing to a more vibrant neighbourhood life. This strategy aligns with Jacobs' (1961) argument that active streets with continuous occupation and a diversity of uses generate "eyes on the street," where the presence of people in everyday situations contributes to both perceived and actual safety within urban environments.

3.6 Housing, Aging and Social Connection

The growing aging population in Europe presents not only demographic and economic challenges, but also increasingly urgent social and spatial questions. Loneliness and social isolation among elderly people have become major public health concerns, particularly in societies where household sizes continue to decrease and aging increasingly occurs within individualized housing structures.

Across the European Union, approximately 30 million adults frequently experience loneliness, with elderly populations being among the most affected groups (European Commission, 2023). In the Netherlands, loneliness has become a particularly significant issue among older adults. According to Statistics Netherlands (CBS, 2024), nearly half of people over 75 report experiencing feelings of loneliness, while social isolation tends to increase as mobility, health conditions, and household networks change over time. Demographic projections suggest that these challenges will intensify in the coming decades as European populations continue to age and single-person households become increasingly common.

Although architecture alone cannot solve loneliness, spatial organization can either reinforce isolation or create conditions that support everyday social contact, mutual care, and informal community networks.

This graduation project introduces shared housing units specifically suited for elderly residents as part of a broader collective living strategy. The intention is not to institutionalize elderly housing, but rather to integrate aging within everyday communal life. Residents maintain private domestic spaces while benefiting from shared facilities and increased opportunities for spontaneous interaction through daily routines such as gardening, cooking, laundry, or workshop activities and events.

This model may also contribute to addressing broader housing pressures. In many European cities, large apartments are occupied by single elderly residents whose spatial needs have changed over time. Providing attractive shared living alternatives may allow these residents to remain socially connected while gradually freeing larger family-sized apartments within the existing housing stock. The project therefore approaches aging not only as an individual condition, but as a collective urban and housing question.

The integration of elderly shared living within a participatory timber topping-up project also strengthens intergenerational exchange. Shared facilities such as the greenhouse, terraces, and workshop create environments where residents of different ages may encounter one another through ordinary activities rather than through specialized social programs alone. Informal forms of care and support can emerge more naturally when social interaction becomes embedded within daily life.

In this sense, social resilience is understood as the capacity of communities to maintain social bonds, mutual support systems, and collective belonging over time. By combining collective facilities, shared living models, and opportunities for participation and appropriation, the project seeks to create a housing environment capable of supporting both social connection and individual autonomy in an aging society.

4.0 Case Studies

4.1 Villa Verde

ELEMENTAL / Alejandro Aravena | Constitución, Chile | 2017

The Villa Verde Project by ELEMENTAL, led by Alejandro Aravena, demonstrates how material choice and construction culture can be leveraged to support long-term adaptability and resident agency in social housing. The project is based on a timber frame construction system, using wood as a local, affordable, and widely understood material embedded in regional building practices. This choice ensures that future modifications can be carried out using familiar techniques, tools, and labor, lowering both economic and technical barriers to participation.

FIG 10. Villa Verde structural timber framework during construction

FIG 11. Completed Villa Verde housing units

The houses are delivered as intentionally incomplete structures, where the essential elements and services are provided, while significant portions of the dwelling remain unbuilt. This open-ended condition anticipates that residents will expand their homes over time, responding to changing household needs and financial capacities. These extensions often take the form of highly informal construction, carried out incrementally and using a variety of materials and methods.

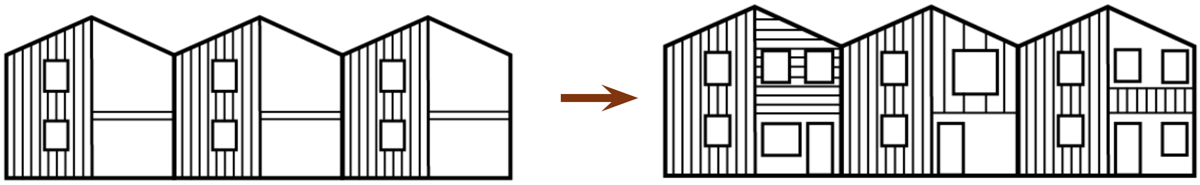


FIG 13. Incremental growth strategy of Villa Verde dwellings

Rather than resisting this informality, the project accommodates it within a clear structural logic that ensures collective coherence at the urban scale. The timber frame acts as a guide, defining where and how expansion can occur while allowing individual expression. Learning happens through building, and resilience emerges not from architectural control but from the ability of the housing system to absorb change. Villa Verde positions adaptability as a social and material process, deeply tied to local knowledge and everyday construction practices.

FIG 12. Resident-led expansion of Villa Verde housing units

4.2 Collegium Academicum

DGJ Architektur | Heidelberg, Germany | 2020

Collegium Academicum is a cooperative student housing project by DGJ Architektur that combines collective self-management with a highly rational timber construction system. The building is conceived as a low-rise structure of four storeys, a scale that allows efficient timber construction while remaining accessible and adaptable over time. Its primary structural system consists of a hybrid timber framework, in which a post-and-beam timber frame carries the main vertical loads, while cross-laminated timber (CLT) wall panels act as two-dimensional shear elements providing lateral stability. This separation between load-bearing structure and spatial subdivision enables a flexible floor plan, where non-load-bearing partitions can be added, removed, or repositioned without affecting the structural integrity of the building.

FIG 14. Collegium Academicum exterior view

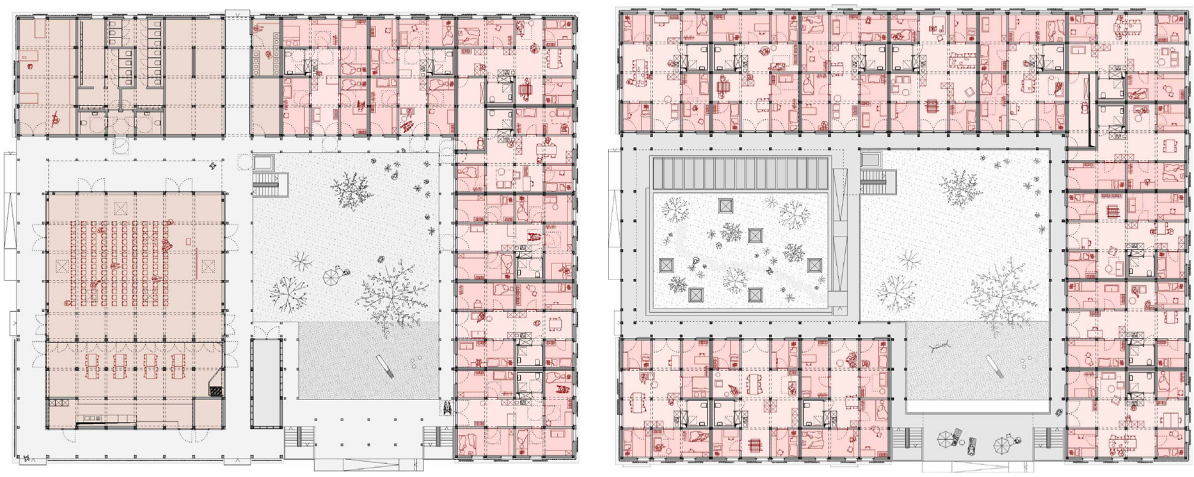


FIG 15. Ground floor and typical floor plans

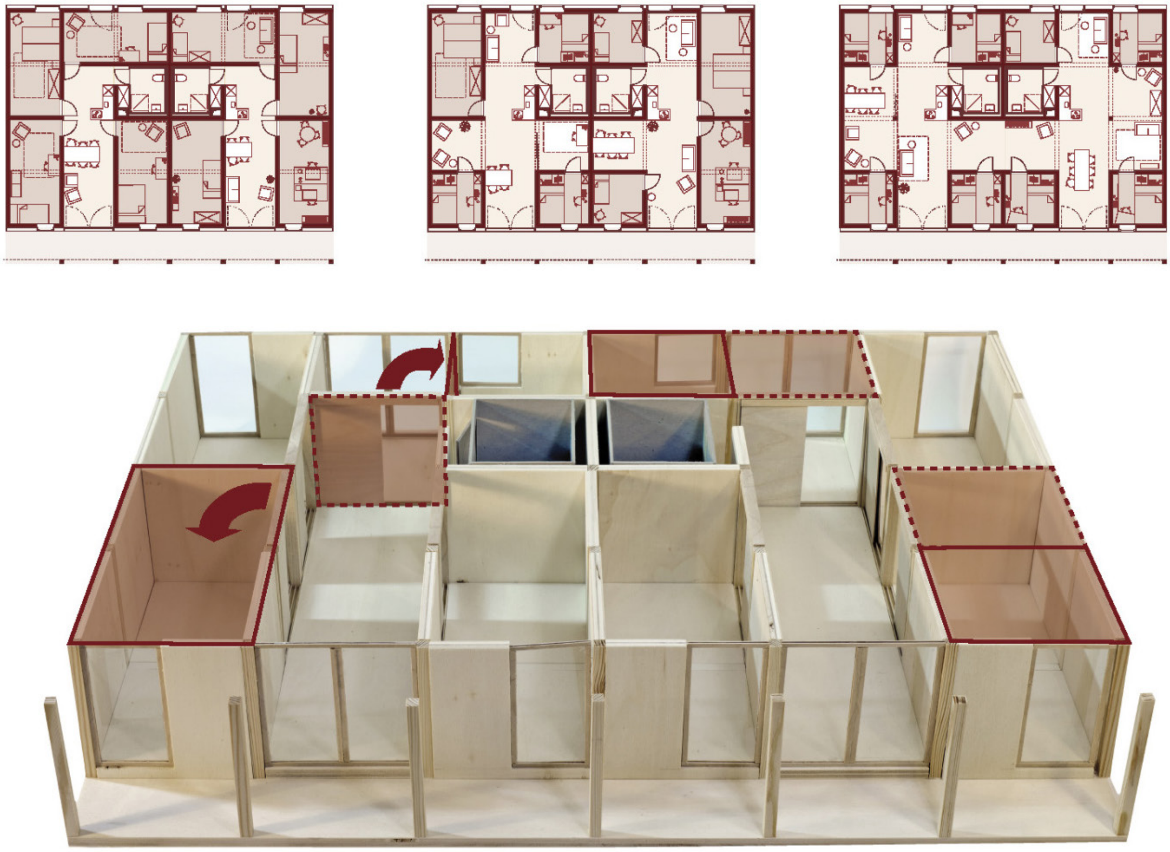


FIG 16. Adaptable apartment layouts and movable partition system

FIG 17. Exposed timber interior structure

Materially, the project makes extensive use of prefabricated timber components, including structural frames, CLT wall panels, ceilings, and façade elements. The building envelope is clad with timber façade panels integrated into prefabricated wall assemblies, combining low embodied carbon with long-term durability through careful detailing and protection against weathering. Internally, the exposed timber surfaces make the construction logic legible, reinforcing an understanding of the building as a system rather than a finished object. Timber is thus not only a sustainable material choice, but also a pedagogical tool, allowing residents to understand, maintain, and adapt their living environment.

FIG 18. Traditional timber joinery detail

The construction and assembly strategy further supports adaptability and long-term use. Major components were manufactured off-site and assembled on-site using traditional wood-to-wood carpentry joints, including form-fitting and friction-locked connections inspired by Japanese timber construction methods, minimizing the use of metallic fasteners. This approach supports design for disassembly, allowing elements to be separated, reused, or replaced at the end of the building's life cycle. Combined with modular layouts and movable internal partitions, the system enables continuous spatial adaptation as needs change.

FIG 19. Prefabricated timber structural assembly

4.3 Mach's doch selbst

BeL – Sozietät für Architektur BDA | Hamburg, Germany | 2013

Mach's doch selbst (Just do it yourself) by BeL – Sozietät für Architektur BDA proposes a radical redistribution of authorship by separating structural provision from spatial completion. The project is based on a steel frame structure that establishes the primary load-bearing system and regulatory compliance, while deliberately leaving the interior open for future inhabitation and transformation. This robust and neutral structural skeleton guarantees safety and durability, while creating a stable base for user-driven construction.

FIG 20. Mach's doch selbst during initial construction phase

FIG 21. Completed housing block

Within this framework, the architects provide a series of suggested floor plan configurations rather than a fixed layout, offering spatial guidance without enforcing a singular mode of living. The architects provide a sort of manual that specifies construction steps, materials (masonry in this case), and even the basic tools required, making the process more accessible to non-professional builders. In this way, learning is embedded directly into the architectural proposal.

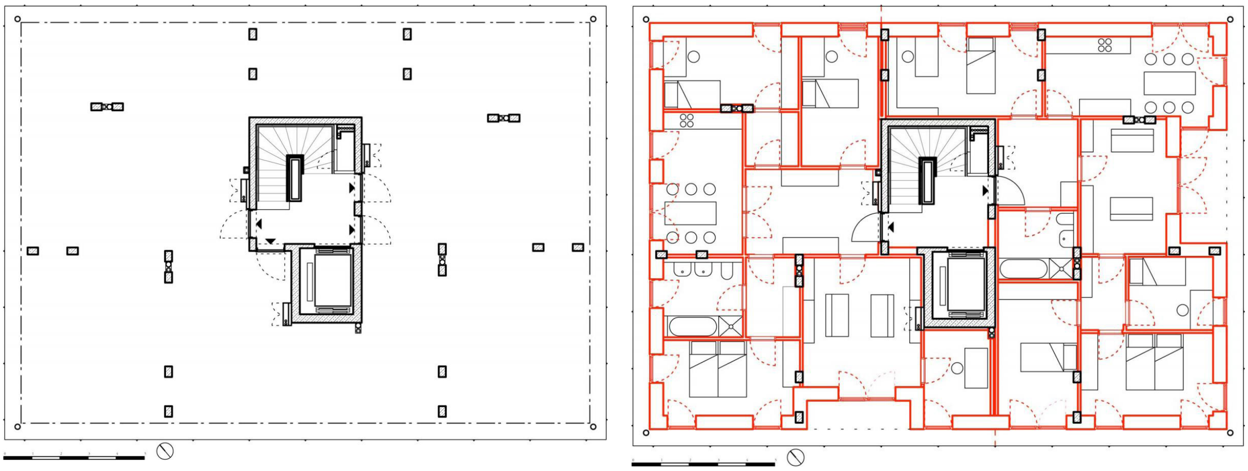


FIG 22. Open structural framework and example apartment layouts

FIG 23. Resident construction manual and infill system

Materially and conceptually, the project embraces imperfection and variation. The infill construction is expected to differ from unit to unit, reflecting individual skills, resources, and preferences, though each unit is responsible for providing its own energy performance certificate. Activism here operates through a clear division of responsibilities: the architect designs the system and its limits, while residents actively shape the spaces they inhabit. The building remains intentionally unfinished, positioning adaptability and collective learning as permanent conditions rather than temporary phases.

FIG 24. Possible façade variation scenarios over time

FIG 25. Completed apartment interior

4.4 De Warren

De Warren Wonerscoöperatie + Natrufied Architecture / GRO Architect | Amsterdam, The Netherlands | 2023

De Warren is a self-initiated and collectively developed housing cooperative in Amsterdam, realized through a long-term process led by its future residents in collaboration with Natrufied Architecture and GRO Architects. The project challenges conventional developer-led housing by positioning residents not only as users, but as clients, decision-makers, and co-producers throughout the entire process—from land acquisition and financing to design and long-term management.

The building is constructed primarily in cross-laminated timber (CLT), chosen for its low environmental impact, precision, and compatibility with prefabrication. The structural system combines load-bearing CLT walls with timber floor slabs, creating a clear and efficient construction logic. Prefabricated elements allowed for rapid on-site assembly while maintaining a high degree of accuracy. At the same time, the project integrates shared spaces—such as communal kitchens, workspaces, and circulation areas—that extend the domestic realm into a collective spatial infrastructure, reinforcing the social ambitions of the cooperative model.

FIG 26. Exterior and communal interior spaces of De Warren

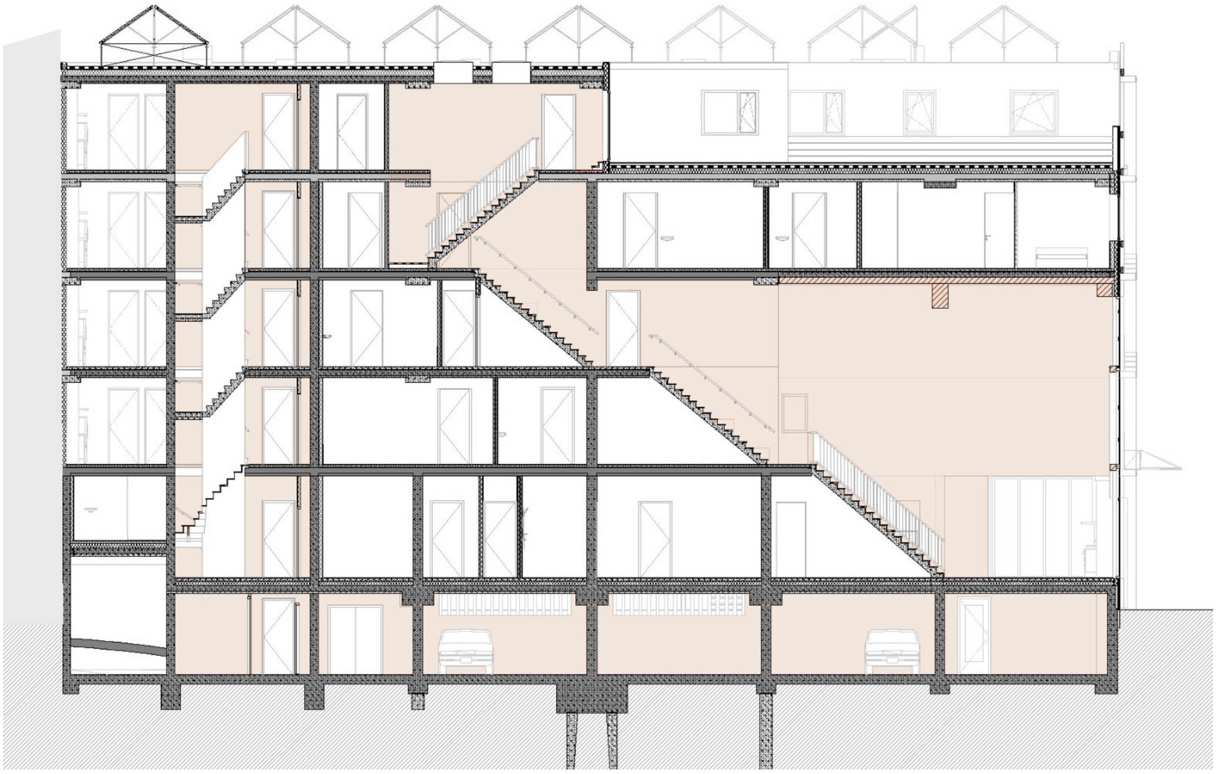


FIG 27. Building section and communal organisation

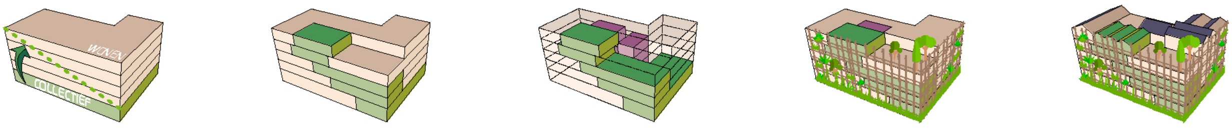


FIG 28. Development sequence of the cooperative project

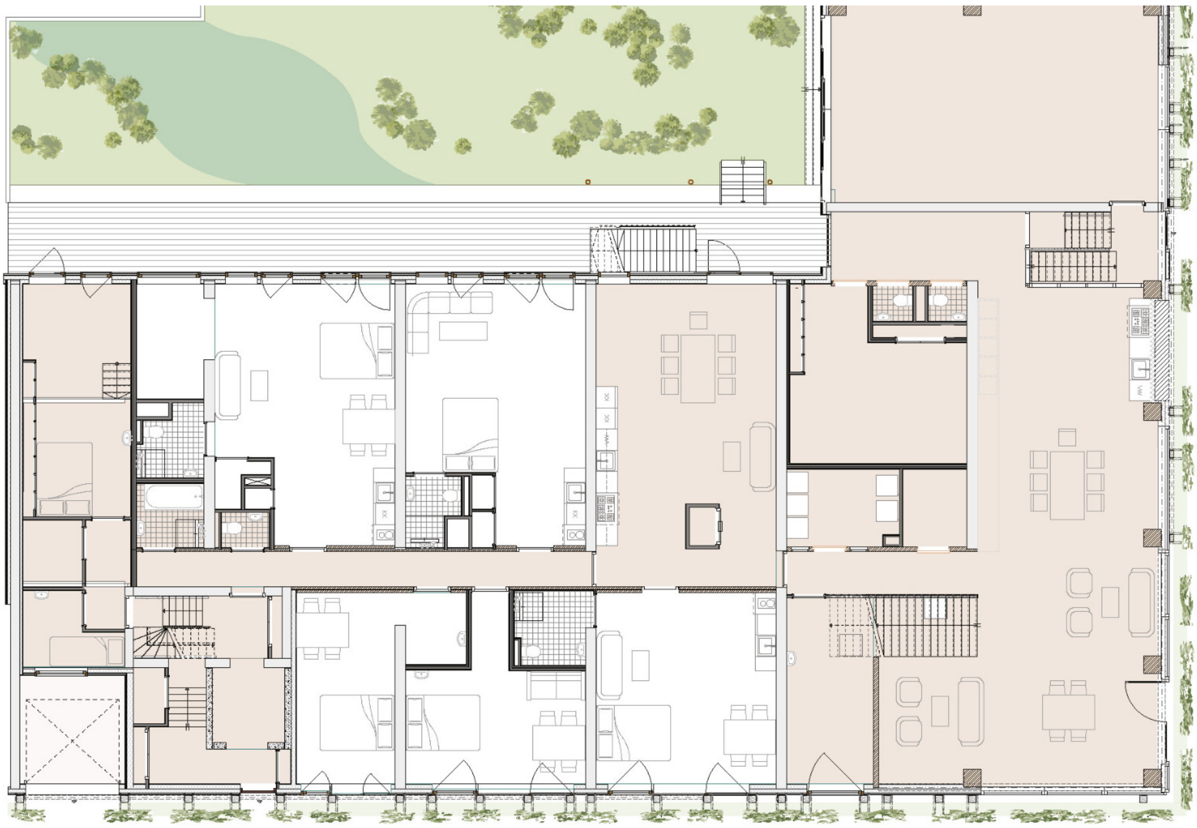


FIG 29. Ground floor plan showing shared facilities

While the building is formally resolved, adaptability is embedded through collective governance rather than physical incompleteness. Decisions about use, maintenance, and future modifications remain in the hands of residents, allowing the building to evolve socially over time. Activism in De Warren operates through process and ownership structures, demonstrating how architectural agency can be expanded beyond construction into financing, decision-making, and long-term stewardship, while timber construction provides a sustainable and legible structural framework.

FIG 30. Communal living room and shared interior spaces

FIG 31. De Warren within the surrounding urban context

4.5 Mutirão União da Juta

USINA CTAH | São Paulo, Brazil | 1990s

Mutirão União da Juta, developed with the technical assistance of USINA CTAH in São Paulo, is a landmark example of collective self-construction (mutirão) as both a social and architectural process. The project was built through the direct labor of future residents, organized as a cooperative effort in which participants contributed time and work in exchange for housing. Rather than separating design and construction, the process integrates them, turning building into a collective act of learning, negotiation, and empowerment.

FIG 32. Mutirão construction process

FIG 33. Residents participating in collective self-construction

The construction system is based on masonry and concrete, using locally available, low-cost materials and techniques that are accessible to non-professional builders. This material choice enables a high degree of participation, as residents can directly engage in the construction process using familiar tools and methods. The architecture emerges incrementally, shaped by available resources, collective decision-making, and on-site adaptation. As a result, the built environment reflects a high tolerance for variation, imperfection, and informal modification, with each dwelling evolving differently over time.

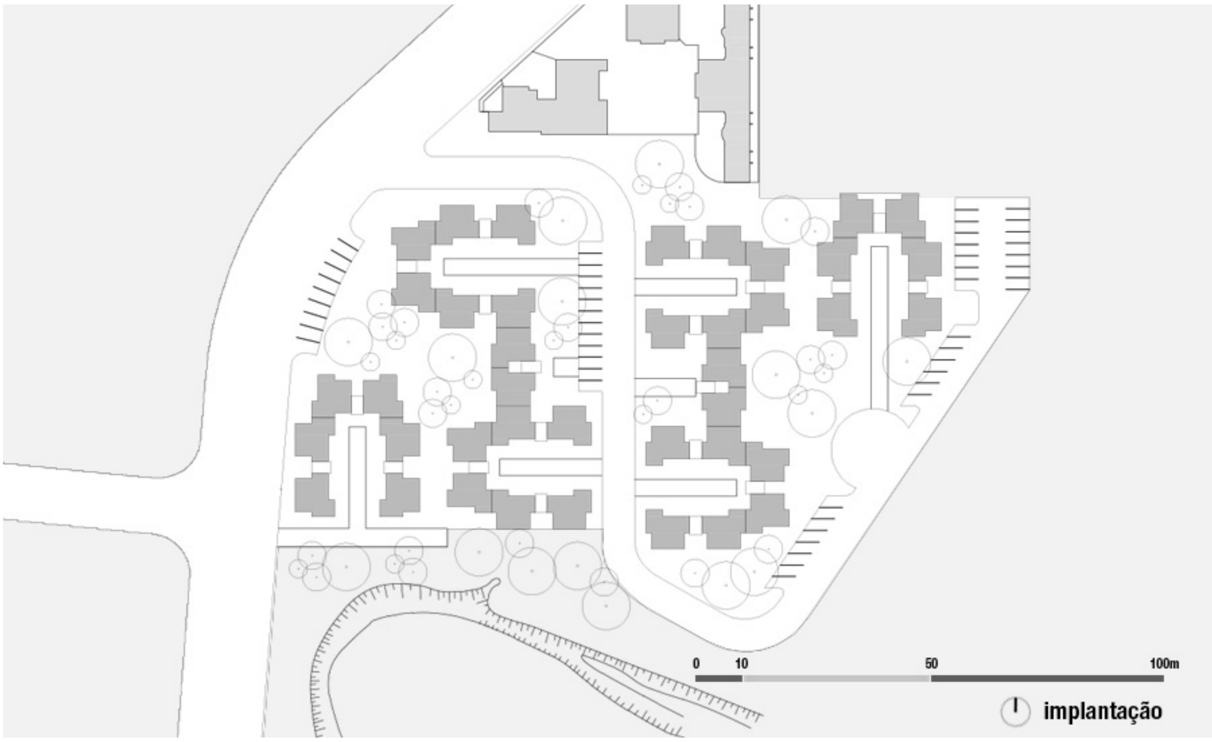


FIG 34. Housing block urban plan

FIG 35. Completed housing blocks

Rather than delivering a fixed architectural object, the project establishes a long-term process of inhabitation and transformation. Expansion, repair, and adaptation occur continuously, often without formal regulation, embedding resilience within everyday practices. Activism here is deeply rooted in self-organization and material accessibility, demonstrating how architecture can support collective agency not only through spatial design, but through the very act of building together under conditions of constraint.

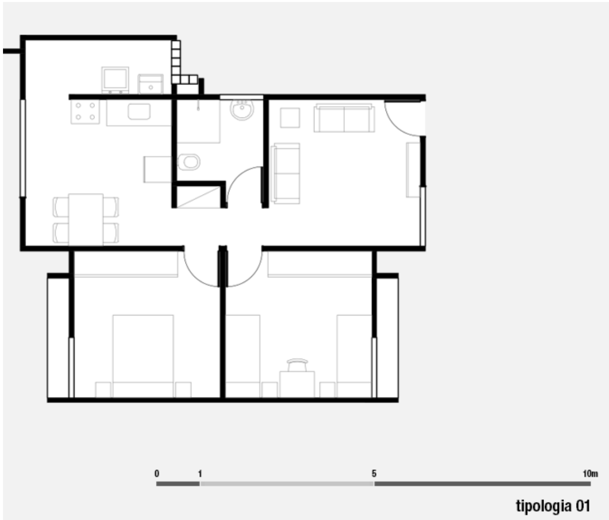


FIG 36. União da Juta's typology 1 floor plan

FIG 37. Collective housing environment

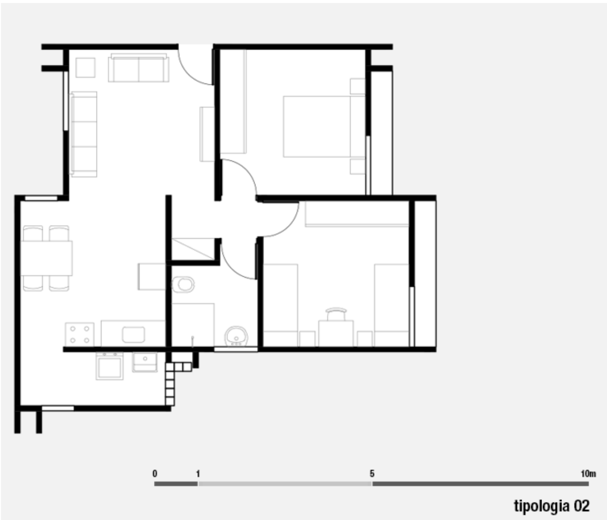


FIG 38. União da Juta's typology 2 floor plan

FIG 39. Shared outdoor spaces and circulation

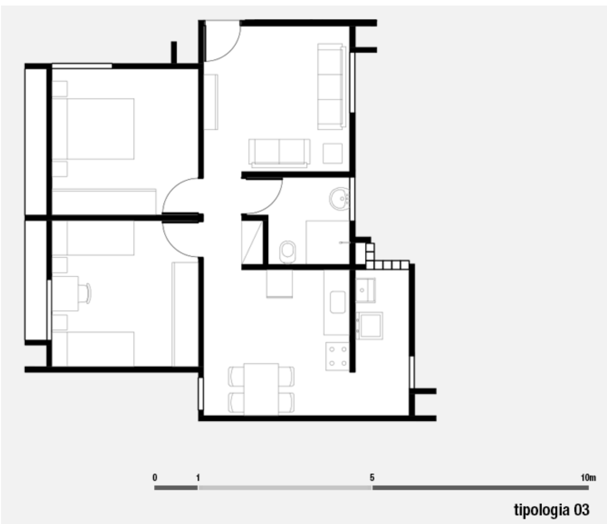


FIG 40. União da Juta's typology 3 floor plan

FIG 41. Vertical circulation staircase

4.6 Walter's Way

Walter Segal | London, United Kingdom | 1980s

Walter's Way, designed by Walter Segal in Lewisham, London, is a pioneering example of self-build housing enabled through an open and accessible timber construction system. Developed in collaboration with future residents, the project was initiated as a response to housing shortages, allowing participants, many without prior building experience, to construct their own homes. Segal's approach was based on a lightweight timber frame system, using standard, off-the-shelf materials and simple tools, eliminating the need for specialized labor or heavy machinery.

The construction method is defined by its clarity, modularity, and accessibility. Timber post-and-beam frames are assembled using dry connections, allowing for straightforward sequencing and on-site adjustments. The system avoids wet trades such as concrete or masonry, making it particularly suited for incremental, user-led construction. Detailed manuals and guidance were provided, enabling residents to learn through building, while maintaining a coherent structural logic across the project. As a result, construction becomes both a technical and educational process, embedding knowledge directly into the act of making.

FIG 42. Walter's Way self-build timber housing

Walter's Way demonstrates a high degree of resident agency, construction accessibility, and learning embedded in the process, while maintaining a relatively clear and consistent material system. Although the structural framework provides order, the infill and internal organization allow for variation and personalization. Over time, the houses have been adapted and extended, reflecting changing needs and individual preferences. The project illustrates how a carefully designed timber system can balance openness and coherence, enabling participation without losing structural legibility, and positioning architecture as a framework for long-term, user-driven transformation.

FIG 43. Resident participation in timber construction

FIG 44. Completed Walter's Way dwellings and later adaptations

4.7 Critical Analysis

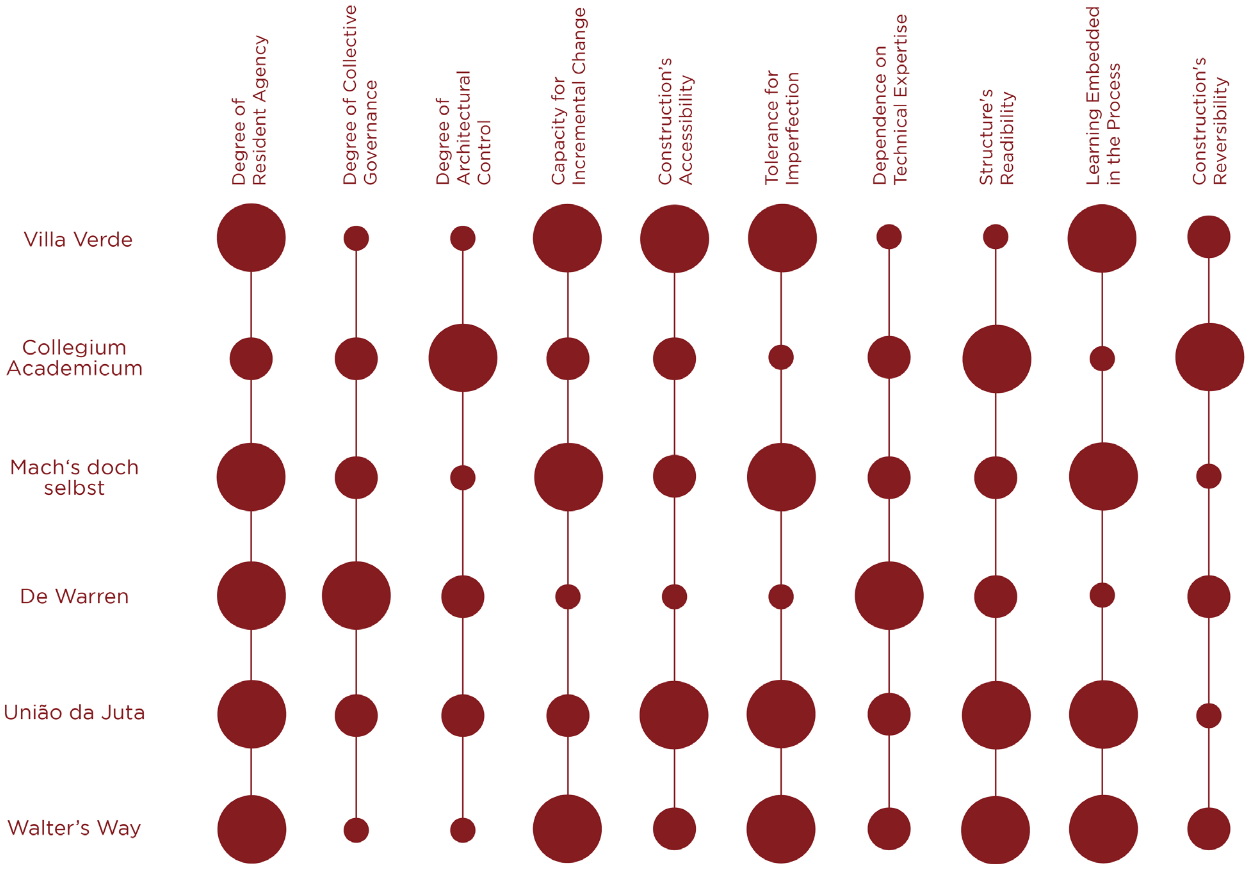


FIG 45. Comparative matrix across case study projects

Across the six case studies, the matrix reveals a strong correlation between degree of resident agency, construction accessibility, capacity for incremental change, and tolerance for imperfection. These criteria describe, respectively, how much control residents have over their environment, how easily non-experts can engage in construction, the extent to which the building can evolve over time, and how much deviation or informality the system can absorb. Projects such as *Villa Verde, Mach's doch selbst,* and *União da Juta* score highly across these dimensions, demonstrating how architecture can operate as an open-ended process rather than a fixed product. In these cases, housing is not delivered as complete, but as something to be extended, adapted, and learned through. Incremental change becomes a fundamental assumption, allowing dwellings to respond to shifting economic, social, and familial conditions.

In contrast, *Collegium Academicum*'s timber post-and-beam and CLT system, combined with prefabrication and precise joinery, allows for adaptability through movable partitions and modular elements, but within a consistent material and structural logic. This results in high construction reversibility and structural readability, meaning that components can be disassembled, reused, and clearly understood, yet also implies a higher degree of architectural control, where change is guided and limited by the system itself.

Within this group, important distinctions emerge. In *Villa Verde*, a timber frame structure provides a stable and legible base for expansion, while the actual extensions often occur through informal, self-built processes, resulting in high tolerance for imperfection but low reversibility. *Mach's doch selbst* operates similarly in its openness, but introduces a more structured approach through a steel frame system, suggested layouts, and a construction manual, which supports learning while still allowing variation. *União da Juta* represents the most extreme condition, where construction accessibility and bottom-up initiation are maximized: residents collectively build using simple masonry techniques, embedding learning directly into the process.

The degree of collective governance adds another layer to the analysis, shifting the focus from **how buildings are constructed** to **how they are initiated and managed over time.** These criteria distinguish projects like *De Warren* and *União da Juta*, where residents are not only builders but also clients, organizers, and long-term decision-makers. In *De Warren*, although construction is highly prefabricated and dependent on technical expertise, residents maintain strong agency through cooperative governance structures. This highlights a key distinction: **agency can be spatial and material, but also organizational and political**. In contrast, projects like *Villa Verde* demonstrate lower scores in governance, as participation occurs mainly after delivery, within a predefined framework.

A clear counter-pattern emerges between resident agency and construction reversibility. In projects where residents freely adapt and extend their homes using diverse materials and informal techniques, such as *Villa Verde, Mach's doch selbst* and *União da Juta*, interventions tend to become permanent and difficult to undo. Conversely, in projects like *Collegium Academicum* and, to some extent, *De Warren* and *Walter's Way* the use of coherent timber systems supports disassembly and long-term adaptability, but often requires higher technical expertise and introduces more constraints. This reveals the critical role of material choice: systems based on dry connections and uniform materials (such as timber) have a greater potential for reversibility, whereas mixed or wet construction systems tend toward permanence.

In projects like *Mach's doch selbst, União da Juta, Villa Verde* and *Walter's Way*, learning is explicit and hands-on, enabled by accessible materials and construction methods. In contrast, *De Warren* and *Collegium Academicum* embed learning more indirectly, through governance, maintenance, and spatial adaptation, while relying on professionalized construction systems.

This expanded analysis highlights that participation is not a singular condition but a spectrum, operating across **material, spatial, temporal, and organizational dimensions**. The matrix reveals not only correlations but also trade-offs: between openness and control, informality and reversibility, accessibility and precision. These relationships provide a critical framework for the design process, allowing informed decisions about where and how to position the project within this field of possibilities.

5.0 Site selection and analysis

5.1 Site research and visit

The decision to focus on Kattenburg emerged through a gradual narrowing of potential sites, guided by both policy analysis and spatial reading. As a first step, the Amsterdam municipality's topping-up policy document was analysed in order to understand which neighbourhoods and building typologies are currently considered feasible for vertical densification. This document outlines structural, morphological and regulatory parameters for topping-up across the city, identifying post-war housing blocks with flat roofs and repetitive structural grids as particularly suitable candidates. Through this analysis, Kattenburg stood out as a neighbourhood where the existing building stock aligns closely with the spatial and technical conditions required for a 50% topping-up strategy.

FIG 46. figure x. Overview of Amsterdam's central area

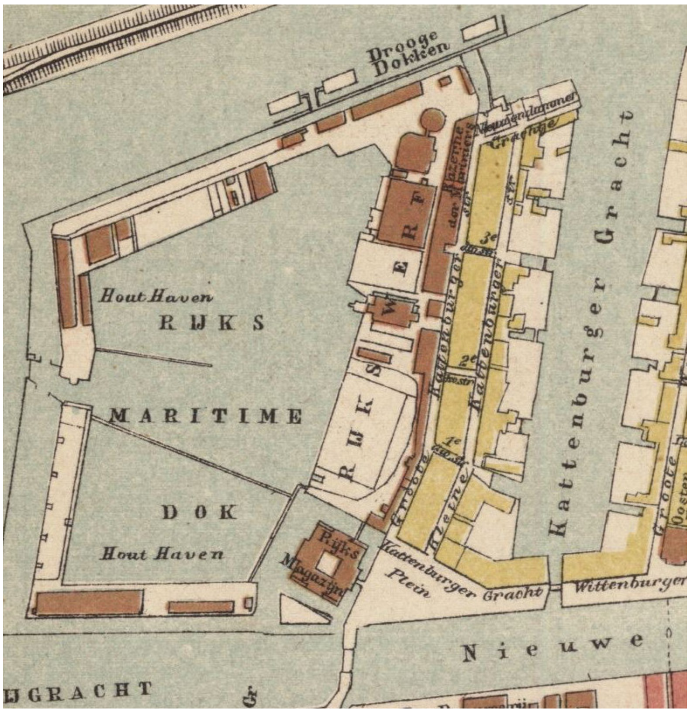


FIG 47. Historical map of Kattenburg from 1875

FIG 48. Historical photo of demolition in Kattenburg (1980s)

Preliminary urban analysis further highlighted Kattenburg's specific morphological condition. The large-scale demolition and reconstruction of the 1970s and 1980s resulted in a uniform residential fabric with limited programmatic diversity. This lack of mixed uses, already visible in maps and planning documents, suggested a neighbourhood that functions primarily as a dormitory rather than an active urban environment.

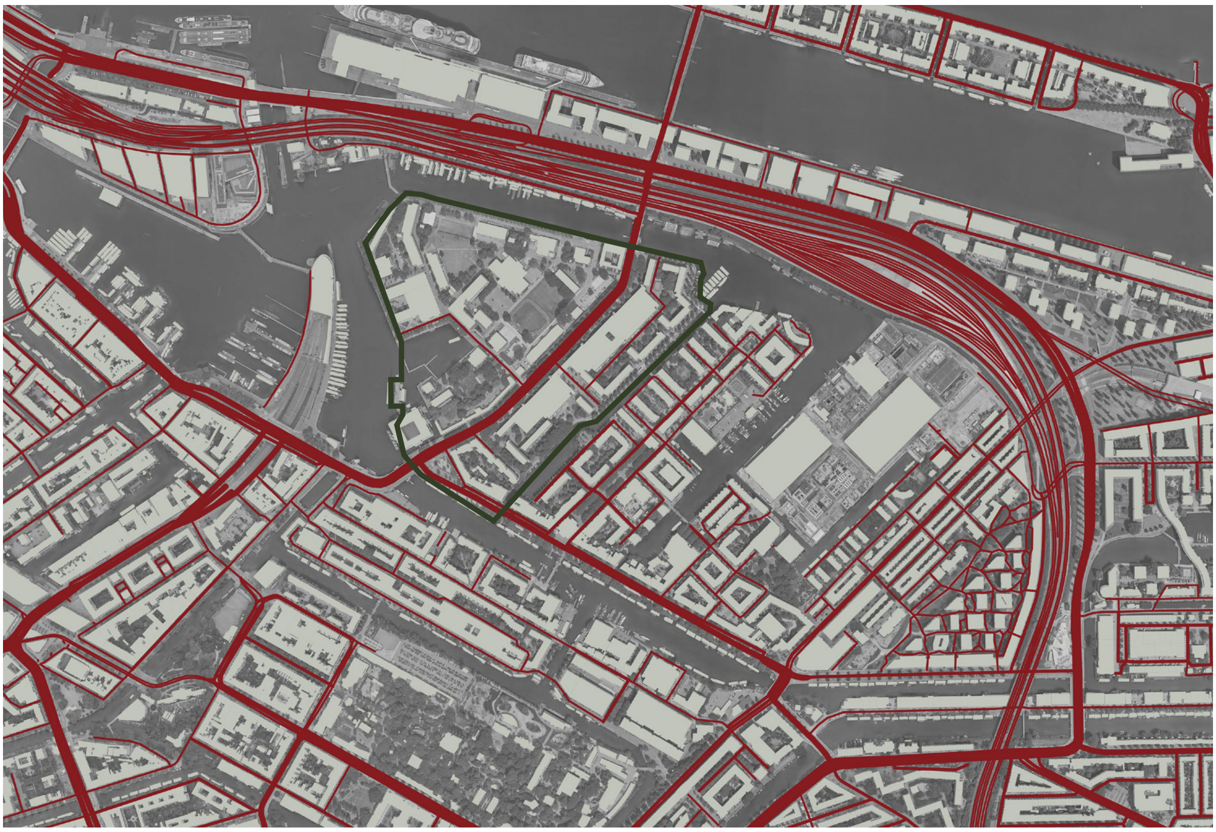


FIG 49. Overview of Kattemburg area

During a first site visit, these observations were confirmed. The absence of everyday amenities and active ground-floor programmes contributes to a sense of emptiness and reduced social intensity in the public realm.

At the same time, the visit revealed qualities that strengthened the potential of the neighbourhood. The extensive roof surfaces, the clearly legible building blocks and presence of existing green spaces provide a strong spatial basis for testing a topping-up strategy that could both densify and activate the area. Moreover, Kattenburg's history of collective organisation and housing activism suggests a social context in which resident involvement and co-creation are not only possible but historically grounded. Taken together, these factors positioned Kattenburg as an optimal location to critically access how a topping-up strategy can improve the life of current and future residents.

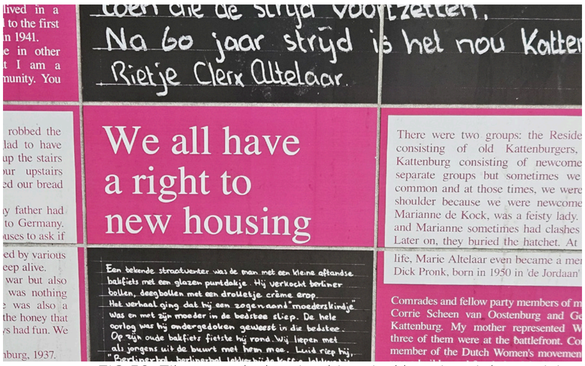


FIG 50. Tile artwork showing historical housing rights activism

FIG 51. Inactive ground-floor frontage

FIG 52. Existing green space within the neighbourhood

FIG 53. Waterfront condition and public space

FIG 54. Existing building chosen for intervention

FIG 55. Typical circulation galleries

FIG 56. Residential entrances and thresholds

FIG 57. View across the neighbourhood fabric

FIG 58. View of internal circulation galleries

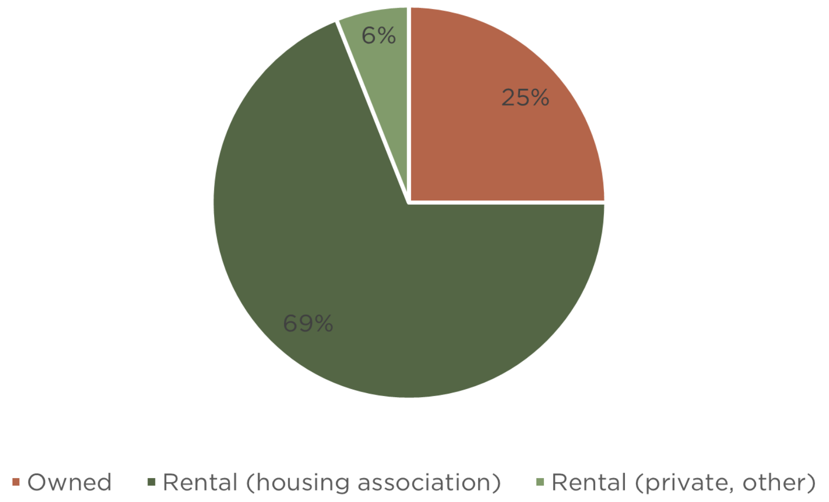
FIG 59. View of building's corner

5.2 Kattenburg profile

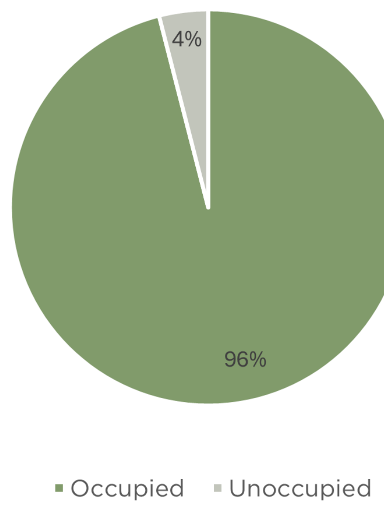
In order to get a deeper understanding of the neighbourhood, demographic and housing characteristics of Kattenburg were sourced. The residential fabric is predominantly defined by its 1970s–1980s "stempelstructuur" housing typology, characterised by repetitive structural systems and blocks of approximately five storeys.

Within this urban structure, the neighbourhood comprises around **785 homes** occupied by roughly **1,725 inhabitants**, reflecting a compact yet relatively low-density residential environment for an inner-city area. The graphs that follow illustrate various socio-spatial indicators that help frame the current conditions and dynamics of the site.

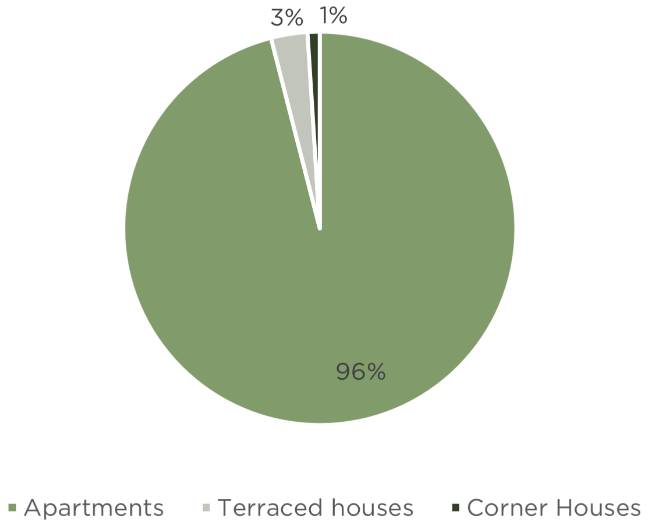
Ownership



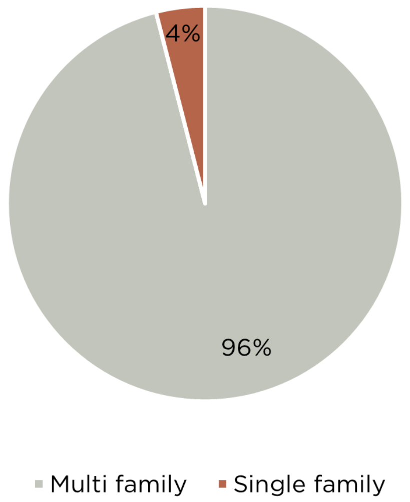
Occupation



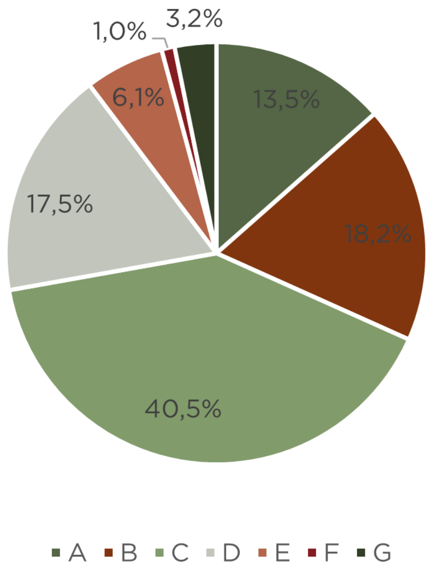
Type of housing



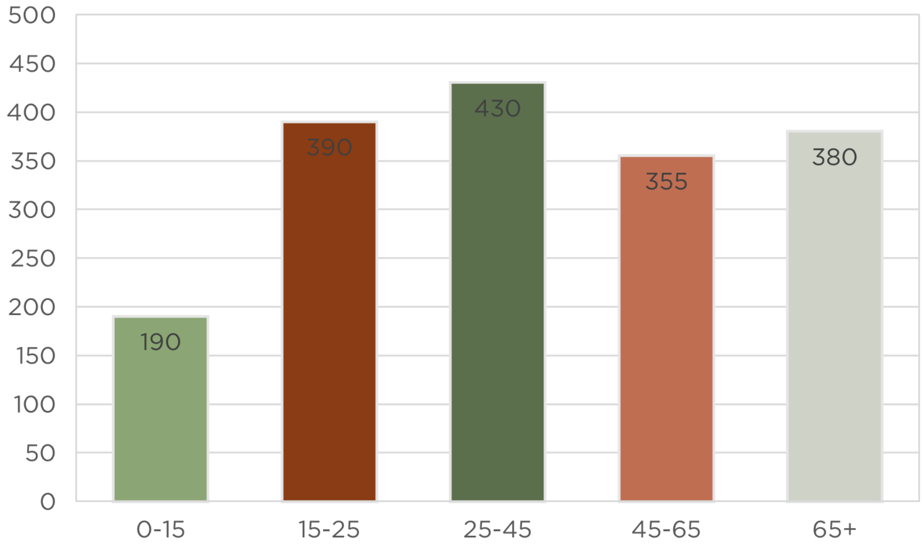
Type of use



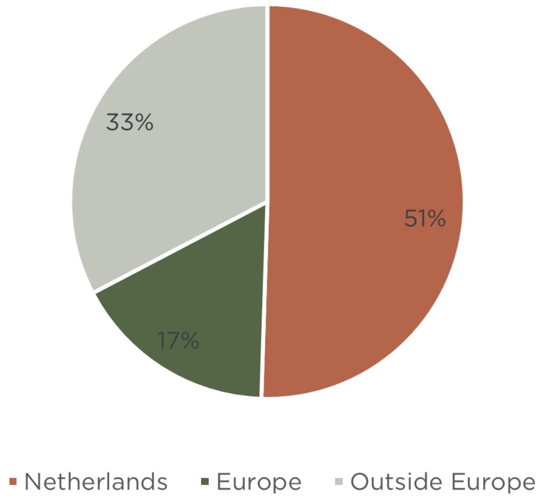
Energy label



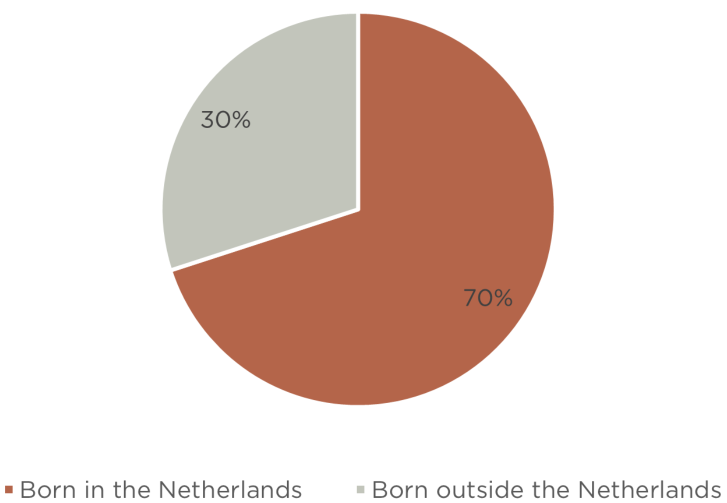
Age group



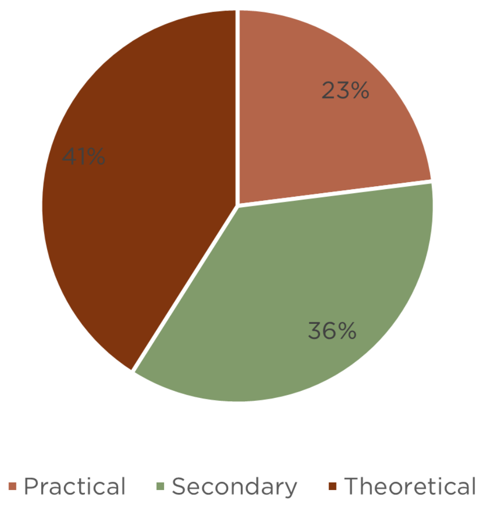
Country of origin



Migration background



Education level



5.3 Residents' Survey

In order to ground the project in the lived experience of residents, many neighbourhood associations were contacted to explore possibilities for resident involvement. Contact was made with the representative of the Buurtorganisatie 1018 (Association of renters of Kattenburg) and a first meeting was scheduled. Through this initial conversation, it became clear that while in-person participation in meetings was not feasible at this stage, there was openness to engaging residents through a low-threshold online questionnaire.

This exchange helped clarify both the practical constraints and the preferred modes of communication within the neighbourhood, leading to the development of a brief survey aimed at gathering residents' views on living in Kattenburg, perceived strengths and challenges, and their openness toward potential future changes. The online questionnaire is intended as a first step in a residents' input, prioritising accessibility and voluntary engagement.

Name (optional):

1. How long have you lived in Kattenburg?

2. What do you enjoy most about living here?

- Location / access to the city
- Green spaces
- Social atmosphere / neighbours
- Peace / quiet
- Leisure options
- Building / apartment quality
- Safety
- Other | open field

3. What would you most like to see improved in the neighbourhood?

- Better upkeep / maintenance
- More green spaces
- More places to meet or gather
- More activities for youth
- More activities for elderly
- More affordable housing
- Better lighting / safety
- Nothing, I'm satisfied as it is
- Other | open field

4. If something were added or upgraded in the neighbourhood in the future, what should it focus on?

- Community facilities
- Green / gardens
- Housing
- Safety and lighting
- Spaces for young people
- Spaces for elderly people
- Other | open field

5. How would you feel about the idea of adding new spaces on top of existing buildings, without demolition or displacement?

- Very positive
- Rather positive
- Neutral / not sure
- Rather negative
- Very negative
- I would need more information to decide

6. If new floors were added, what should they become? (select up to 3)

- Additional housing
- Green roofs / gardens
- Spaces for young people
- Spaces for elderly people
- Community rooms / shared facilities
- Hobby / workshop spaces
- Other | open field

7. How do you feel about using wood as a building material for new additions on top of buildings?

- Very positive
- Rather positive
- Neutral / not sure
- Rather negative
- Very negative
- I would need more information before having an opinion

8. What comes to mind when you think of building with wood? (max. 3 answers)

- Warm / natural look
- Sustainable / good for the environment
- Safe / strong
- Fire risk concerns
- Maintenance concerns
- I don’t have a specific opinion
- Other | short text

9. Would you like to have a say in what gets added if such a project moved forward?

- Yes
- Maybe / depends
- No
- I don’t know yet

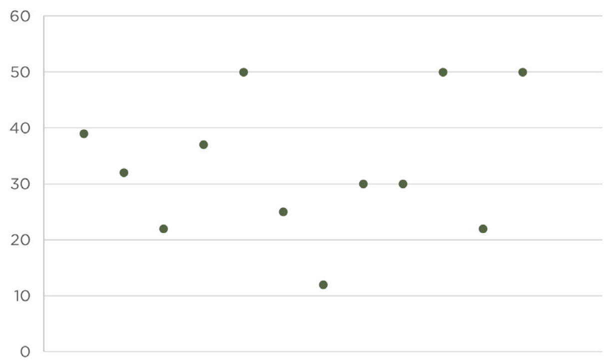
10. If yes or maybe, what level of involvement would feel comfortable? (select all that apply)

- Receiving information and updates
- Giving feedback when asked
- Attending a meeting or workshop
- Co-designing the new space with others
- Helping to build / maintain / organise activities
- Other | open field

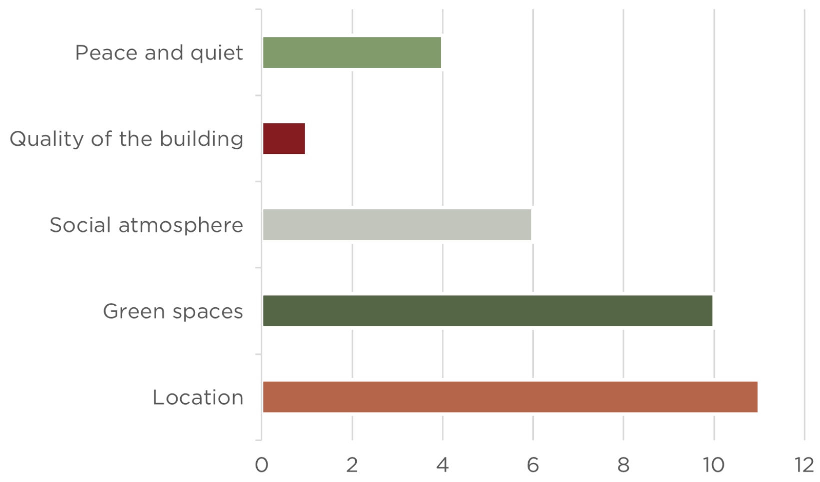
Results

Mostly due to time constraints and language barriers, it is important to keep in mind that the survey results are not representative of the entire Kattenburg population, as the sample is small (12 respondents) and consists mainly of long-term residents.

Time living there (years)

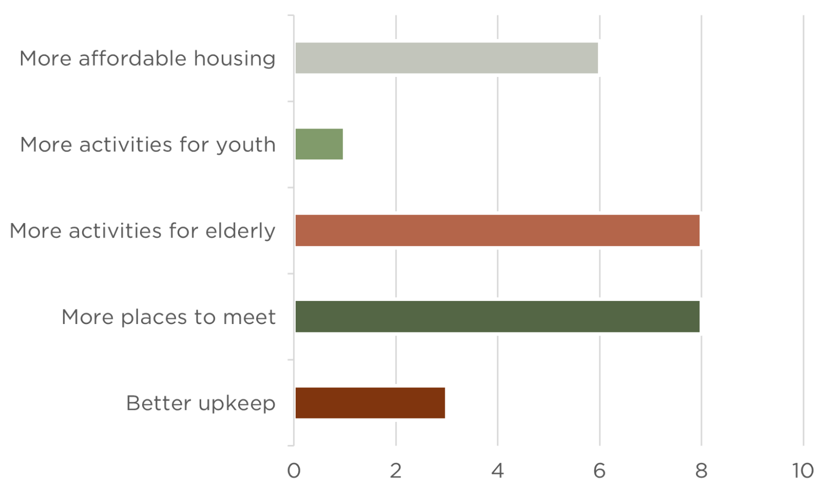


What do you enjoy most about living here?

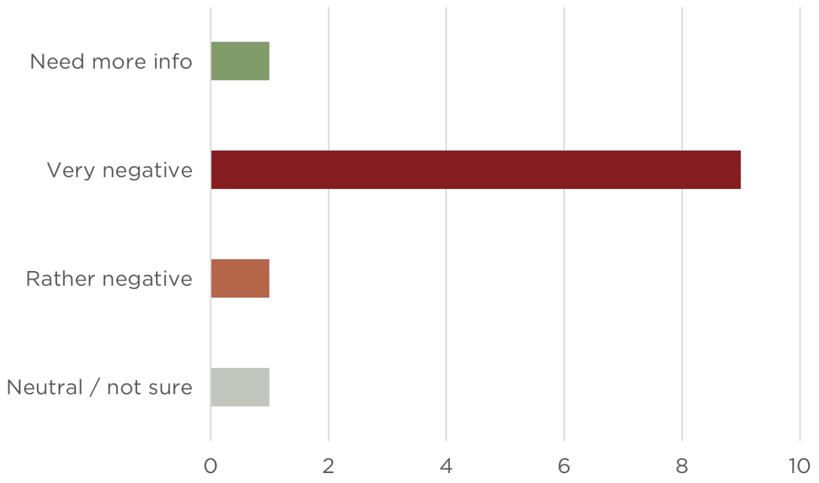


If something were added or upgraded, what should it focus on?

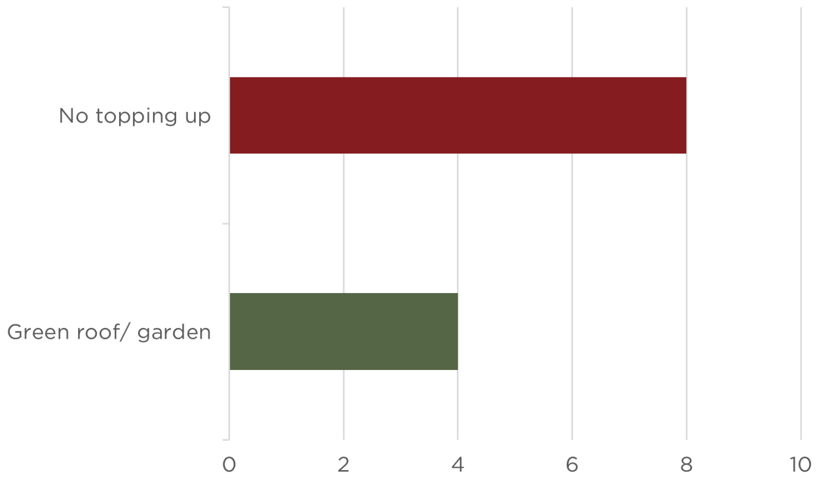
What would you most like to see improved?



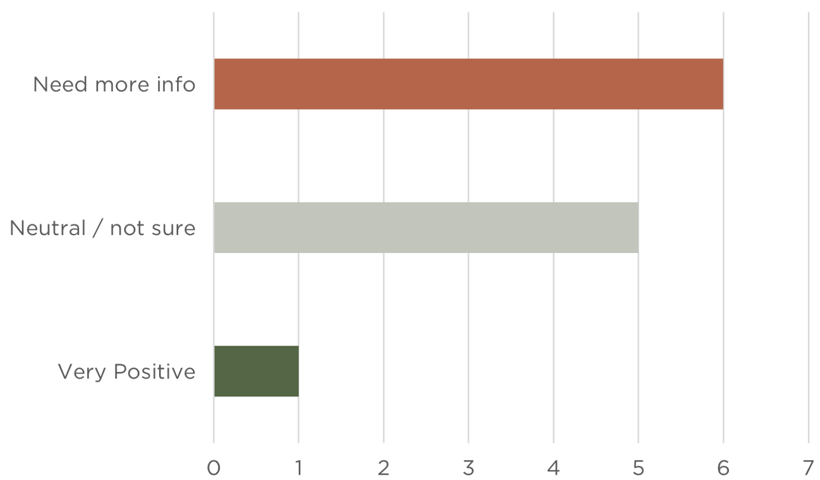
How would you feel about the idea of adding new spaces on top of existing buildings, without demolition or displacement?



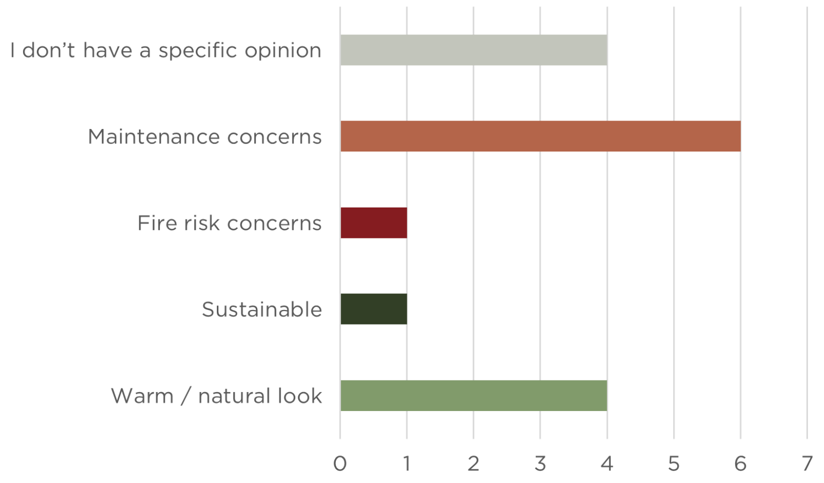
If new floors were added, what should they become?



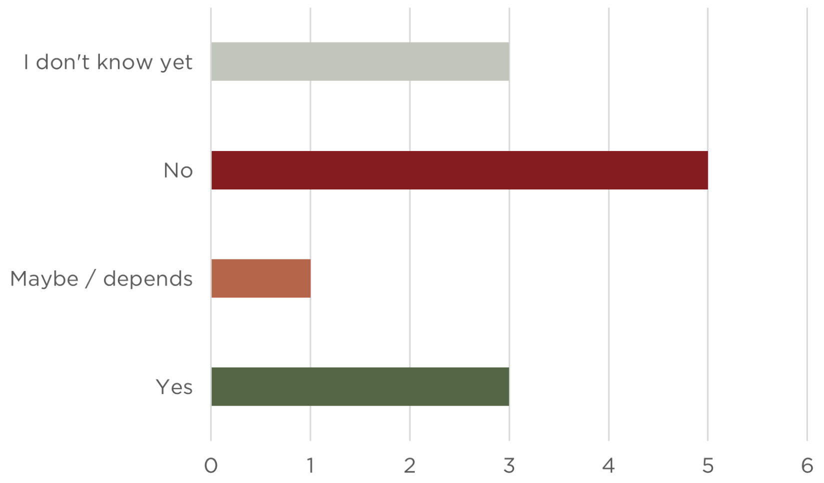
How do you feel about using wood as a material for new additions on top of buildings?



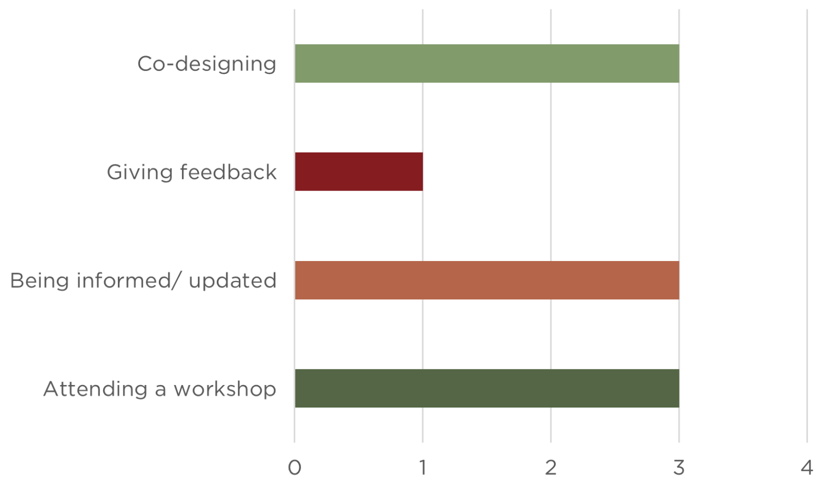
What comes to mind when you think of building with wood?



Would you like to have a say in what gets added if such a project moved forward?



What level of involvement would you feel comfortable with?



5.4 Takeaways

Even though not statistically relevant, the responses provide valuable insight into how deeply attached residents are to the neighbourhood and what they value most in their everyday living environment, such as the location, green spaces, social cohesion and sense of calm. At the same time, the survey helps identify clear points of resistance and concern, particularly regarding physical change and vertical expansion, as well as unmet needs such as accessible communal spaces. Timber is not either strongly embraced nor rejected: there seems to be a lack of knowledge and understanding of the material.

Rather than offering generalisable conclusions, the conversation with the representative of the association, combined with the survey serves as a valuable qualitative tool to understand sensitivities, priorities and lived experiences that can meaningfully inform the design approach and programme of the project.

6.0 Design Results

Building upon the site analysis and selection process, the following chapter presents the design outcome of the research. The proposal translates the opportunities and challenges identified within the existing building and its surrounding context into an architectural framework that supports incremental growth, resident participation, and long-term adaptability. Rather than presenting a fixed solution, the project seeks to establish a balance between professional provision and user appropriation, enabling residents to actively shape their living environments over time.

The design proposal emerged from the combination of historical and morphological analysis, demographic and housing research, on-site observations, the study of relevant precedents, and community input gathered through conversations with the residents' association representative and the resident survey. Together, these investigations informed the definition of the target groups, programme distribution, and guiding design principles. The following sections illustrate how these findings were translated into spatial strategies, technical systems, and architectural interventions across multiple scales, from the urban context to the detailed construction of the self-build elements.

6.1 Design proposal

Based on the **site analysis**, including **historical and morphological research, demographic and housing characteristics,** and **on-site observations**; combined with the **critical analysis of case studies and community input** gathered through conversations with the association representative and the **resident survey**; the project framework was established. These informed: an ideal target group, a preliminary programme, and the development of guiding design principles.

Target group

Kattenburg's current demographic profile is characterised by a high proportion of single households, a significant share of adults aged 25–44, and a relatively small number of families with children. Social housing demand in Amsterdam is particularly acute among young adults and starter households, who face long waiting times and limited access to affordable housing within the *WoningNet* system.

In response, the proposed new housing units **primarily target young adults and young couples** (aged ~18–35) on the social housing waiting list, while also including a **smaller number of units for elderly residents** already living in the neighbourhood. This approach creates opportunities for older residents to relocate from larger, less accessible dwellings to newer, smaller units better suited to their needs (such as those with lift access and adapted sanitary facilities), while freeing up larger apartments for young couples and families. In this way, the project supports both local demographic dynamics and broader ambitions for a socially resilient and inclusive city.

Preliminary Programme

The preliminary programme combines housing with shared and productive spaces that respond directly to the social and spatial needs identified in the neighbourhood. The project proposes a **mix of housing typologies**, primarily aimed at young adults and small households, complemented by a **range of collective and community-oriented facilities**. As part of the spatial upgrade of the existing building, lifts are introduced, improving current accessibility and ensuring inclusive use of both housing and shared programmes across all floors.

In addition to housing, the programme includes **multifunctional spaces** intended to support everyday social life and resident-led activities. These spaces provide a dedicated venue for residents' meetings (currently lacking in the neighbourhood), as well as Dutch language courses, responding to the fact that approximately 30% of residents come from outside the Netherlands. They also accommodate **cultural, artistic, and community workshops**, alongside educational activities that introduce non-professionals to timber construction and building practices.

FIG 60. Urban plan with selected building highlighted

In addition to housing, the programme includes **multifunctional spaces** intended to support everyday social life and resident-led activities. These spaces provide a dedicated venue for residents' meetings (currently lacking in the neighbourhood), as well as Dutch language courses, responding to the fact that approximately 30% of residents come from outside the Netherlands. They also accommodate **cultural, artistic, and community workshops**, alongside educational activities that introduce non-professionals to timber construction and building practices.

The programme further integrates a **woodworking workshop/ building site**, supported by dedicated **storage spaces for materials, tools, and power equipment**. As part of the design guidelines, the e**xisting ground-floor storage units are removed and replaced with more active and publicly oriented uses**, such as cafés, restaurants, and cultural or community functions. Public and semi-public programmes are concentrated on the ground floor and lower levels to strengthen street-level interaction, while housing is primarily located on the upper floors, ensuring privacy while maintaining a clear vertical hierarchy of uses.

With an existing floor area of around 6.750 m², the 50% topping-up strategy results in approximately **3.375 m²** of additional programme.

FIG 61. Aerial view of selected building

6.2 Design Methodology

Design Principles	Challenges	Plan of Action
Accessible Construction	• What is more acessible? Manual fabrication? Digital tools?	1. Study reference projects and construction systems 2. Understand trade-offs and stabilish priorities
	• What are the size and weight limits for resident-handled components? • How can they reach higher floors?	1. Iteratively test maximum element sizes based on stairs, lifts, cranes, or manual handling 2. Explore on-site assembly X off-site prefabrication hybrids
Capacity for Incremental Change	• How much and how can this growth happen?	1. Iteration between studying reference projects and designing different typologies
Degree of Agency/ User Interaction Participation	• What/ How much can users do? • Who decides when incrementing happens: individuals? collective? • How are conflicts between residents resolved spatially?	1. Translate governance into architectural rules (zones, grids, limits)
Climate Performance	• Can good climate performance be achieved? • How to deal with weathering?	1. Study temporary states as valid architectural moments 2. Design a robust initial envelope that performs climatically even before expansions
Safety	• How to ensure structural and fire safety?	1. Define clear *"do not touch" X "build here" zones*

Initial Outcomes

Final Outcomes

- A logistics diagram as part of the architectural proposal
- A set of design rules derived from transport constraints

- Overview on possible expansions scenarios

- A set of spatial rules for collective decision-making
- A diagrammatic governance model embedded in the architecture

- A catalogue of climatic expansion typologies

Timber Construction system
- Structural grid
- Assembly process
- Safety requirements

Spatial rulebook
- What is fixed
- Where/ how can things be added

Participation Framework
- Who builds what
- Where
- Under which conditions

Future scenarios
- Different growth paths over time
- Individual *X* collective dwellings

Building manual
- Building instructions
- Catalogue of elements to choose from

FIG 62. Design methodology diagram

6.3 Circulation and workflow

The circulation and flow strategy balances everyday residential movement with the logistical demands of on-site timber construction. Central to this is the new service lift (3.2 x 2.2 m), which serves both residents and the transport of materials from the ground-floor woodworking workshop. This dual function supports an incremental, resident-involved construction process, while also introducing a key constraint: the lift acts as a bottleneck, limiting the maximum size of timber elements and directly informing the project's construction logic.

The workshop's direct truck access allows larger components to be delivered and processed before being adapted to the lift's dimensions, establishing a clear flow from large-scale delivery to manageable building parts. On the upper floors, 1.8-meter-wide circulation galleries and generous space in front of the lift ensure efficient movement of both people and materials.

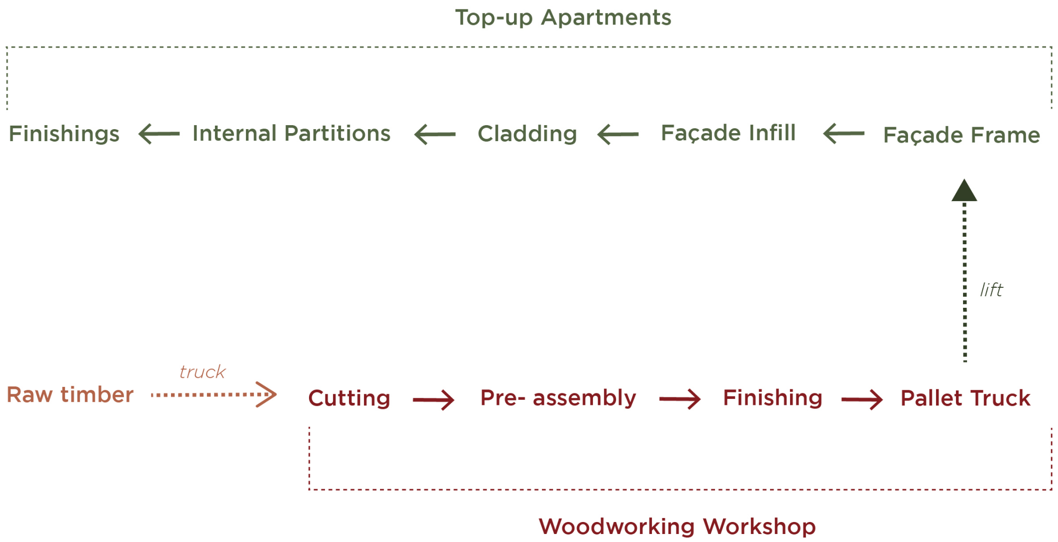


FIG 63. Workflow diagram

At the top, circulation culminates in a shared terrace located at the sunniest corner, hosting a kitchen, laundry, and greenhouse. This space acts as a social "magnet," drawing residents through the building and encouraging interaction. In this way, circulation becomes not only a functional system but also a framework for community building.

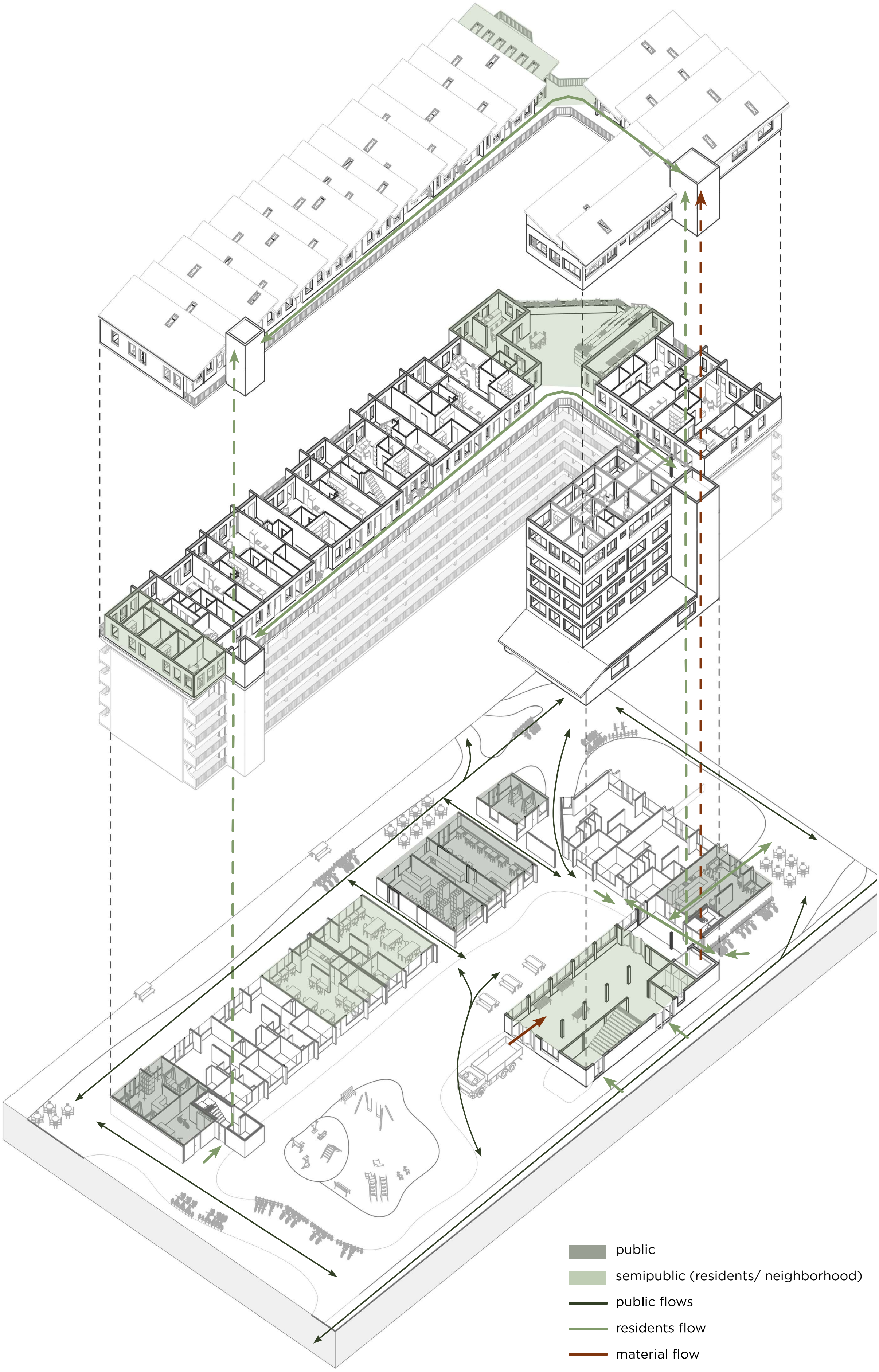


FIG 64. Circulation diagram

6.4 Accessibility in Construction as a Design Driver

Accessibility in construction was established as one of the primary design criteria throughout the development of the façade system. Since the project proposes a participatory and incremental construction process involving future residents with limited building experience, technical decisions were not evaluated solely according to thermal or structural performance. They were also assessed according to ease of assembly, required tools, handling complexity, and potential for errors during construction. The façade therefore evolved through a series of iterations aimed at simplifying the construction process while maintaining adequate environmental performance.

6.4.1 Façade layer optmization

Initial façade iterations consisted of a larger number of layers and assembly steps, increasing construction time and complexity. Each additional layer introduced more components, fixings, interfaces, and opportunities for mistakes during assembly. Through iterative testing in Ubakus and research into integrated timber products, particularly the STEICO product line, the wall build-up was gradually simplified while maintaining acceptable thermal performance. Products capable of combining multiple functions, such as weather protection, wind tightness, and insulation support, reduced the need for additional construction layers. The final façade composition therefore emerged as a balance between thermal requirements and construction accessibility.

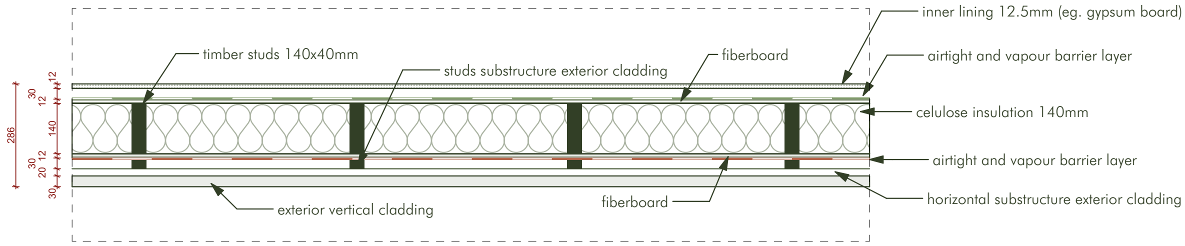


FIG 65. Early façade wall plan

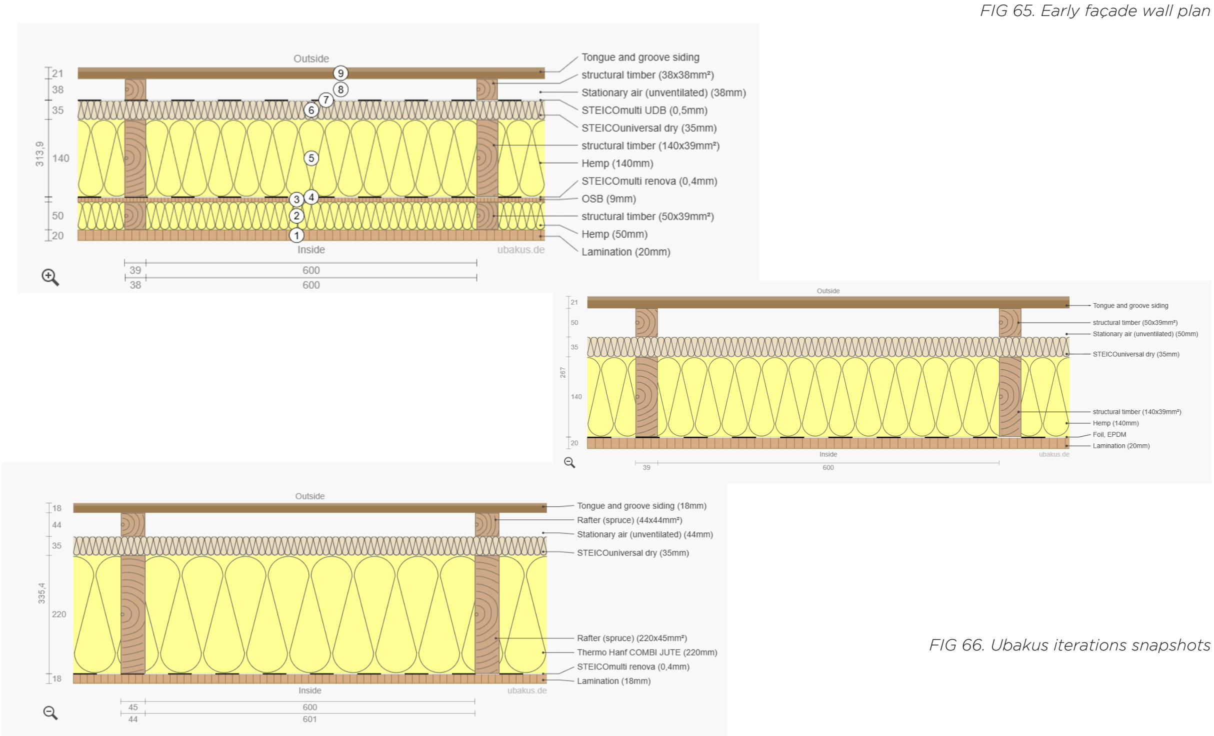


FIG 66. Ubakus iterations snapshots

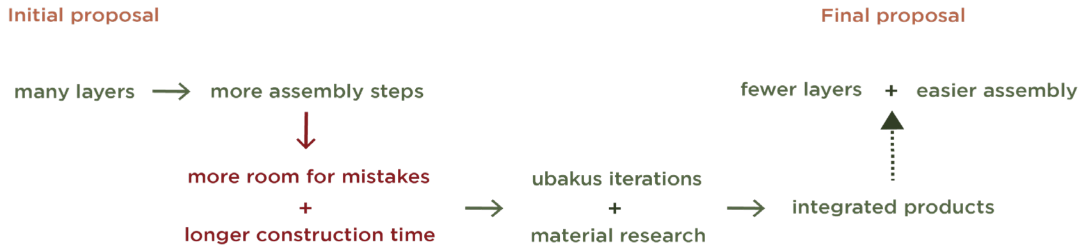


FIG 67. Diagram of façade development process

1. Plywood 18mm

2. Moisture variable vapour membrane *(STEICOmulti renova)*

3. Timber frame studs 220x45mm

4. Hemp fiber insulation 220mm *(Thermo Hanf COMBI JUTE)*

5. Fiberboard 35mm *(STEICOuniversal dry)*

6. Vertical timber studs 44x44mm

7. Horizontal open joint cladding 18mm

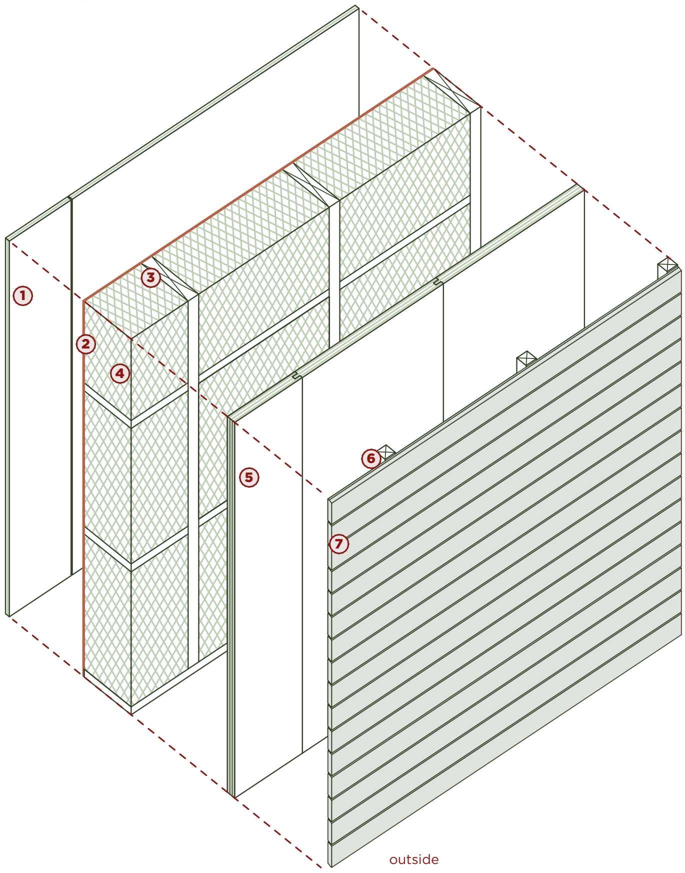


FIG 68. Exploded façade axonometry

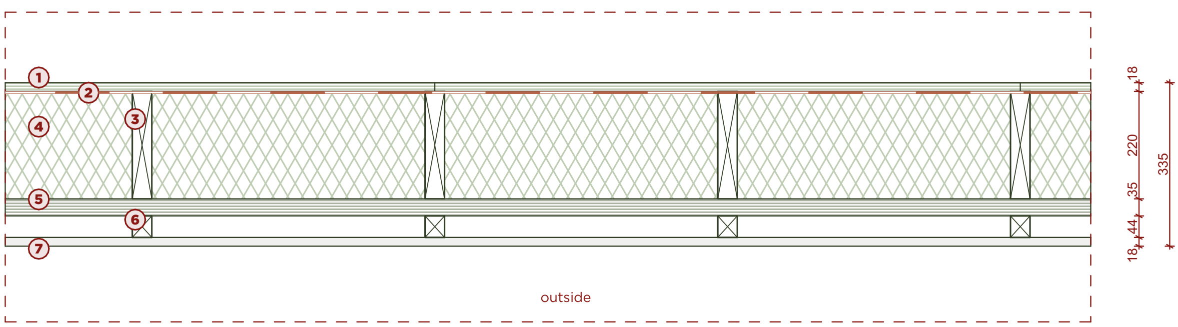


FIG 69. Final façade plan

6.4.2 Module size and handling constraints

The dimensions of the prefabricated façade modules were also developed through an iterative process. Different module sizes were explored and evaluated according to logistical and ergonomic criteria. The final dimensions of approximately 1.62 x 2.98 m emerged as a compromise between transport constraints and ease of handling. The dimensions allow the elements to fit within the service lift and circulation spaces while remaining manageable for two to three residents using simple equipment such as pallet trucks. Weight reduction and manoeuvrability therefore became important criteria alongside construction efficiency.

The bigger units are composed of 3 main modules, while the smaller apartments are assembled with 1 main module and 1 filler module.

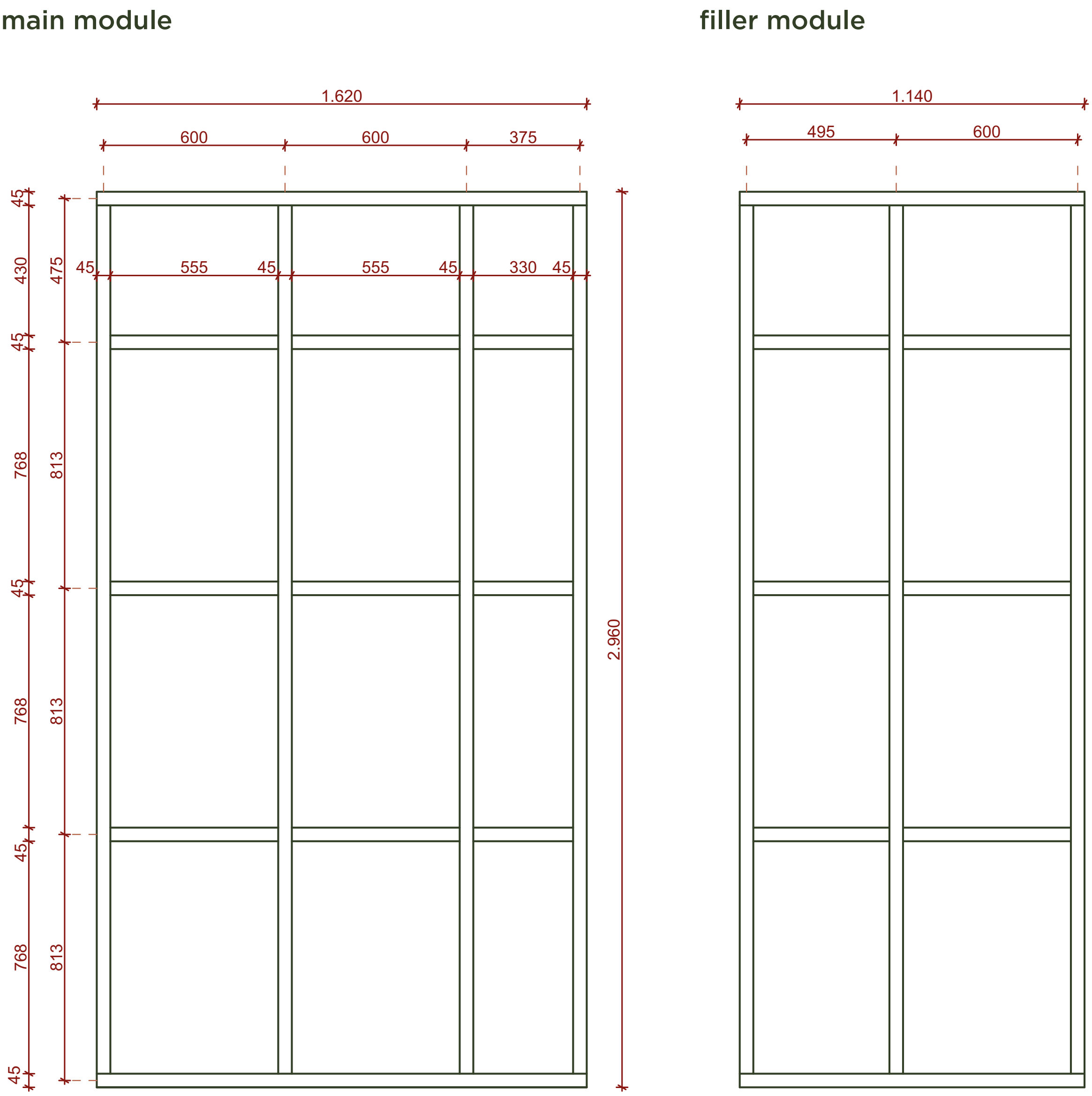


FIG 70. Pre-assembled timber frame modules

6.4.3 Material accessibility

Different insulation alternatives were assessed according to both environmental and practical criteria. Bio-based materials were prioritised due to their lower embodied carbon and compatibility with timber construction. Hemp batt insulation was selected because of its ease of handling and installation by non-specialists. Its semi-rigid composition allows friction fitting between timber studs with relatively simple cutting procedures and minimal equipment requirements. Alternatives such as cellulose insulation require specialised blowing equipment, while mineral and glass wool can cause irritation to the skin and eyes, increasing protective equipment requirements and potentially creating a less accessible construction process.

Material	Installation complexity	Health/ Safety requirements	Bio- based
Glass wool	Medium	High	✗
Mineral wool	Medium	High	✗
Cellulose	High	Low	✓
Hemp batt	Low	Low	✓

FIG 71. Comparative table of insulation materials

FIG 72. Hemp batt insulation

6.4.4 Cladding installation

Horizontal timber cladding was eventually selected due to its simpler assembly logic. Unlike vertical cladding systems, which typically require an additional layer of horizontal battens over the ventilated cavity, horizontal boards can be fixed directly onto vertical battens. This eliminated an entire construction layer, reducing material use, installation time, and the number of operations required during construction. Physical study models were also produced to understand assembly sequencing and maintenance implications.

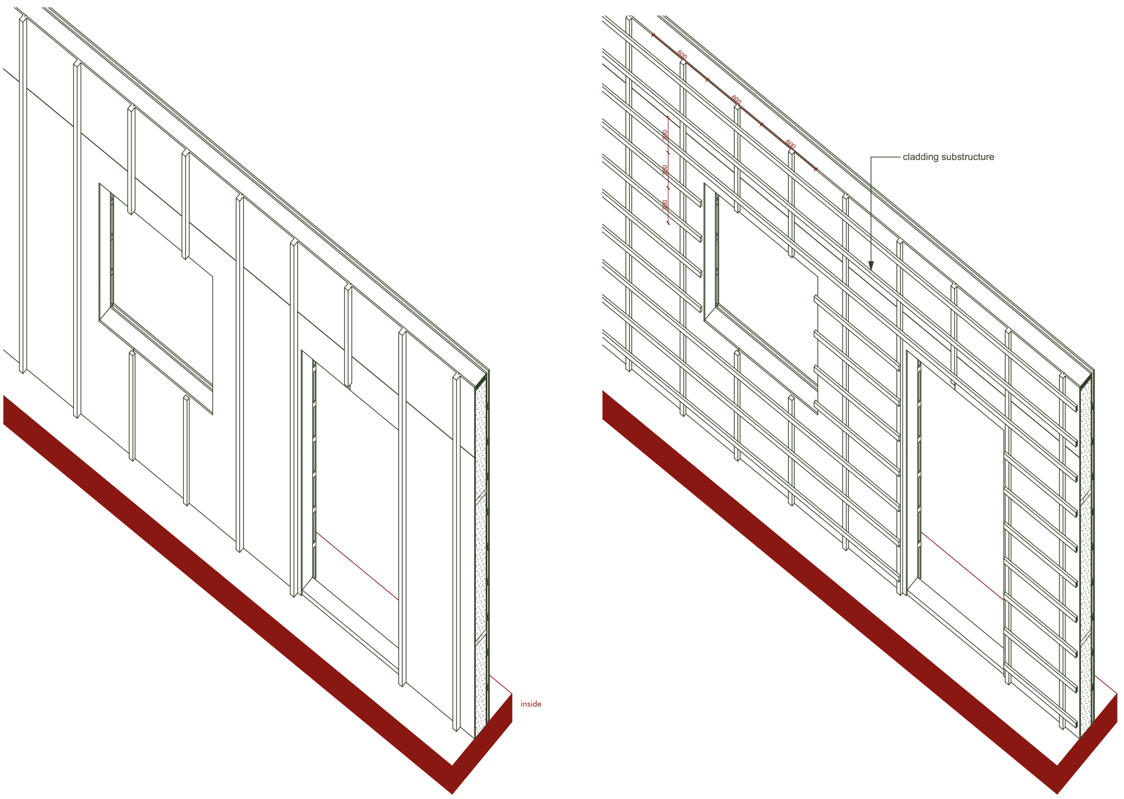


FIG 73. Drawings of substructure: vertical X horizontal cladding

FIG 74. Physical models experimentation

6.4.5 Horizontal boarding type

Beyond selecting the cladding orientation, the profile of the timber boarding itself was also evaluated according to two main criteria: ease of manufacturing and ease of maintenance. Since the project aims to support resident participation not only during initial construction but also throughout the building's lifespan, maintenance and replacement strategies became important considerations.

Different horizontal timber profiles were explored, including open joint, square edge, feather edge, rebated feather edge, shiplap, and tongue-and-groove systems. Profiles relying on interlocking geometries, such as tongue-and-groove and shiplap systems, generally require more precise machining and more controlled installation processes. They also complicate future replacement, as damaged boards frequently require partial disassembly of surrounding elements.

Boarding type	Installation complexity	Manufacturing complexity	Repair complexity
Tongue & Groove	High	High	High
Shiplap	Medium- High	Medium	Medium
Rebated feather edge	Medium	Medium	Medium
Square edge	Low	Low	Medium
Feather edge	Low	Low	Medium
Open joint	Low	Low	Low

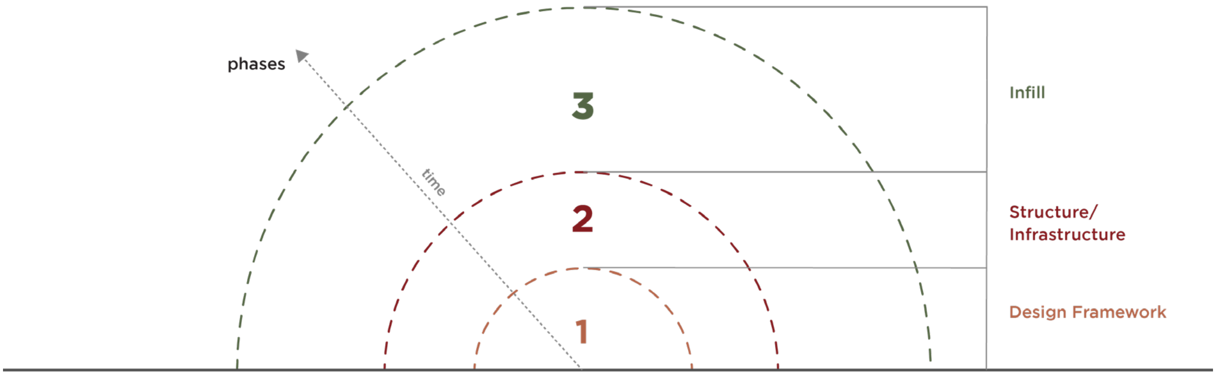
FIG 75. Comparative table of horizontal boarding types

Simpler profiles such as square edge and feather edge significantly reduce manufacturing complexity. However, the open-joint system was ultimately selected as it provided a balance between ease of fabrication and long-term adaptability. Individual damaged boards can be removed and replaced independently without dismantling larger portions of the façade, simplifying maintenance procedures and allowing residents to carry out repairs with limited technical knowledge.

FIG 76. Construction process: physical model open joint horizontal cladding (1.1 scale)

FIG 77. Physical model open joint horizontal cladding (1.1 scale)

6.5 Agency across building layers



1. Architect
- Structural load-bearing system: Columns + Beams + Bracing/ shear walls + Roof + Slabs
- Primary service shafts
- Circulation: Access points + Lifts/ Stairs + Hallways + Fire escape routes
- Material and Spatial Logic: Construction manuals for residents + Rules of extension

2. Technicians
- Prefabricated structural assembly
- Structural connection to existing building
- Lift installation
- Main service infrastructure (plumbing, electrical)
- Fire systems

3. Residents
- Collective spaces configuration
- Workshop use + construction of elements
- Façade modules and position
- Façade cladding
- Internal walls and finishes
- Secondary wiring
- Furniture

FIG 78. Agency Across Building Layers diagram

This diagram illustrates how agency is distributed across different building layers and actors within the project. Rather than concentrating decision-making and construction in a single entity, the proposal structures the building as a phased and layered system, where architects, technicians, and residents each take responsibility for specific components over time. The structural framework establishes stability and long-term rules, technical systems ensure performance and safety, and the infill remains open to adaptation and collective appropriation. In this way, the project aligns construction logic with social organisation, enabling participation while maintaining coherence and feasibility.

Technicians
- structure
- membranes
- drainage
- flashing
- temporary weather panels
- raised deck

Residents
- choose façade position
- remove decking panels where space expands
- install floor internally
- build façade modules
- choose and install cladding
- build internal walls + finishes
- finishes

FIG 79. Agency Across Building Layer Diagram | Technicians vs Residents

Façade Placement Rules and Resident Construction Zones

The façade system is designed to allow residents to gradually shape and personalise their homes while maintaining a coherent technical and structural framework. Rather than allowing completely unrestricted construction, the project defines a series of prepared façade lines and construction zones that simplify waterproofing, reduce technical complexity, and support resident-led assembly. The overall strategy creates a balance between flexibility and collective coordination. More detailed assembly information can be found throughout the *Building manual* *(appendix 1)*.

At the lower façade edge, residents can choose between four predefined façade positions spaced every 600 mm. These lines correspond directly to prepared timber support strips integrated into the floor build-up by professional contractors before resident occupation begins. The support strips define the structural fixing points for the prefabricated timber façade modules and ensure that all possible façade locations remain compatible with drainage, waterproofing, and structural tolerances.

On the upper side of the plan, facing the communal circulation space, only two façade positions are possible. This reduced flexibility helps maintain a more controlled and consistent relationship with the shared circulation zone while preserving adequate passage widths, daylight access, and fire-safe escape routes. Together, these predefined lines establish a clear construction grid that residents can easily understand and build within.

The position selected by residents determines the balance between interior floor area and exterior balcony space. Moving the façade further outward increases the internal living space while reducing the balcony depth. Positioning the façade further inward creates a larger balcony and more generous outdoor threshold space. In all cases, a minimum exterior balcony width of approximately 800 mm is preserved. This minimum dimension ensures that residents can still comfortably access and maintain the façade from the outside during construction and future repair works.

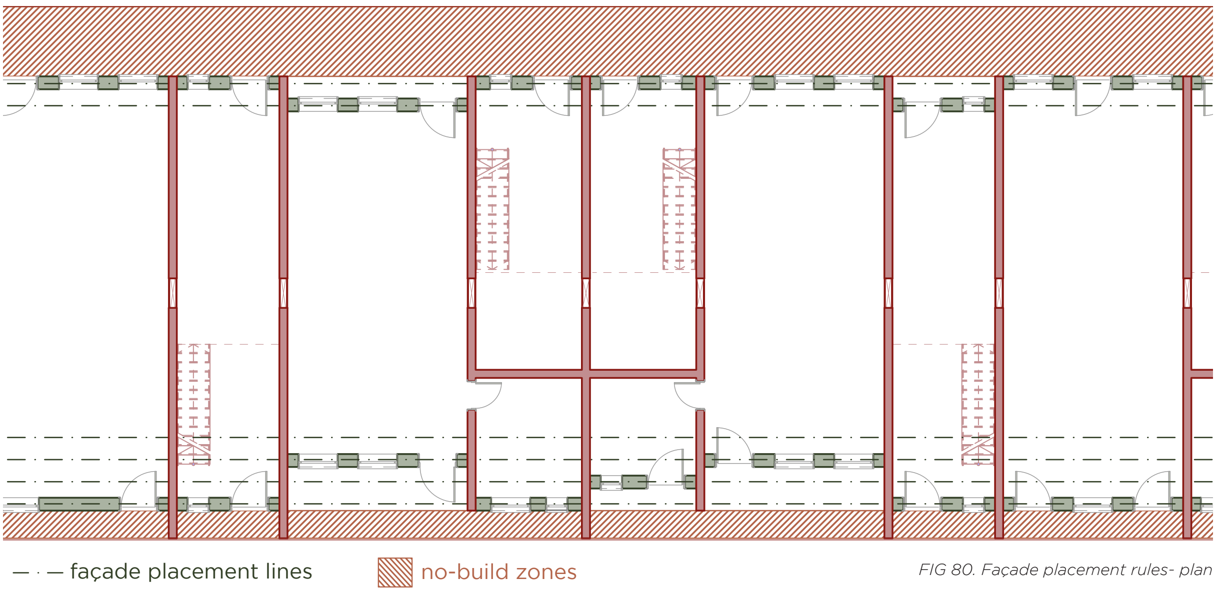


FIG 80. Façade placement rules- plan

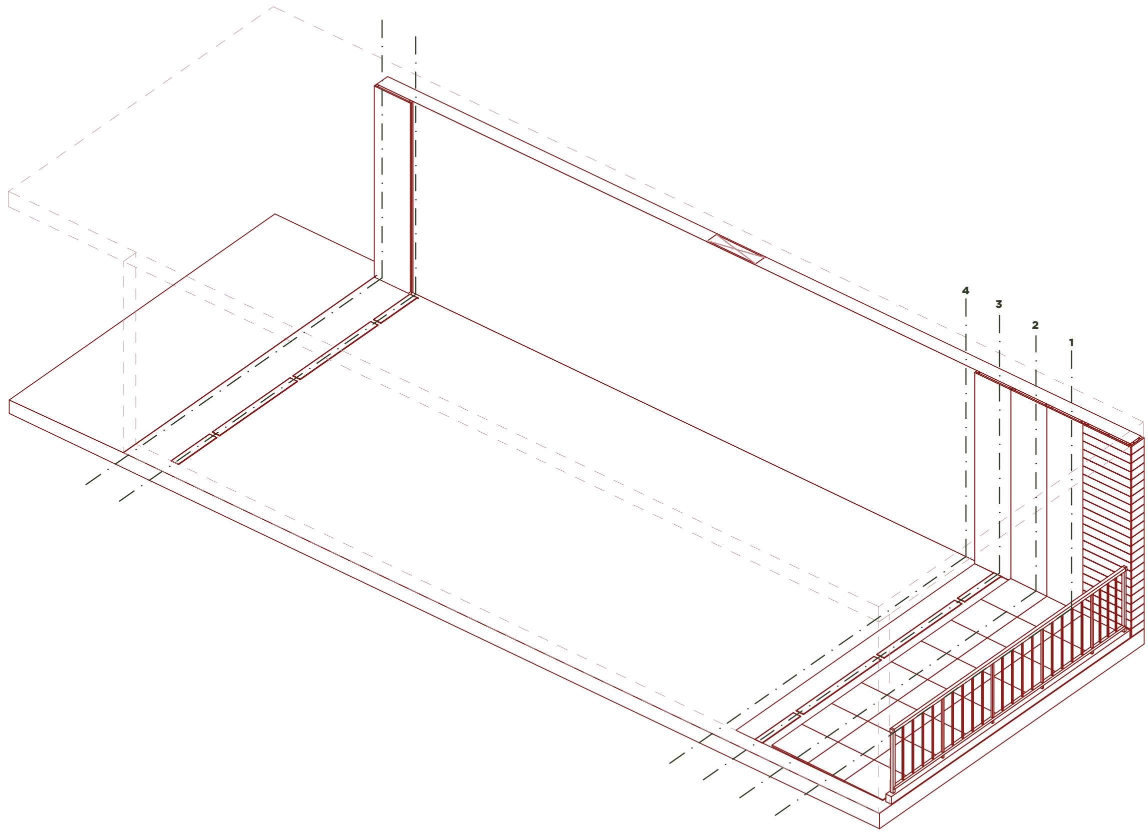


FIG 81. Façade placement rules- isometric

The dashed orange zones represent no-build zones. At the top of the plan, this area corresponds to the communal circulation space, which must remain unobstructed at all times. At the bottom of the plan, the no-build zone guarantees the minimum balcony dimension and protects the exterior drainage and waterproofing logic of the slab edge.

To simplify the self-build process, all technically sensitive exterior preparation works are completed beforehand by professional contractors. These tasks include the waterproofing membrane, drainage layers, prepared support strips, and temporary weather protection systems. The floor surface from the fourth façade line toward the slab edge is always treated as an exterior condition, regardless of the final façade position chosen by residents. This means that the waterproofing, drainage slope, and weather-resistant floor build-up are already resolved before resident construction begins.

Similarly, the compartment walls extending into this exterior zone are designed as overdimensioned external walls with additional insulation and weather protection. The slab edge build-up follows the same principle. This strategy allows different neighbouring apartments to position their façades differently over time without creating exposed thermal bridges or technically unresolved edge conditions.

The exterior floor surface incorporates a slope of approximately 2% toward the slab edge to ensure proper rainwater drainage. Above this waterproofed layer, removable raised deck tiles are pre-installed up to the third façade line. These temporary deck elements protect the waterproofing during early occupation while also reducing unnecessary work and material waste during the self-build process.

If residents choose to build on the third façade line, no deck removal is required. This represents the most straightforward construction scenario and minimises waste generation. If the façade is positioned further outward, on lines one or two, residents must remove the surplus deck tiles located within the future interior area before beginning construction. Conversely, if residents choose the deepest balcony configuration, additional deck tiles may need to be installed in the remaining exterior area. Because neighbouring apartments may remove unused tiles from their own balcony zones, leftover elements can potentially be reused collectively within the building.

A similar logic applies to the wall surfaces. Before façade construction begins, exposed exterior walls are protected with sacrificial timber boards and temporary battens. These elements protect the weatherproof layers during the phased construction process and allow the building to remain durable even before all façades are completed. Depending on the selected façade position, residents remove the necessary sacrificial boards and battens before installing the timber frame modules. Any surfaces that remain permanently exposed after construction must later receive the final cladding layer.

Once the façade enclosure is complete and weather-tight, residents can proceed with the installation of the interior floor finish, partition walls, furniture, and additional internal adaptations. This phased approach allows the building envelope to progressively transition from a temporary protected condition into a fully inhabited domestic space while maintaining a dry and relatively accessible construction process throughout.

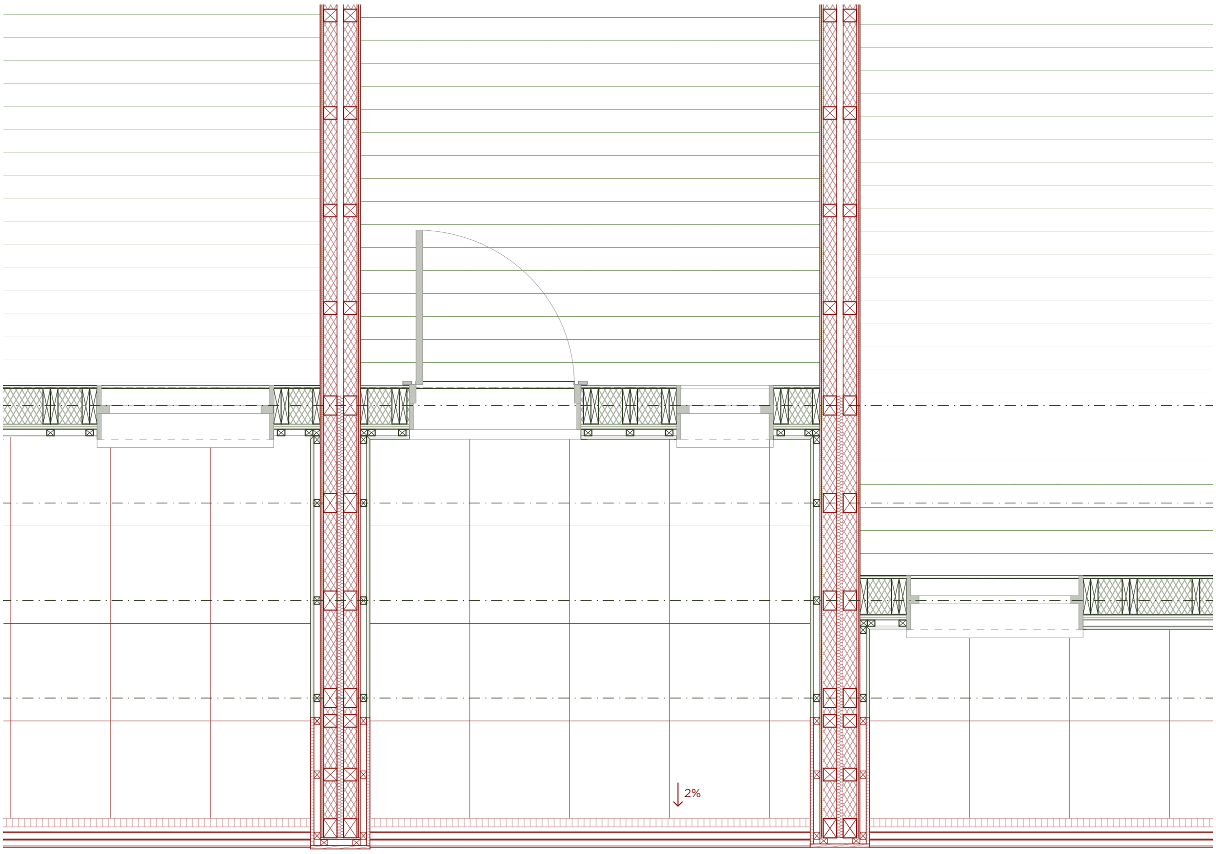


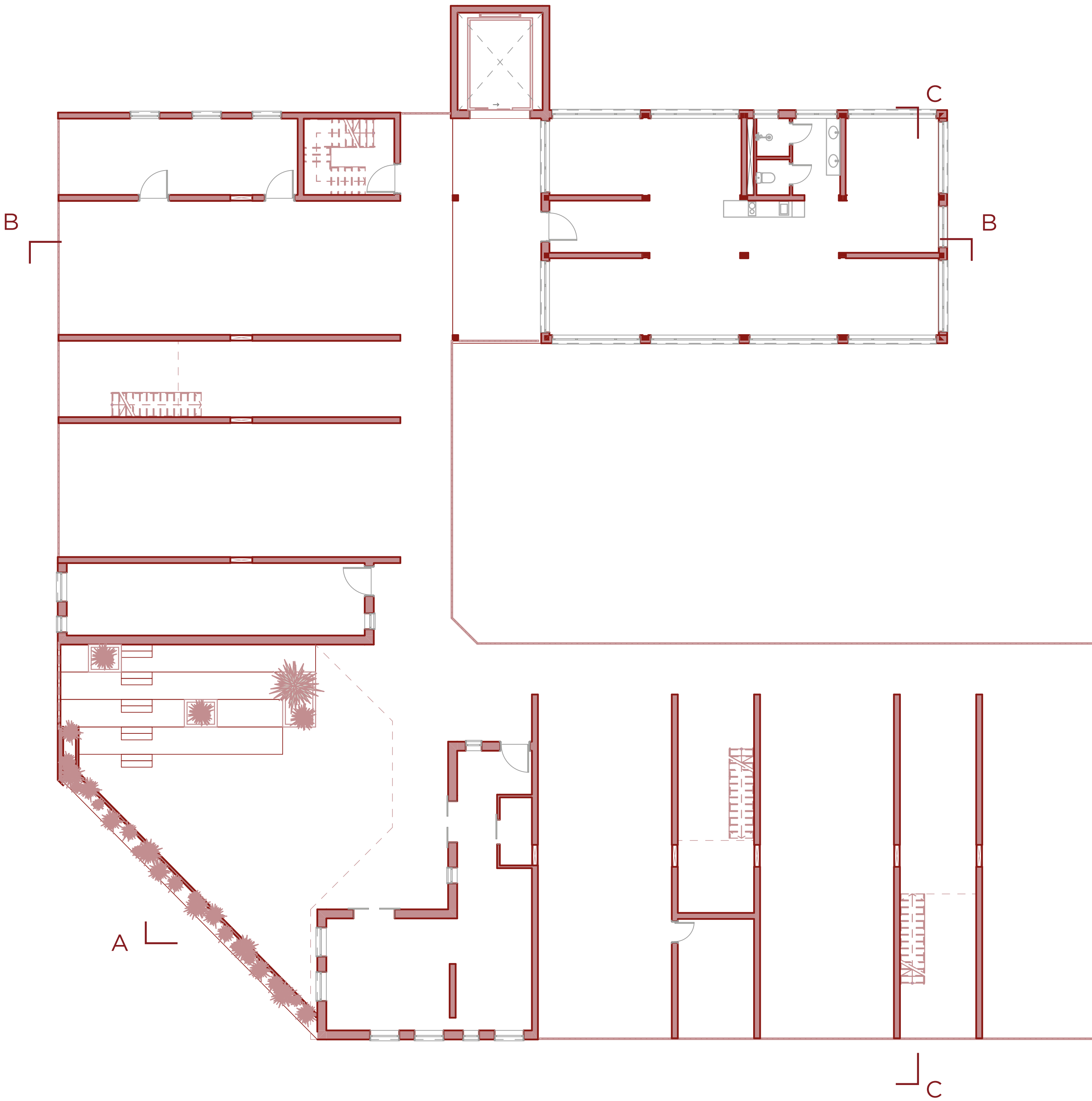
FIG 82. Façade placement detail- plan

Ground floor plan

1. Woodworking workshop
2. Existing apartments
3. Access hall
4. Grocery shop / Food stall
5. Café
6. Restaurant
7. Event space
8. Coworking space
9. Second hand shop
10. Bike-repair shop
11. Playground
12. Outdoor gym

FIG 83. Ground floor plan

Floor plan top up +1 | layer 0



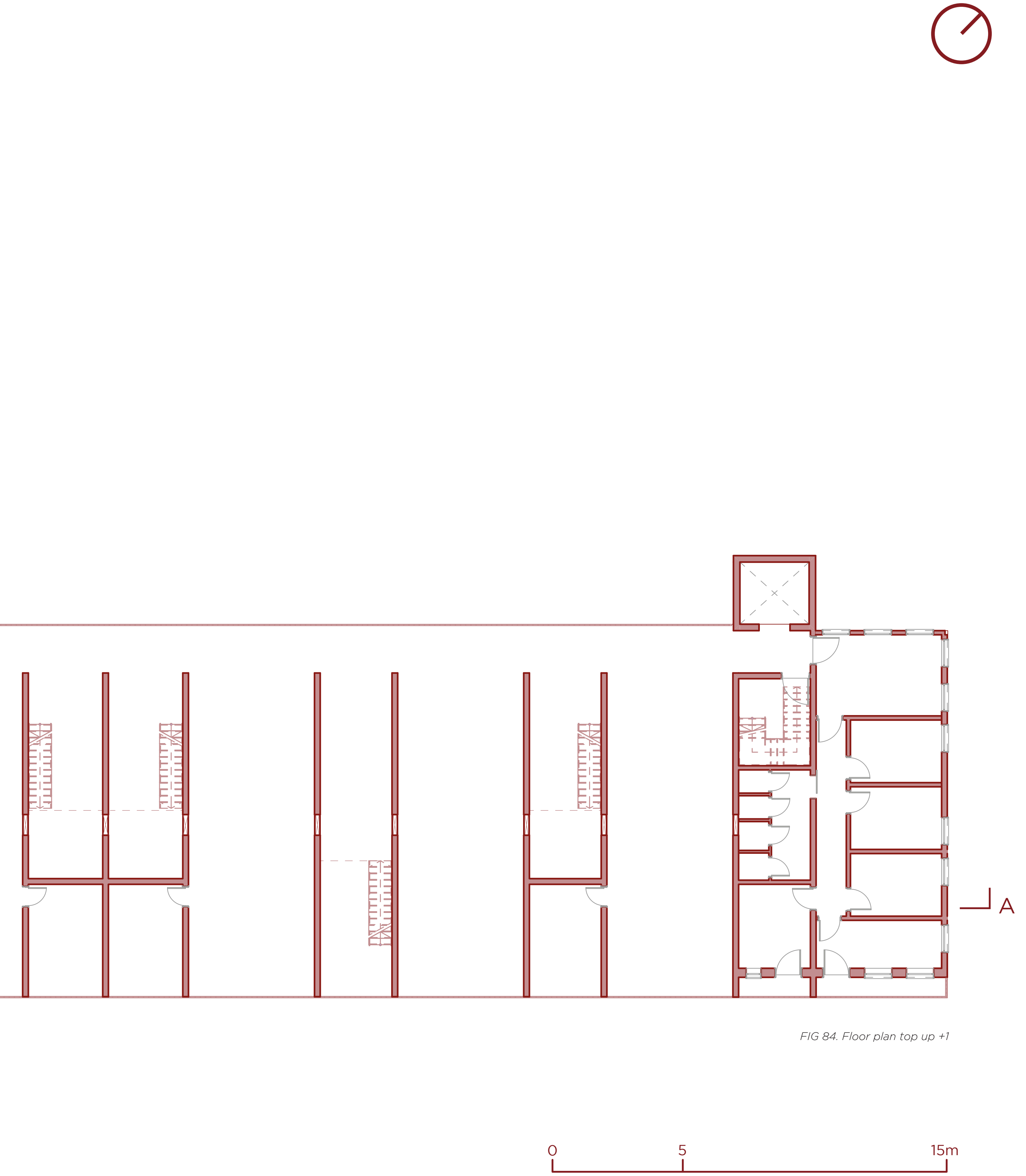


FIG 84. Floor plan top up +1

Floor plan top up +1 | layer 1

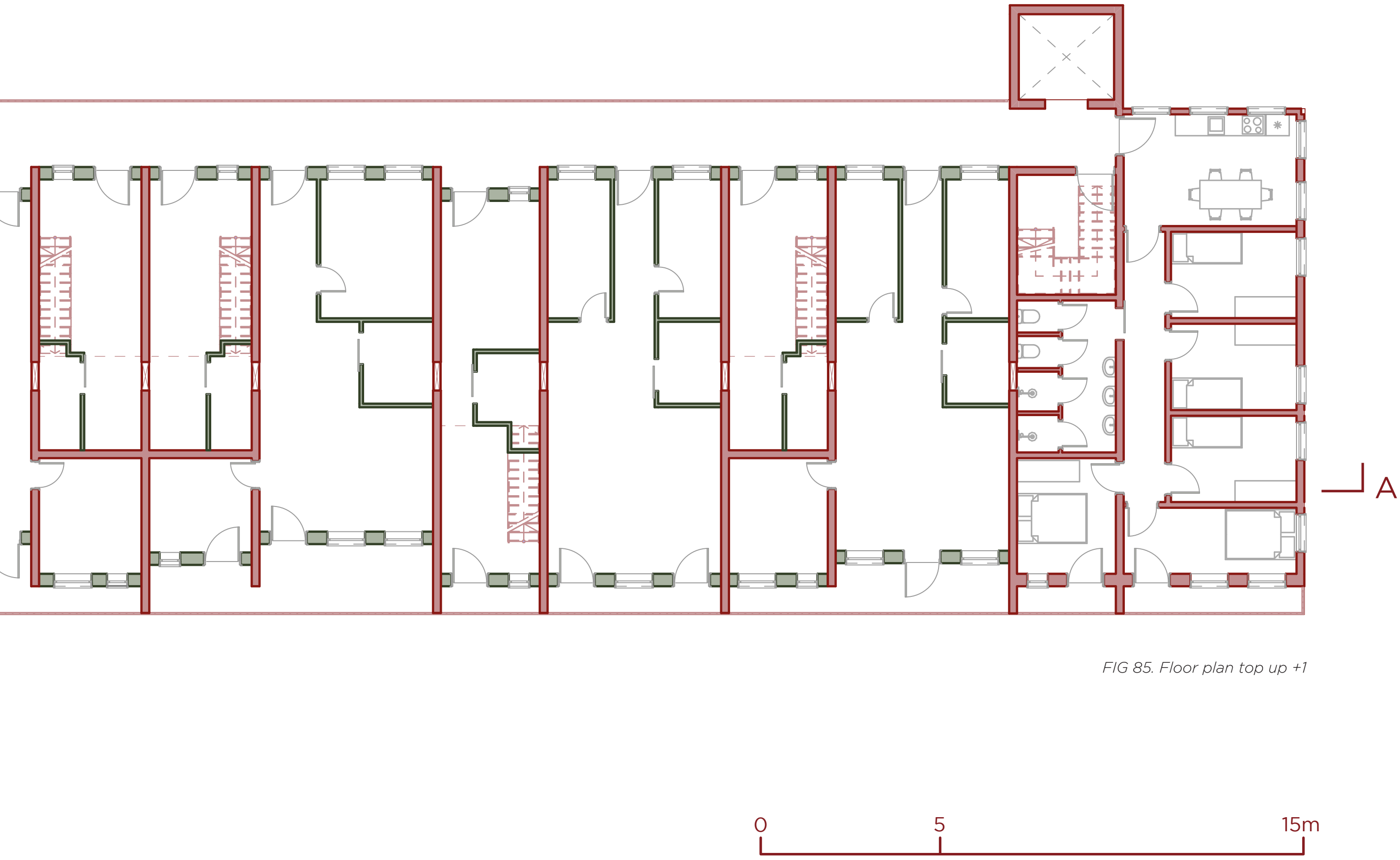


FIG 85. Floor plan top up +1

Floor plan top up +1 | layer 2

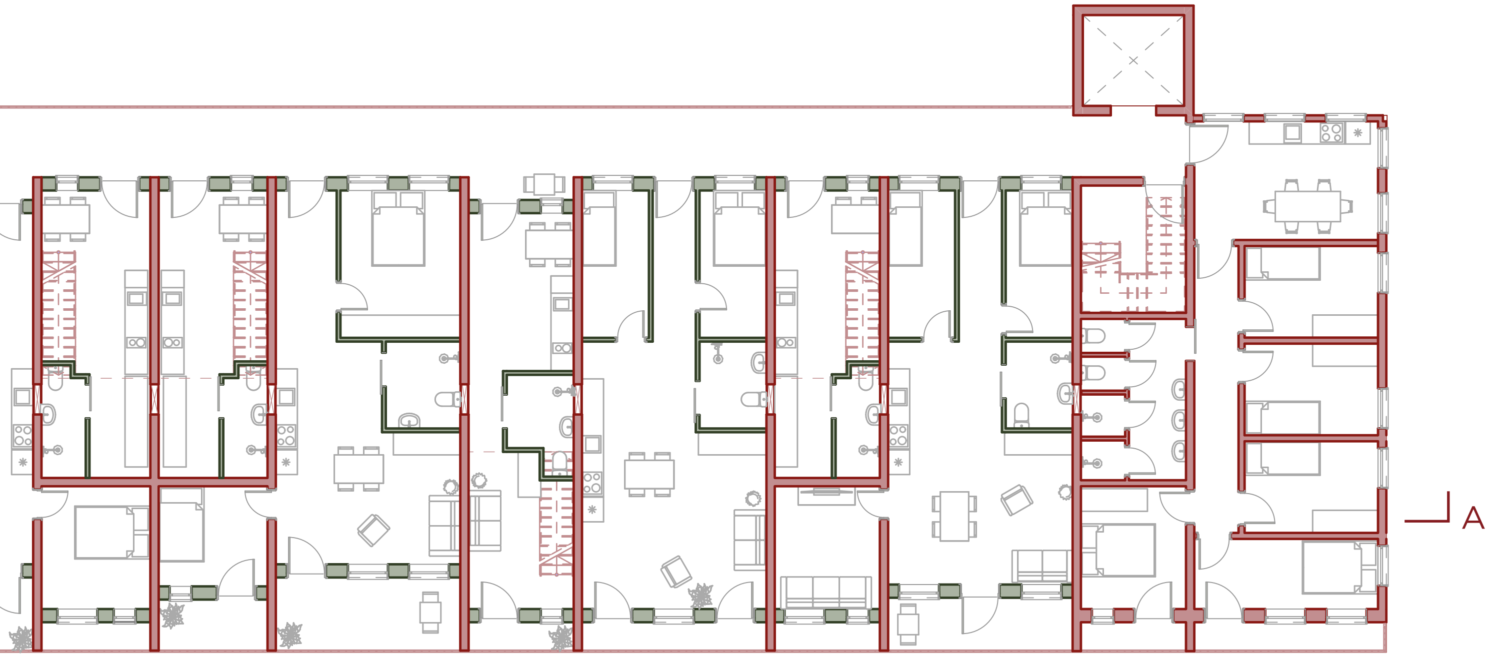
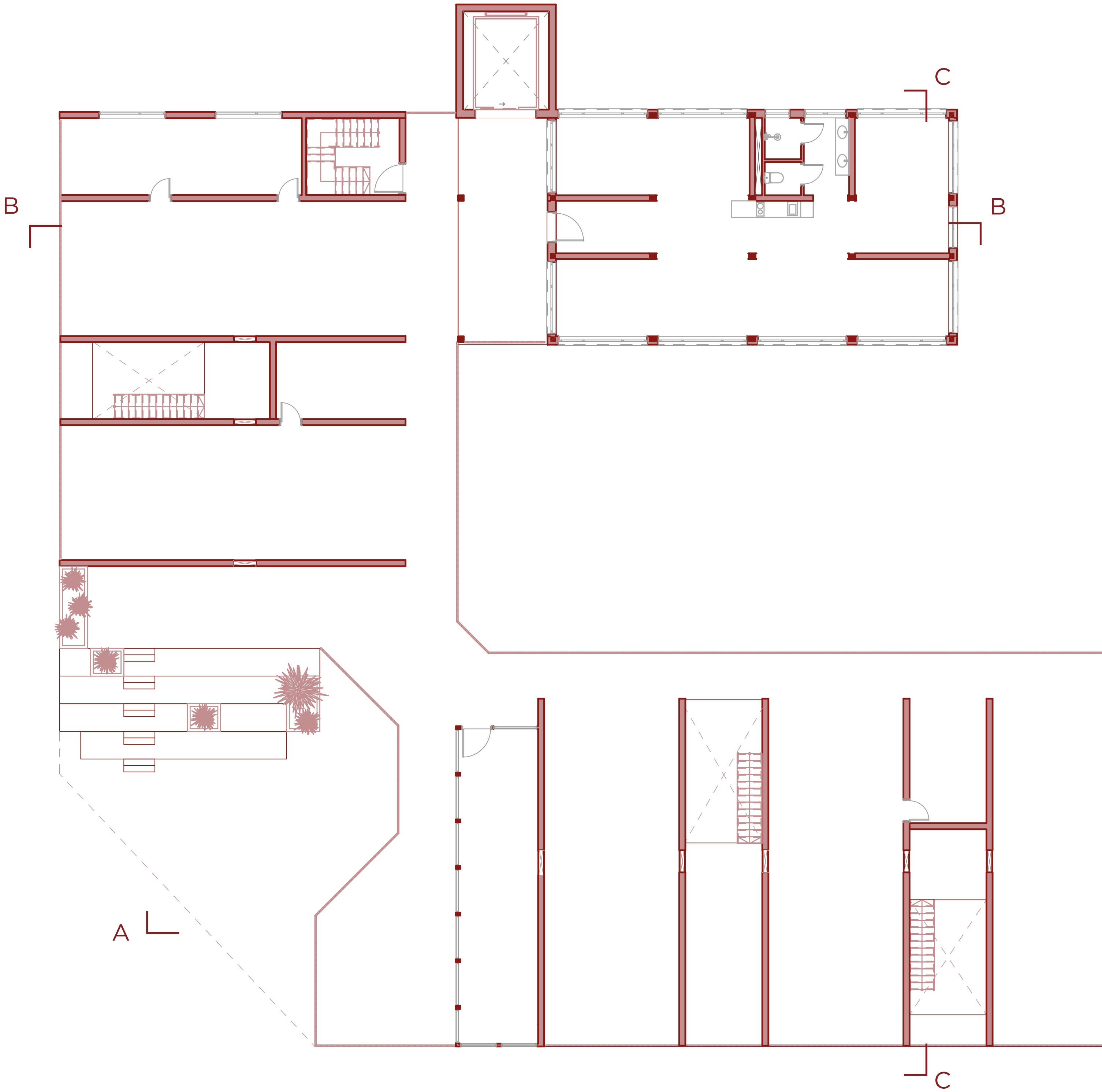


FIG 86. Floor plan top up +1

Floor plan top up +2 | layer 0



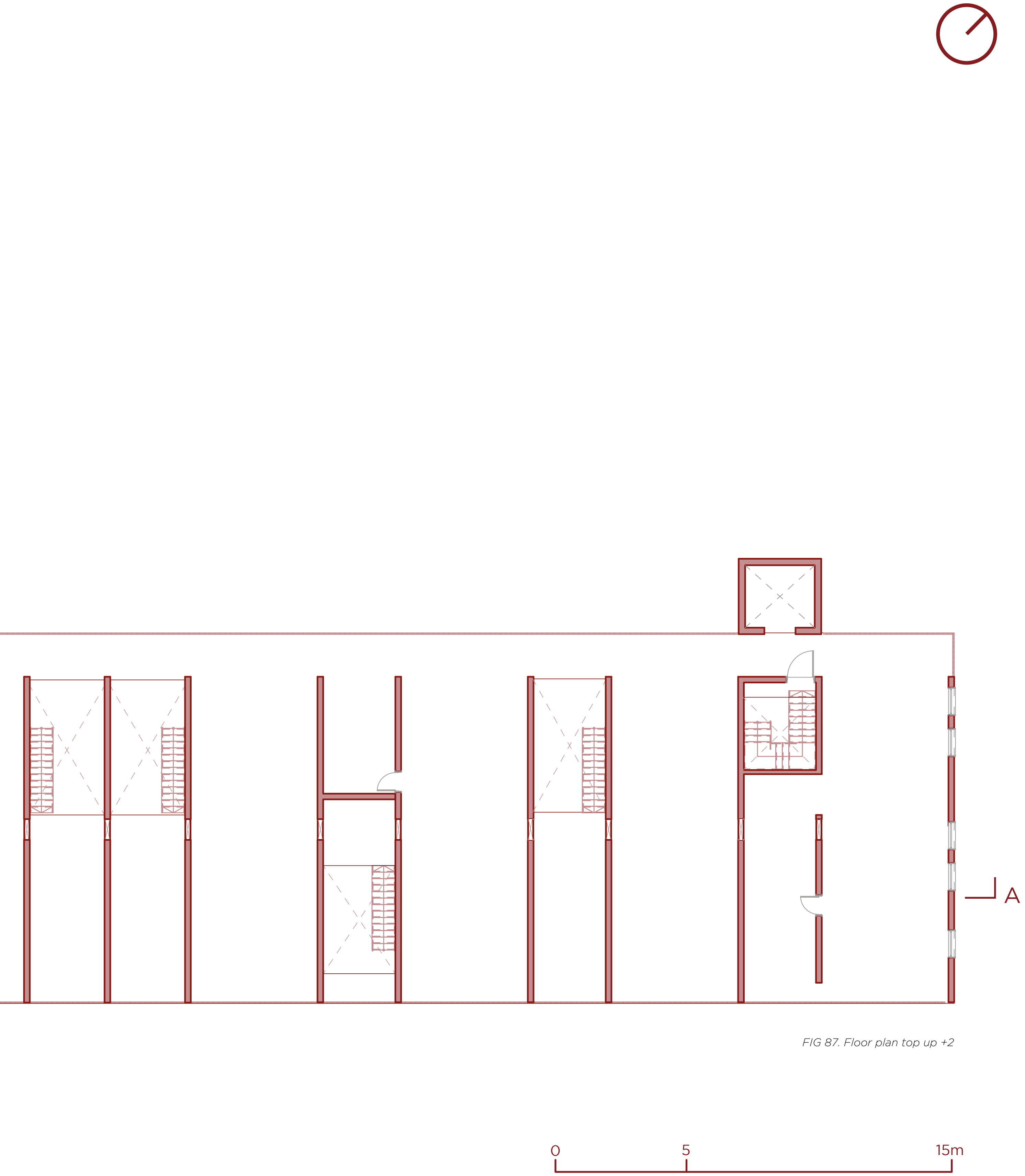
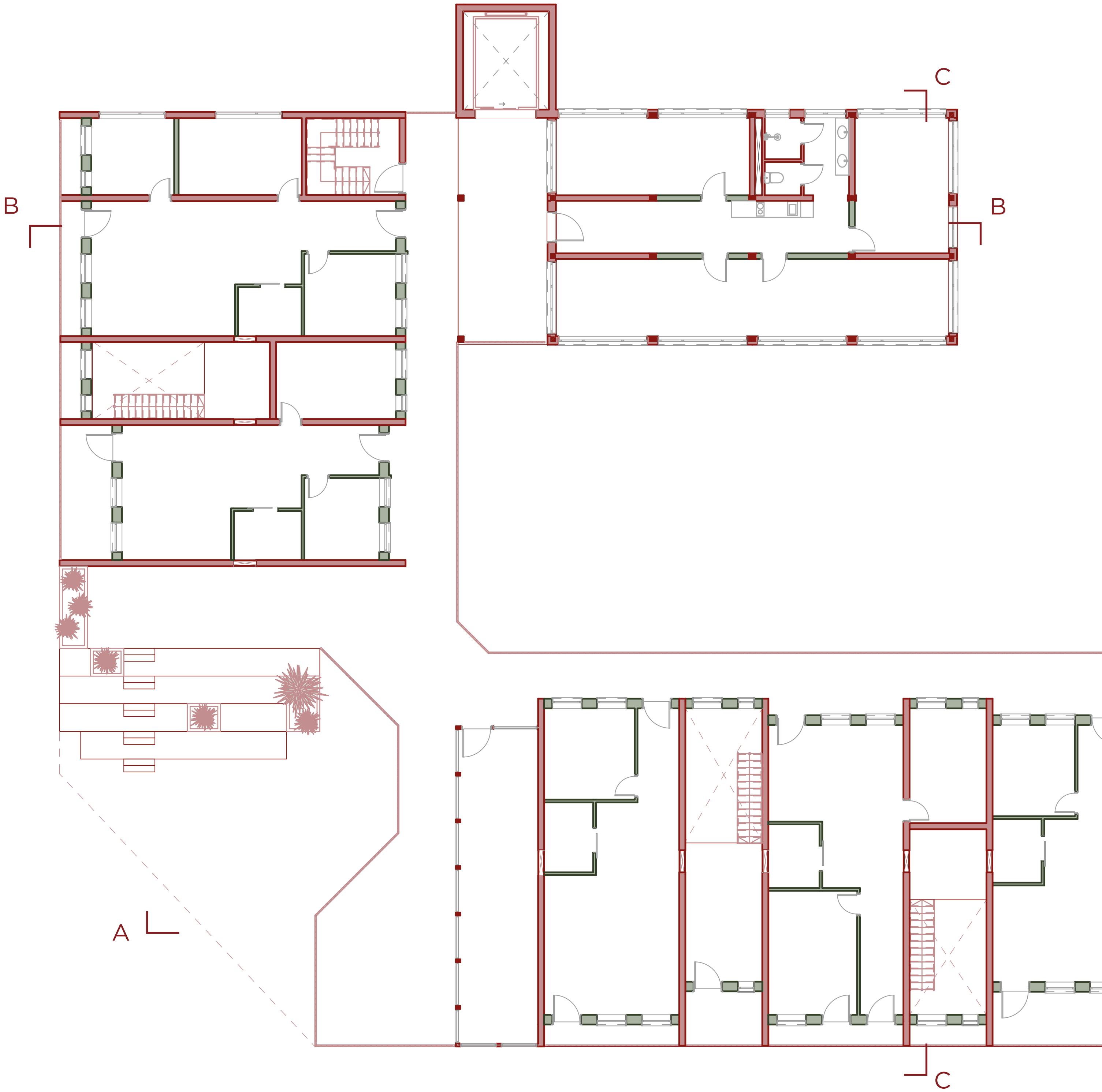


FIG 87. Floor plan top up +2

Floor plan top up +2 | layer 1



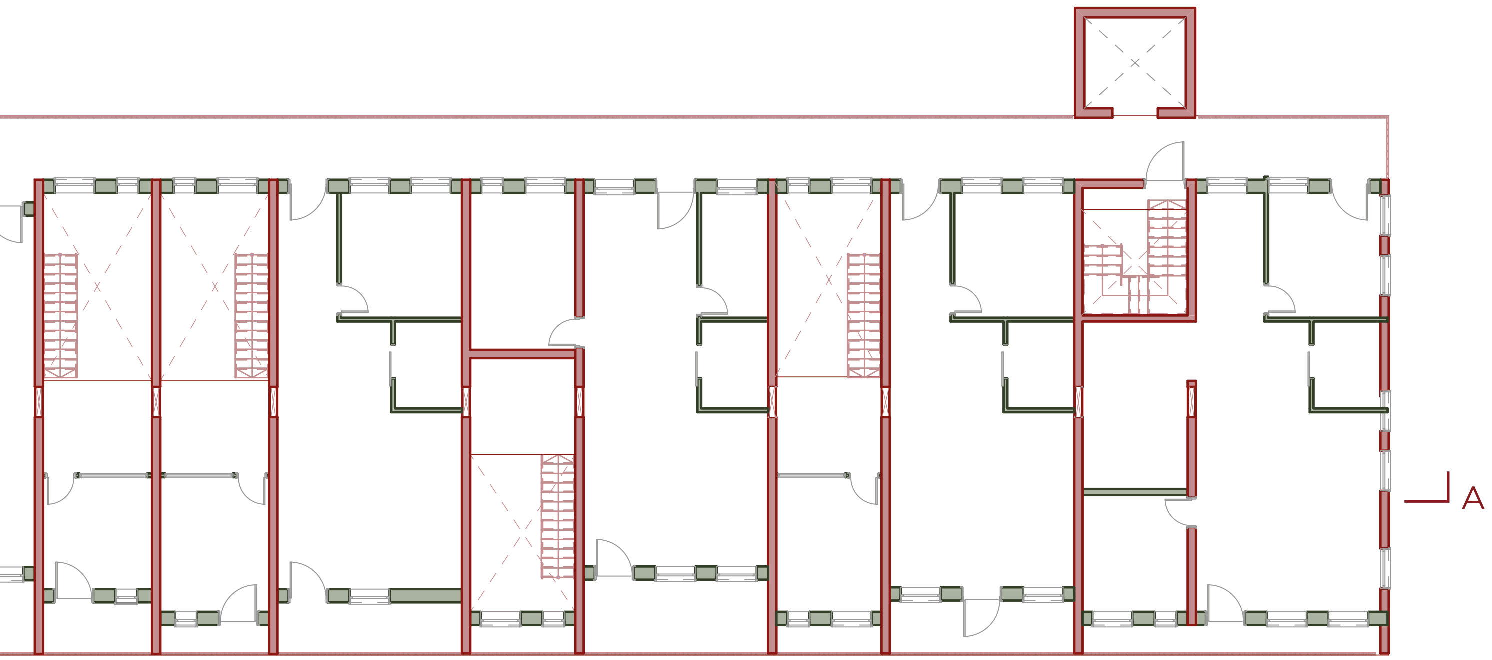


FIG 88. Floor plan top up +2

Floor plan top up +2 | layer 2

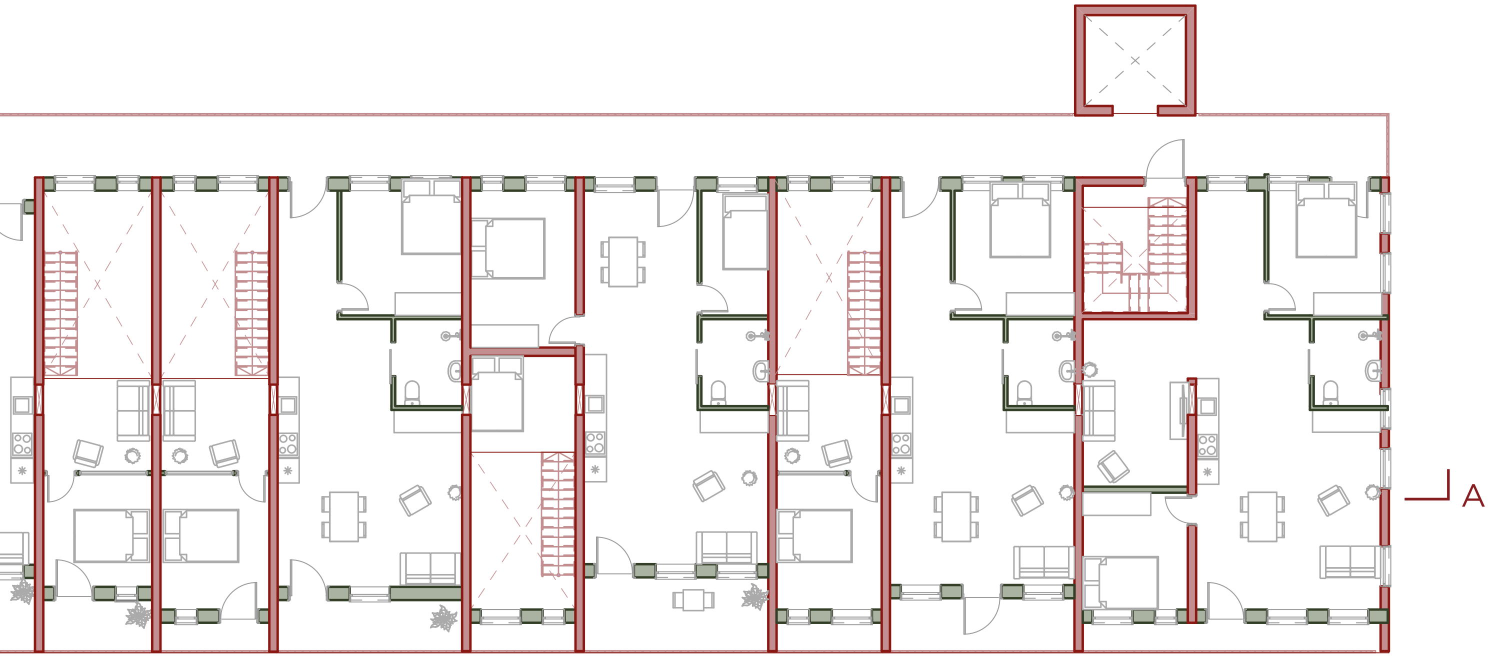


FIG 89. Floor plan top up +2

Section A

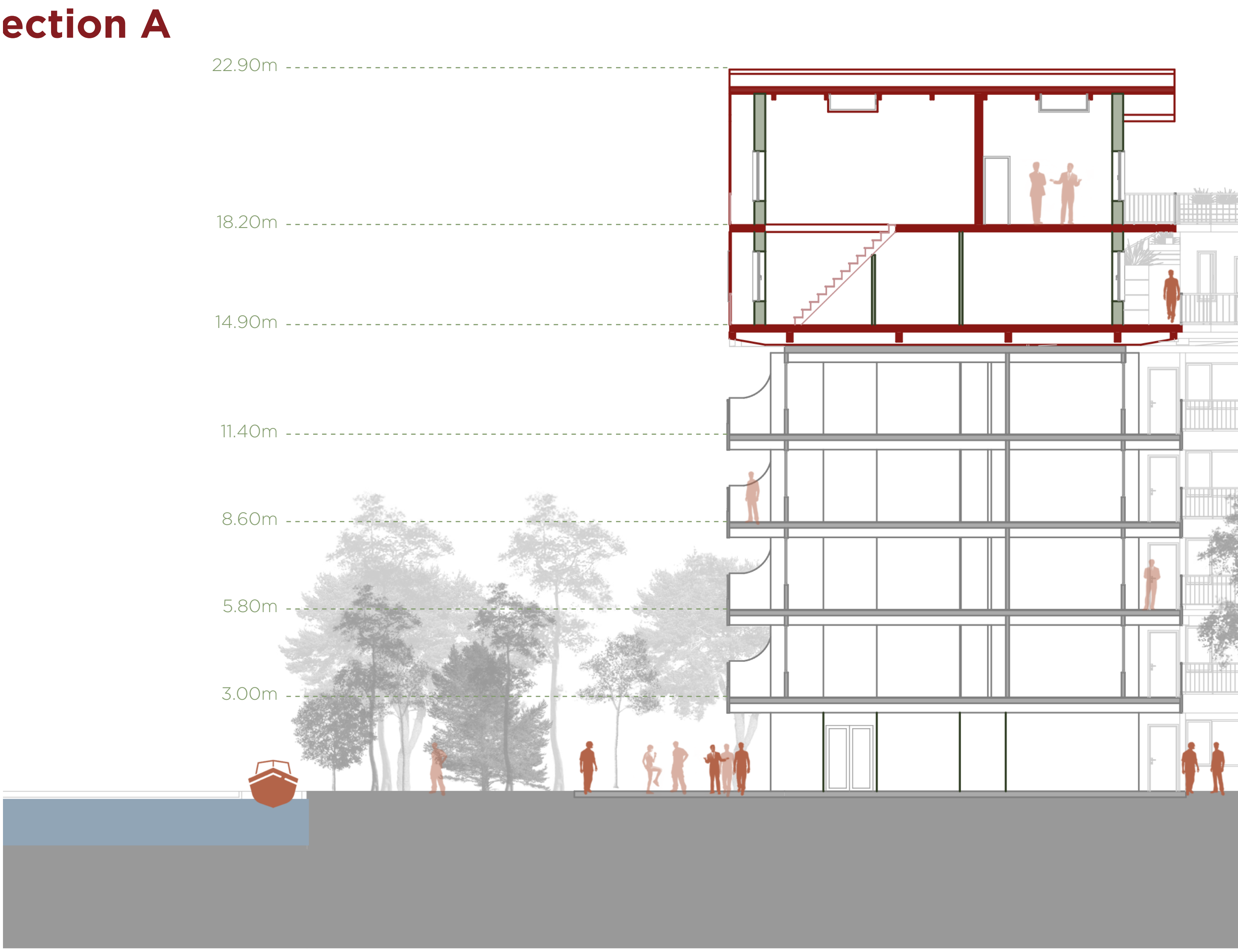
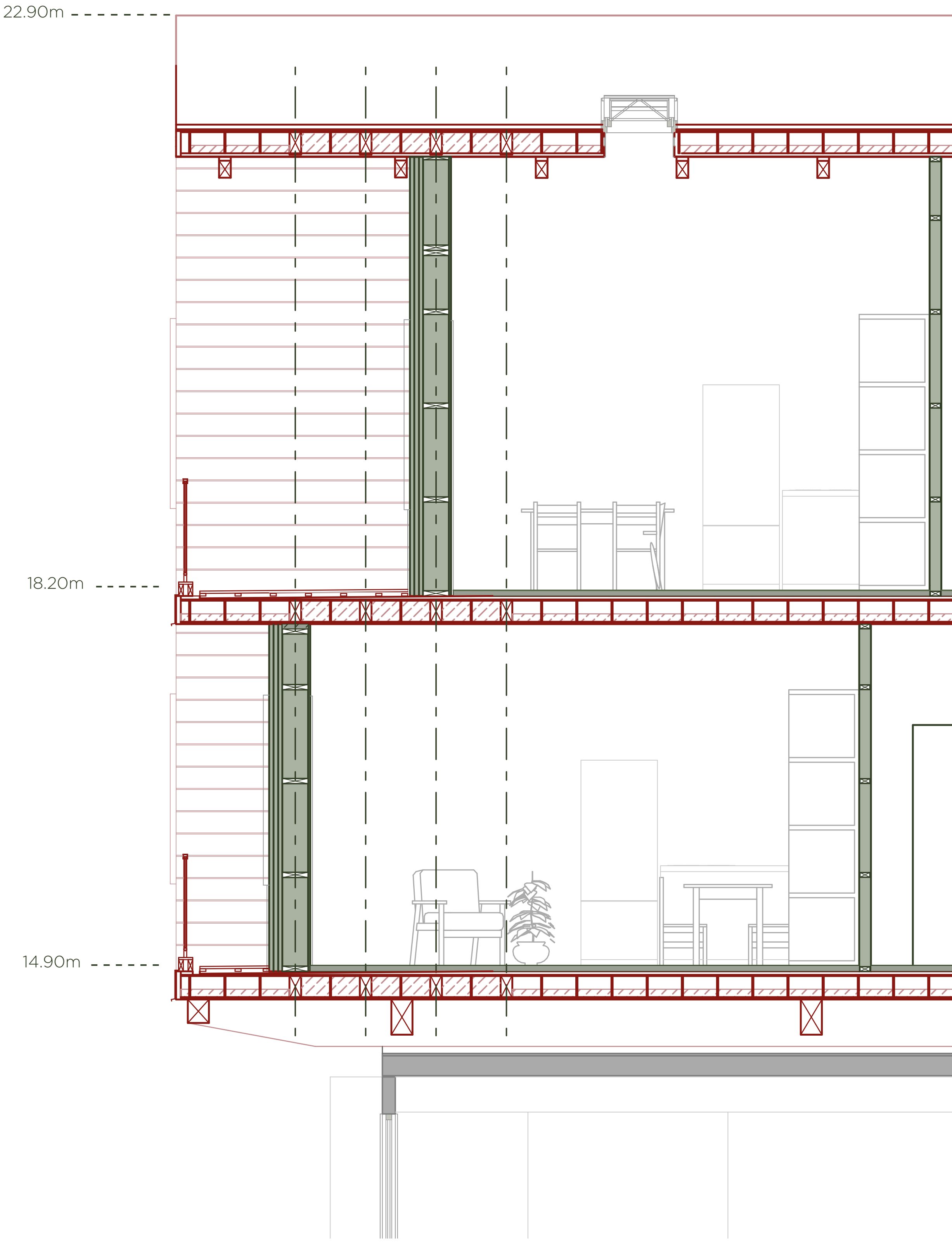


FIG 90. Section A

Section A.1



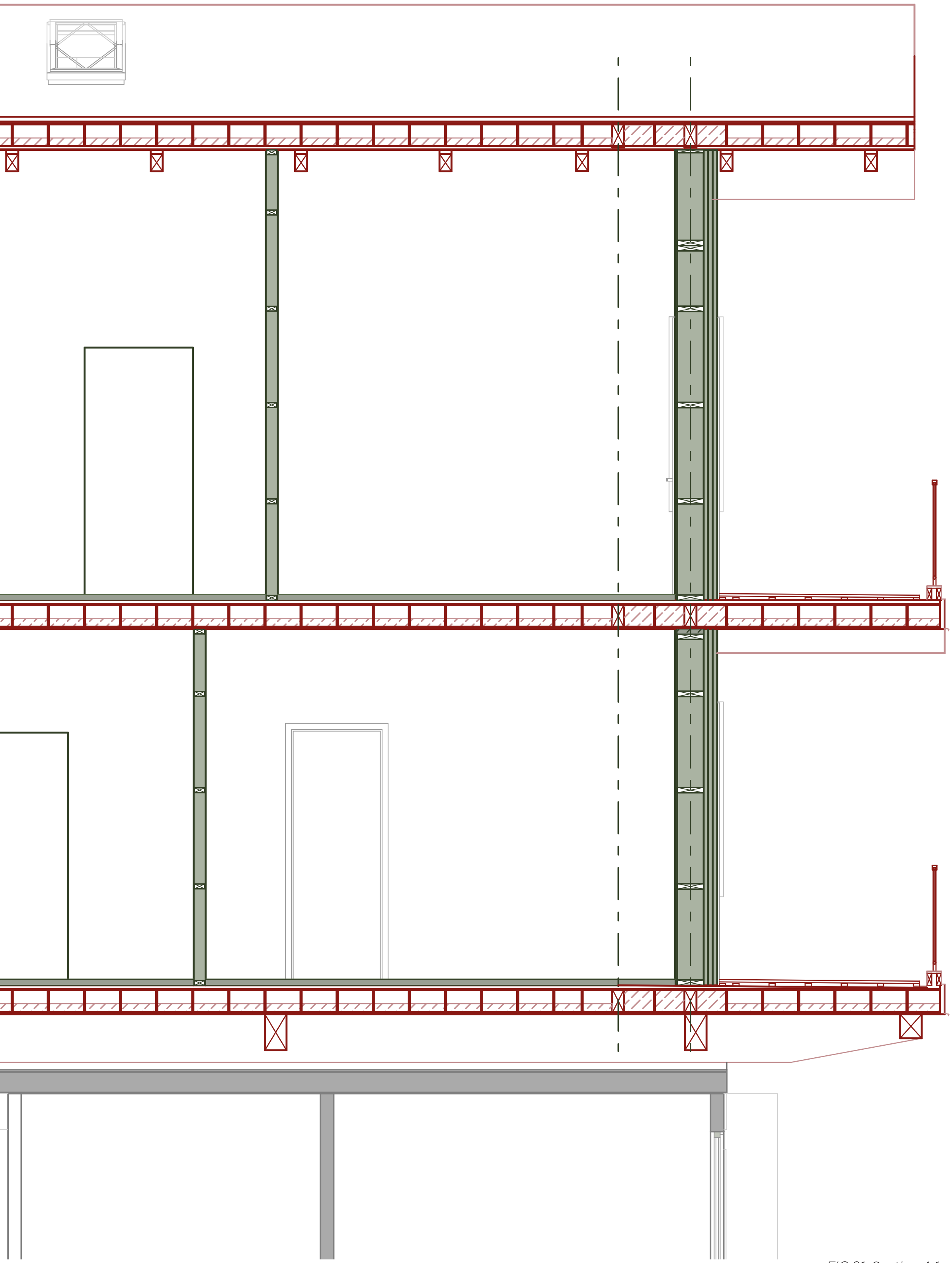
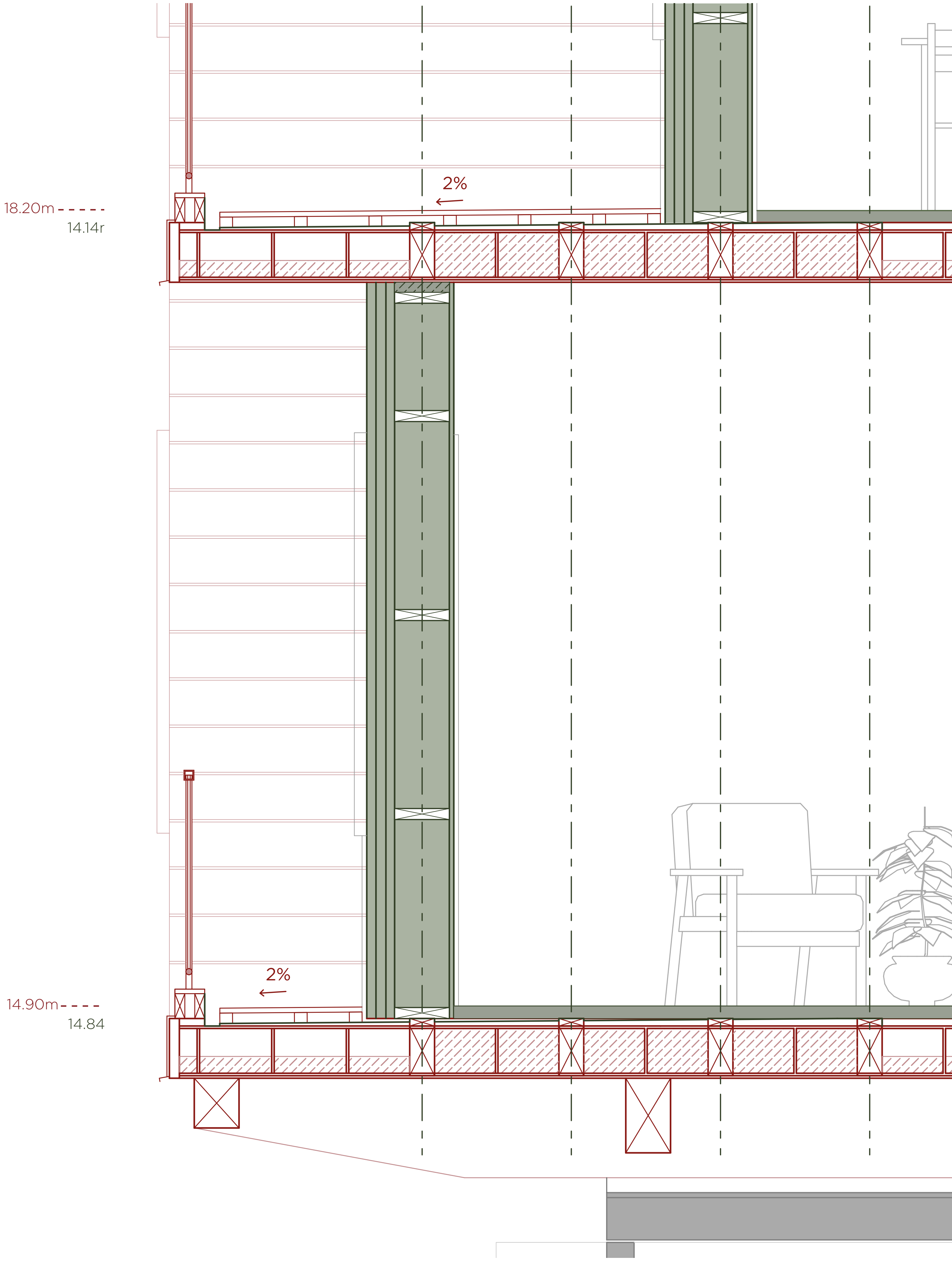


FIG 91. Section A.1

Section A.2



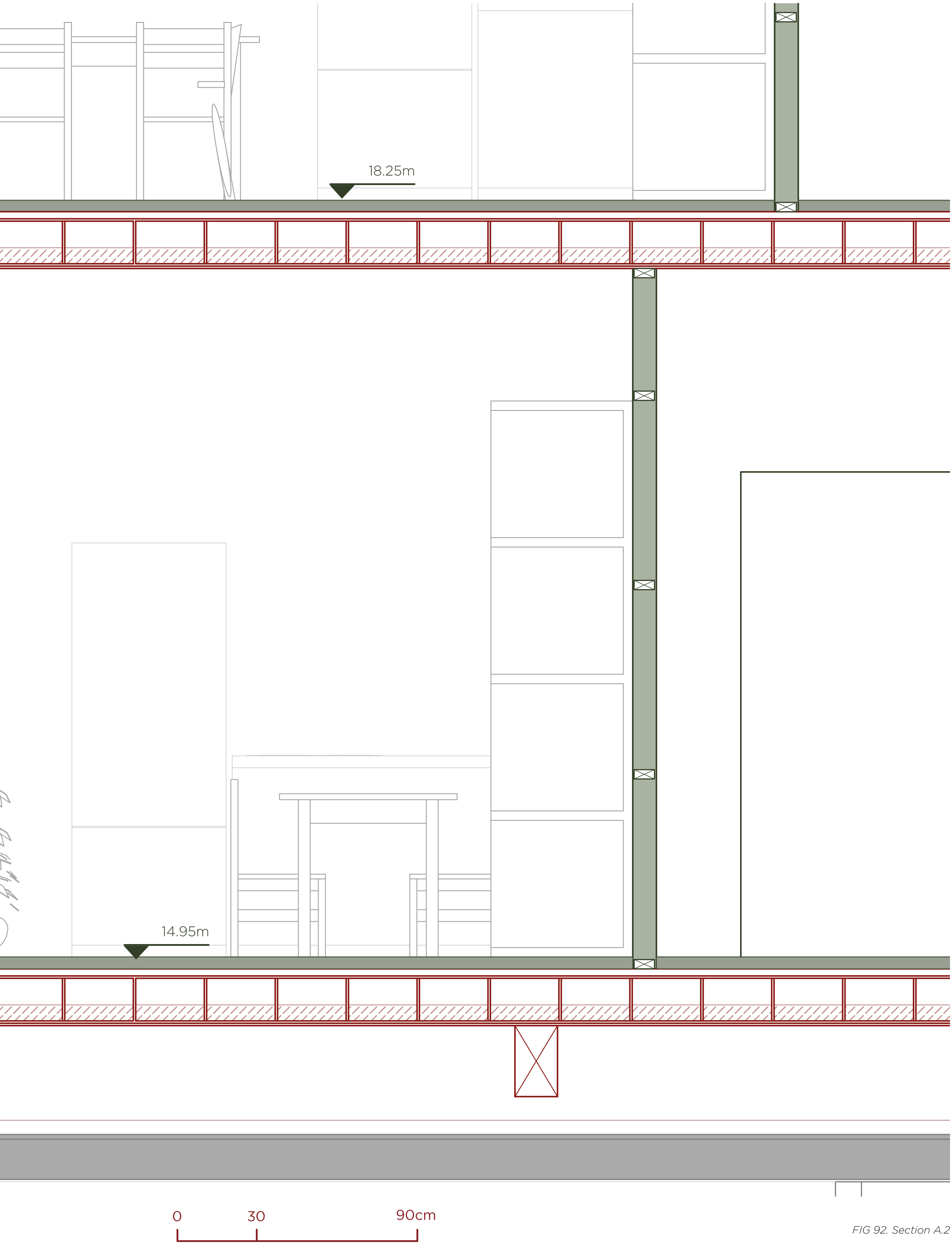
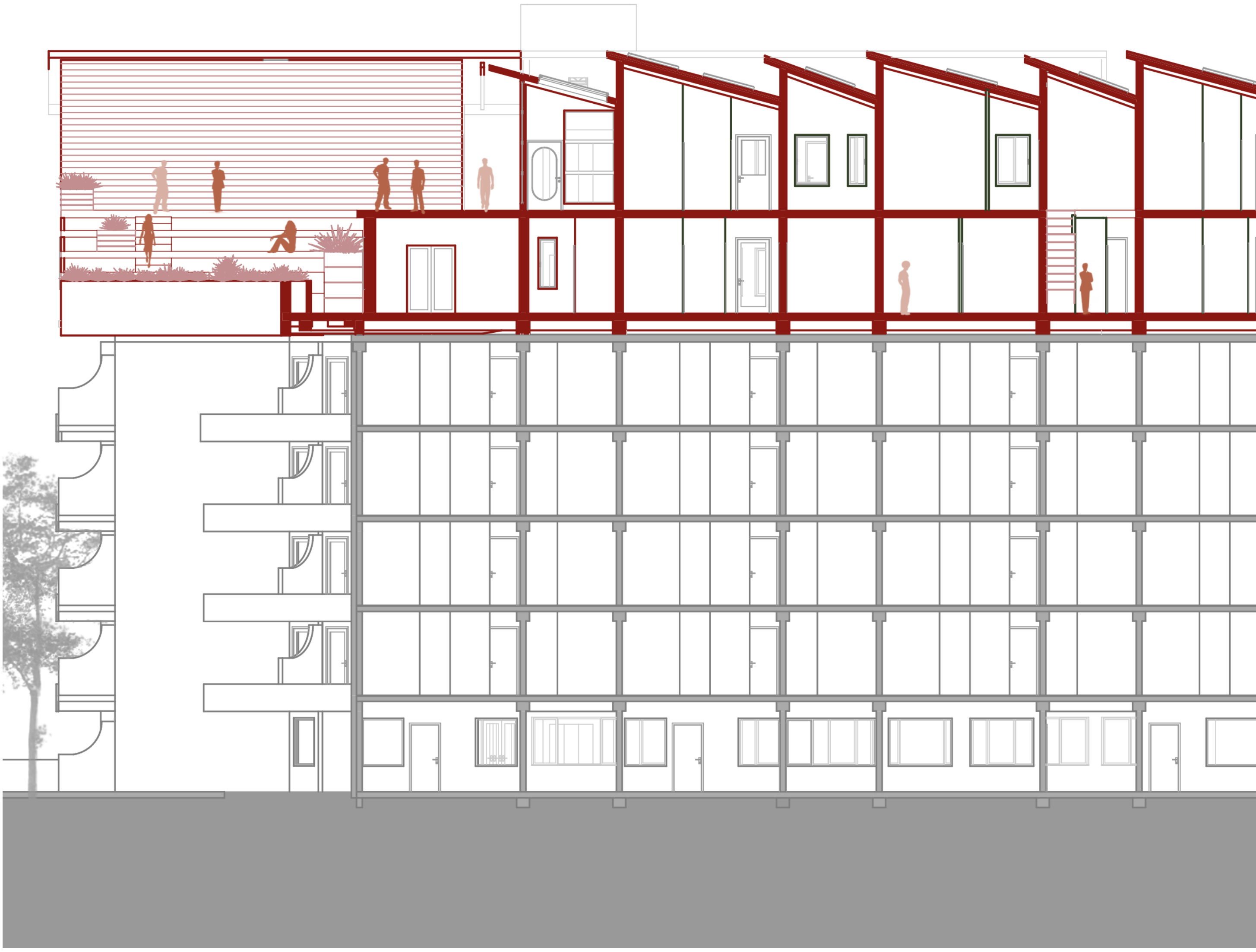


FIG 92. Section A.2

Section B



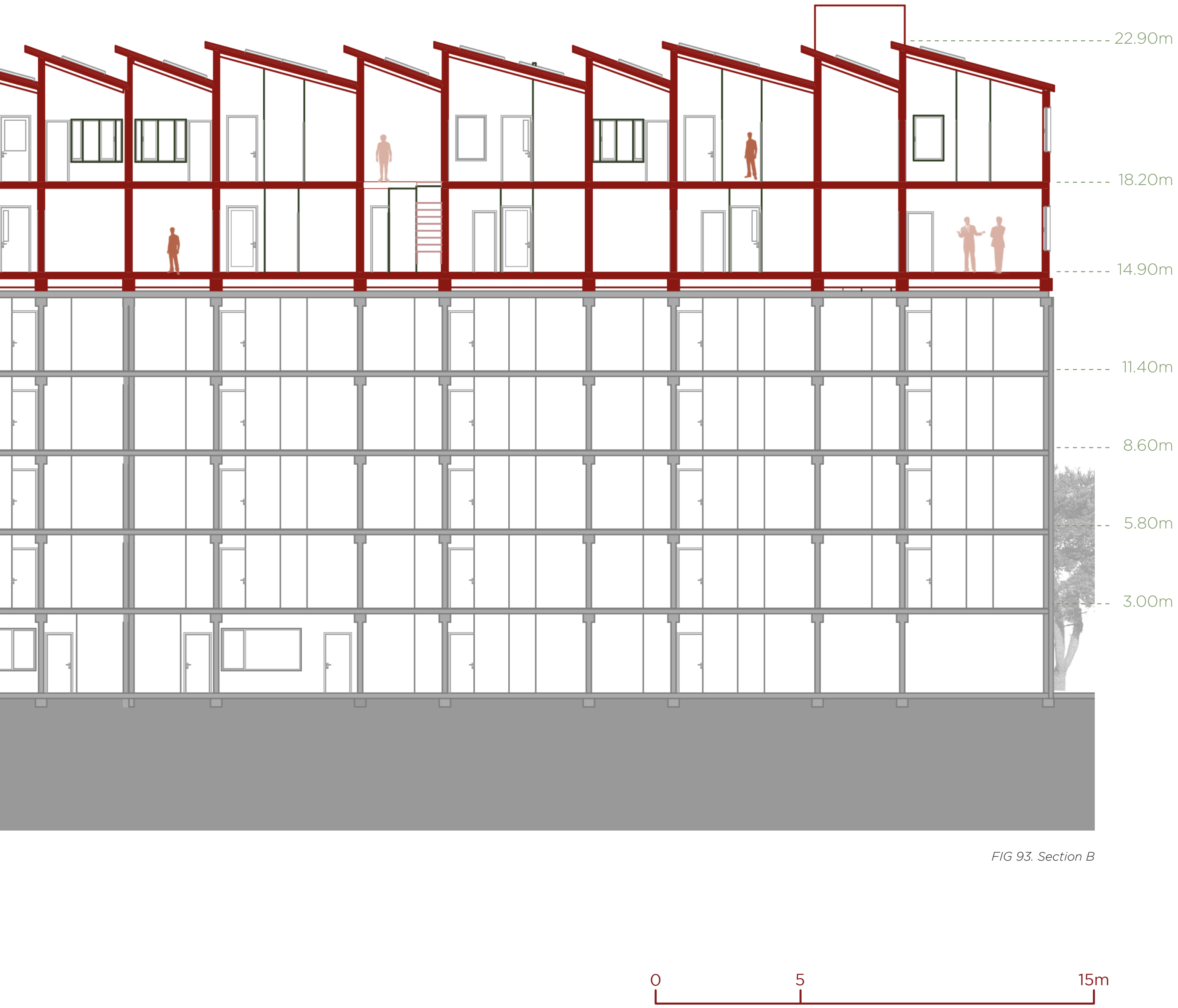


FIG 93. Section B

Section C

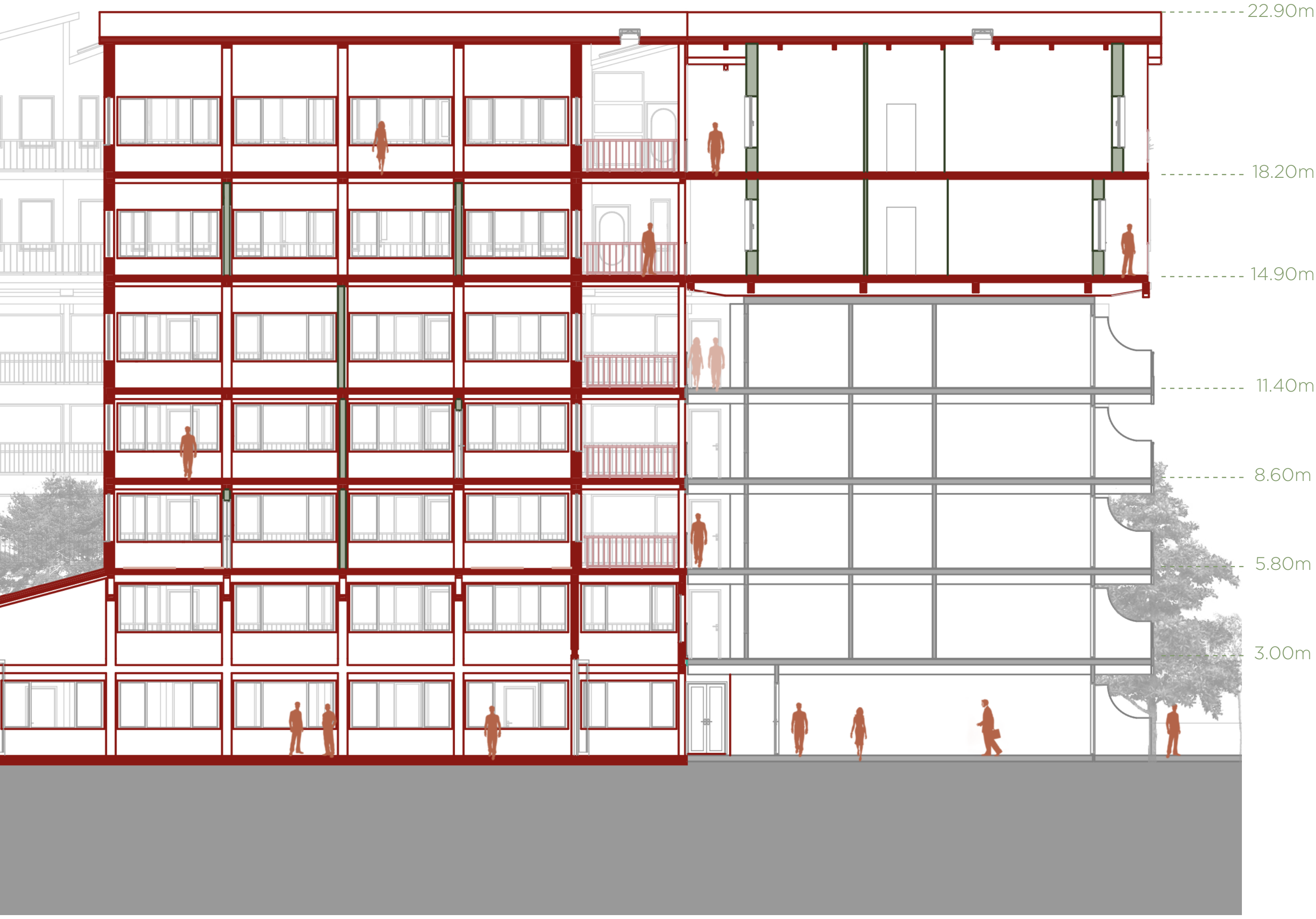
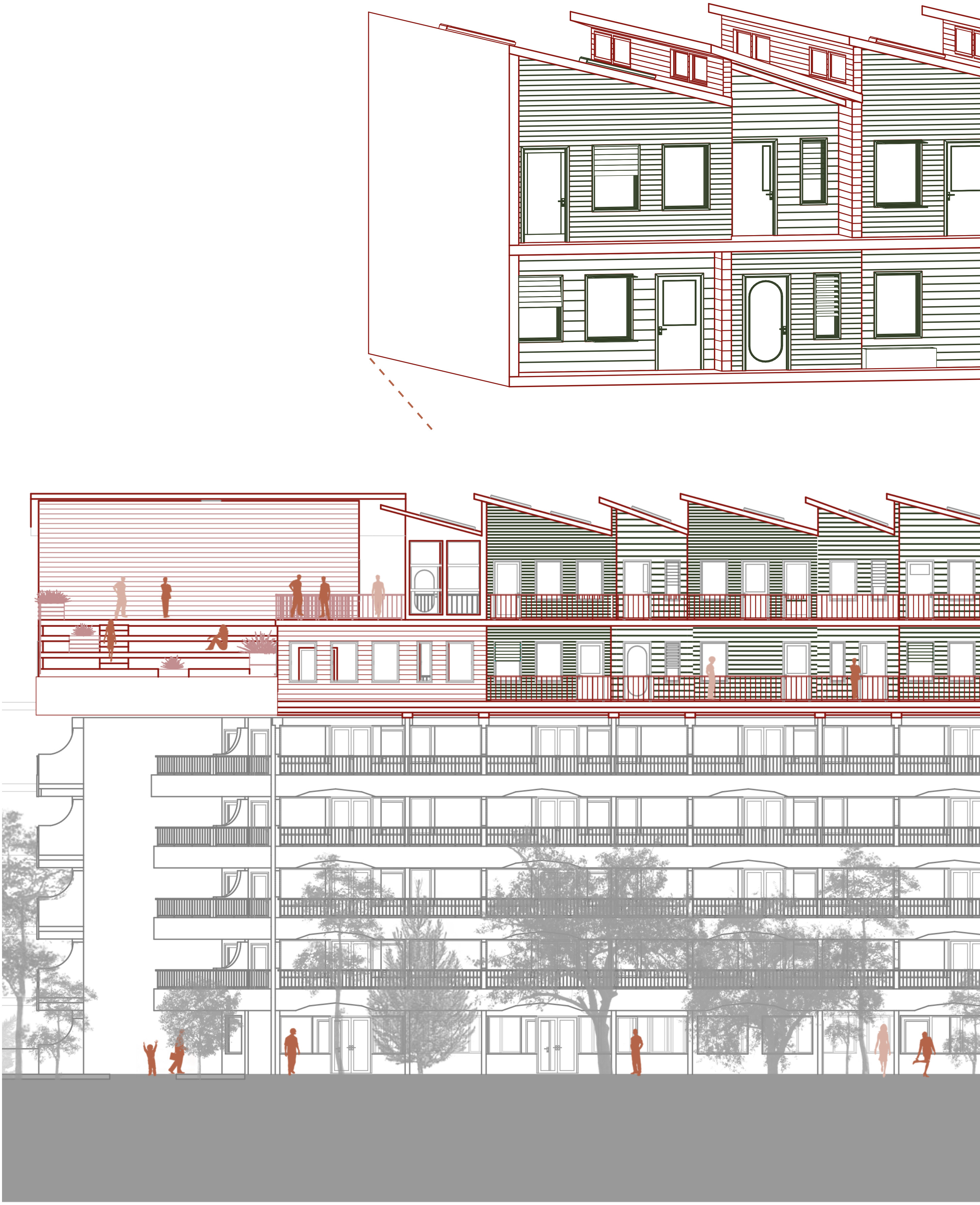


FIG 94. Section C

Elevation



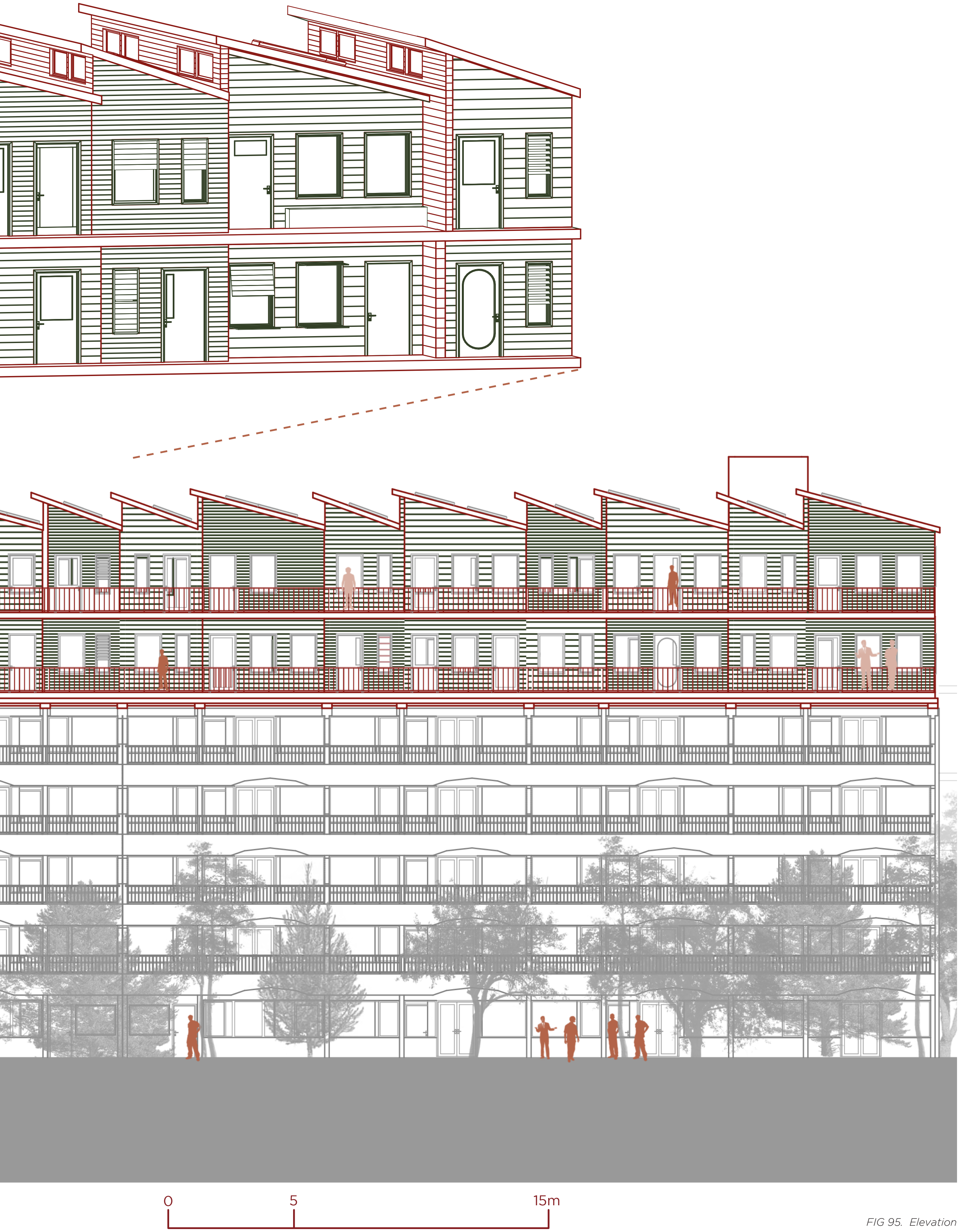


FIG 95. Elevation

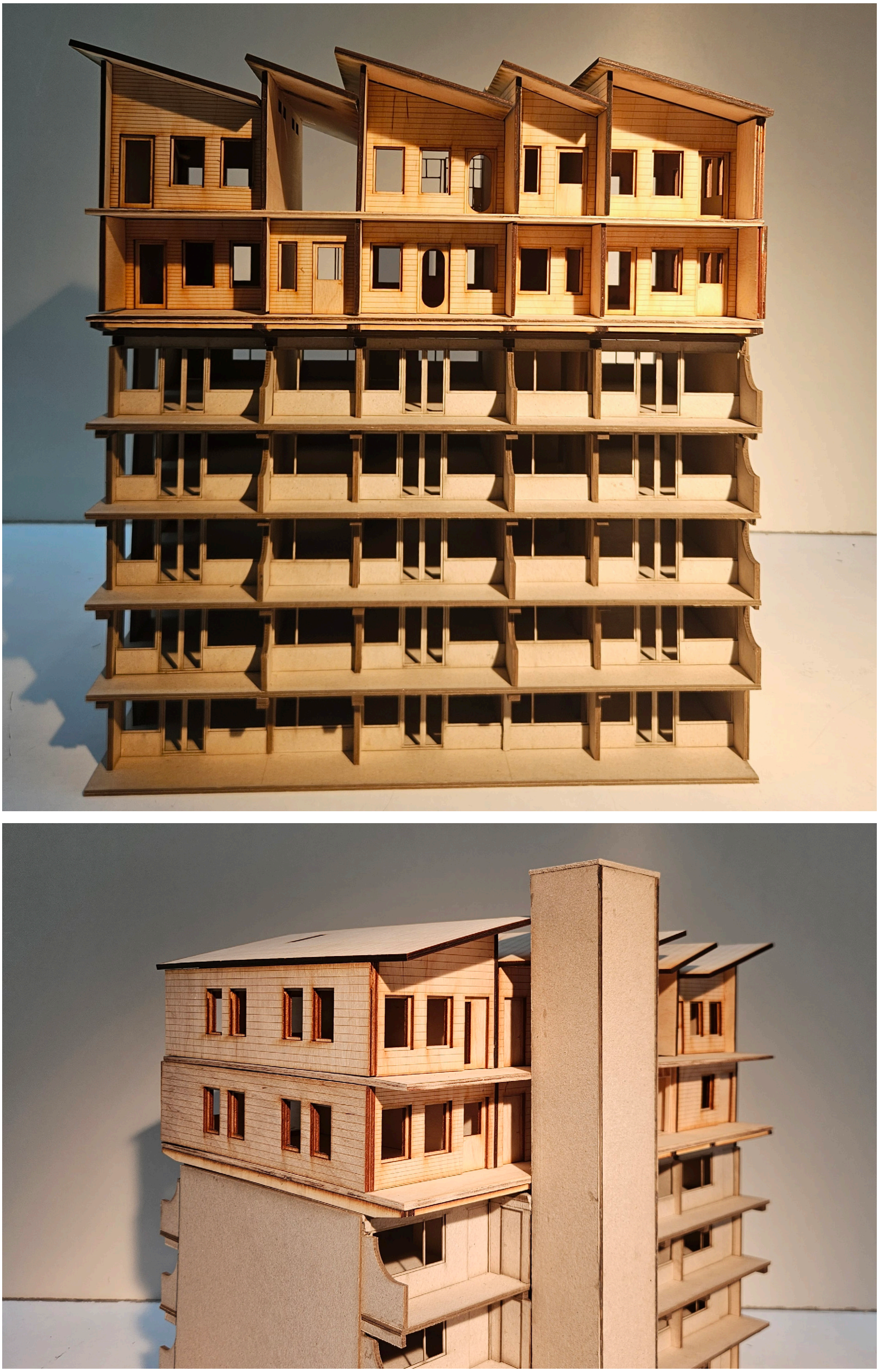


FIG 96. Physical model showing the different façades possibilities (scale 1.50)

FIG 97. Physical model showing incrmental growth (scale 1.50)

Exploded axonometric

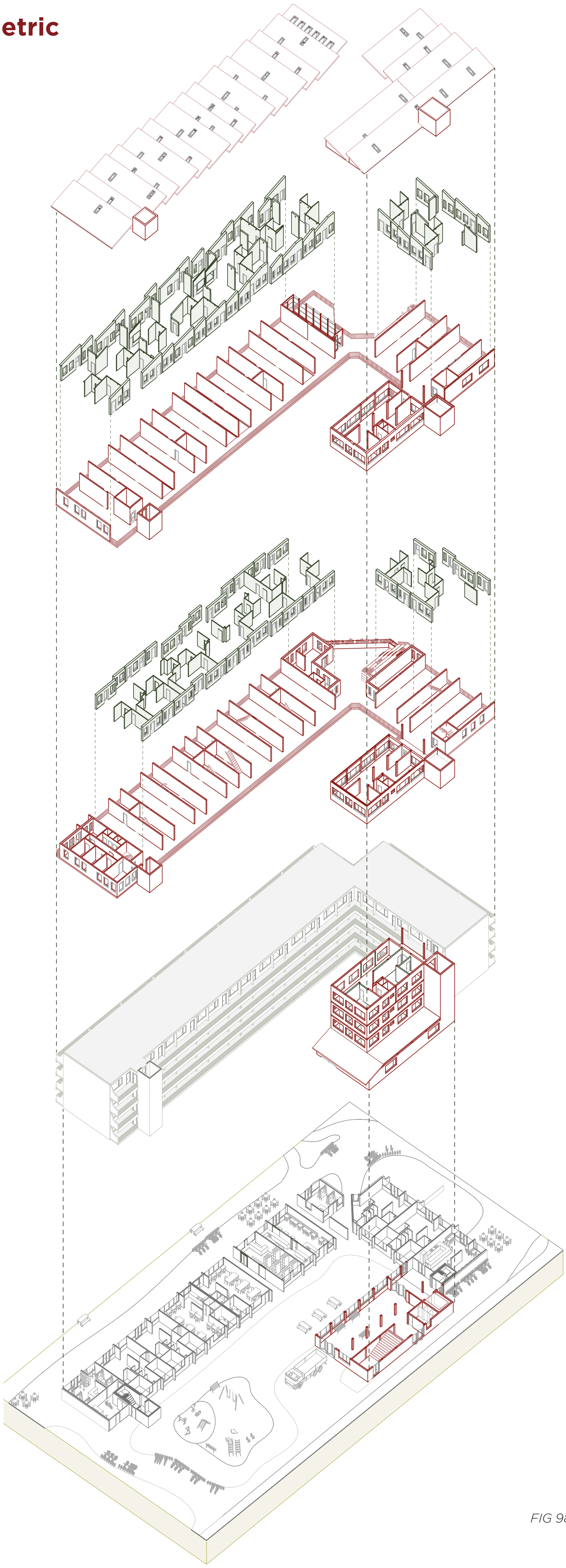


FIG 98. Exploded axonometric

6.6. Structural assembly

New building addition

The new seven-storey timber structure is conceived as a highly prefabricated dry construction system assembled entirely by professional contractors. Structural components are manufactured off-site in dimensions compatible with conventional truck transportation, reducing on-site work and simplifying logistics. Prefabrication allows for greater precision and quality control while significantly reducing construction time and exposure to weather conditions. The floor slab elements integrate reinforcement beams with pre-designed openings that allow the steel column connections to fit directly into place, simplifying assembly and enabling a rapid and repetitive construction sequence. The building is assembled floor-by-floor through a clear sequence of horizontal and vertical elements that gradually establish structural stability and enclosure.

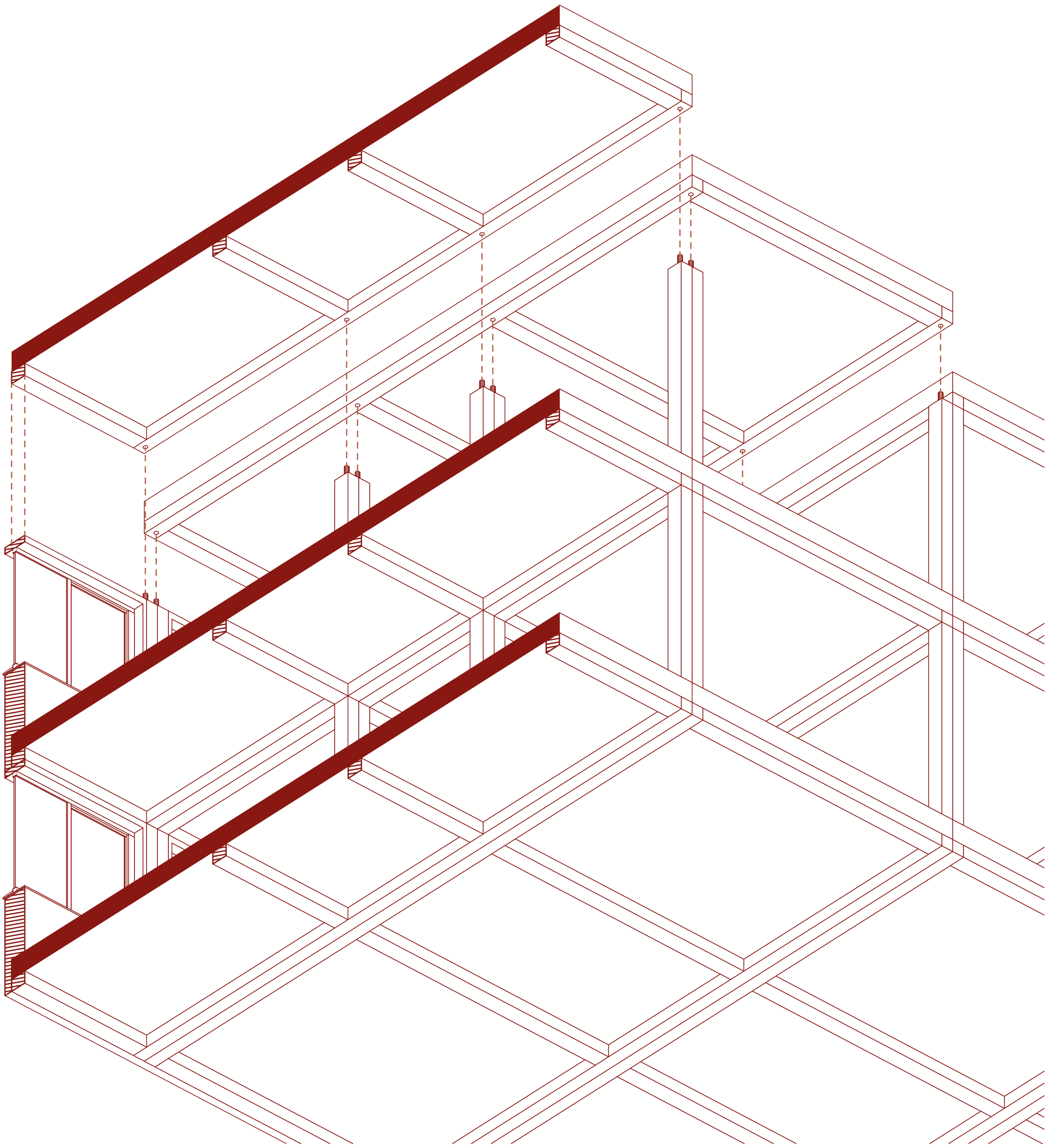


FIG 99. Structural assembly- bottom view

Step 1- Floor slab placement

Construction begins with the installation of prefabricated slab elements. Rather than a single large component, the floor is divided into smaller modules sized for transport and lifting. These slab pieces incorporate integrated reinforcement beams that strengthen the structure while also preparing the connections for the following assembly stages. Once placed, they provide an immediate working platform for subsequent construction activities.

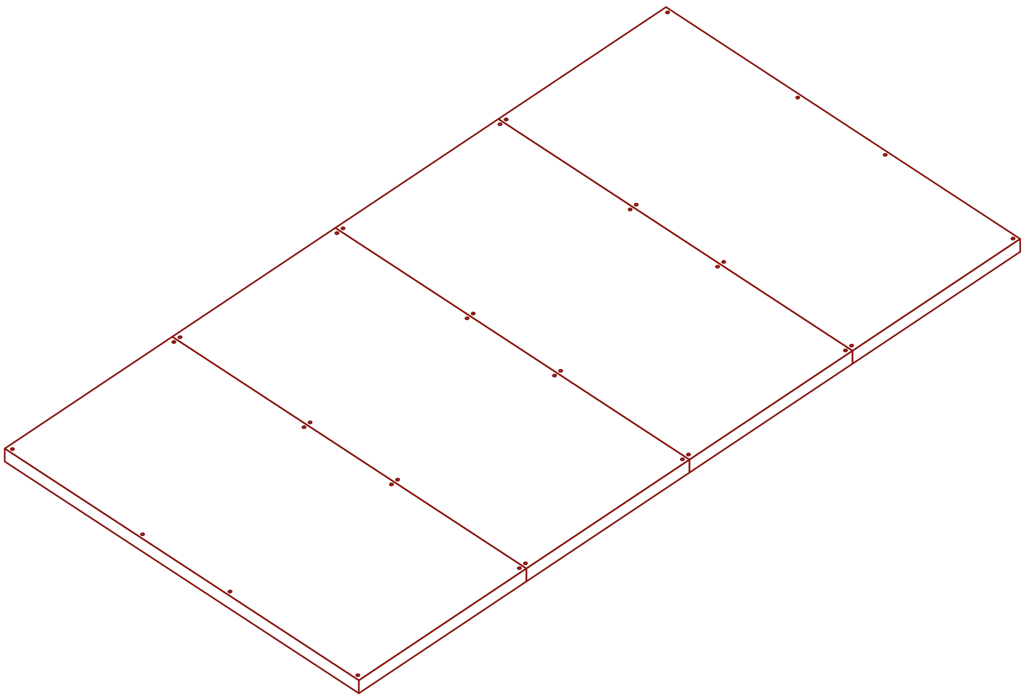


FIG 100. Structural assembly- step 1: floor slab

Step 2- Columns and walls

After the slab platform is completed, prefabricated timber columns and fixed CLT wall elements are installed. The columns transfer vertical loads through the structural system, while the CLT walls contribute to lateral stability and help brace the building against horizontal forces such as wind. The connection system is designed so that the steel fittings at the base of the columns align directly with the openings integrated into the slab reinforcement beams, enabling a quick and accurate installation process.

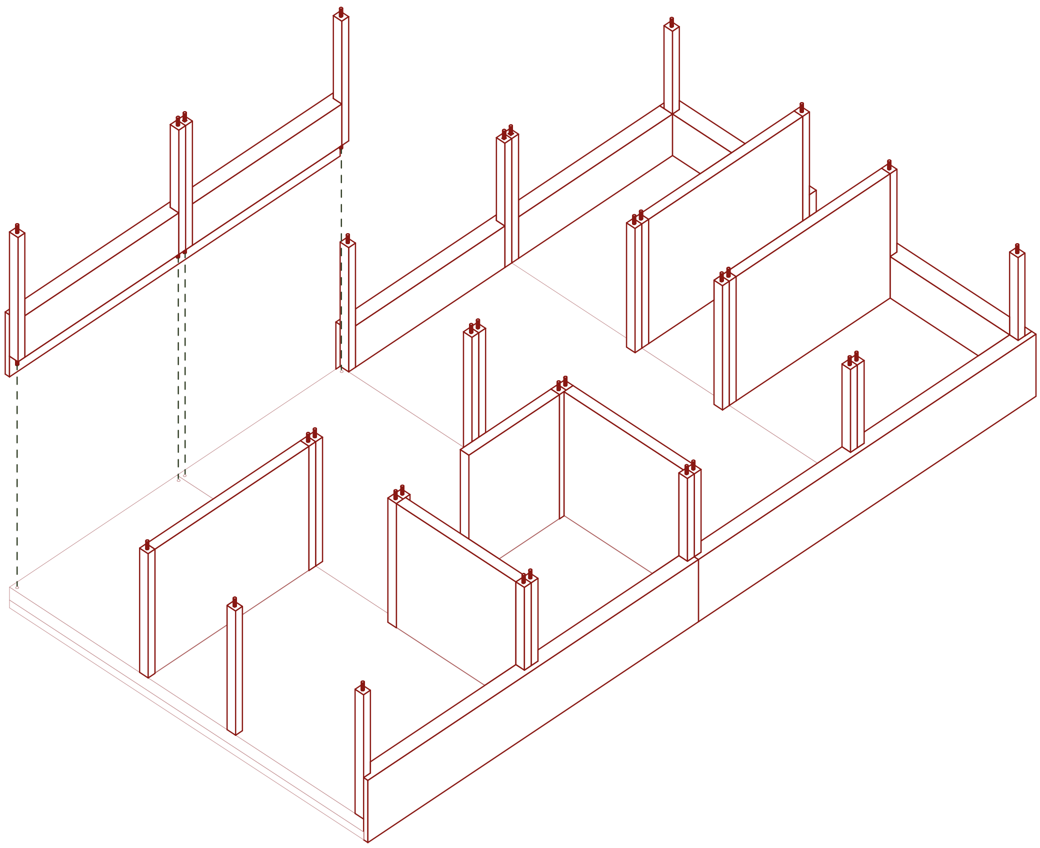


FIG 101. Structural assembly- step 2: columns and walls

Step 3- Windows

Following the primary structure, prefabricated façade elements with integrated windows are positioned between the structural components. Installing the window systems as prefabricated assemblies accelerates the enclosure process and improves quality control regarding airtightness and weather protection. This rapidly creates a protected building envelope, allowing internal work to proceed under sheltered conditions.

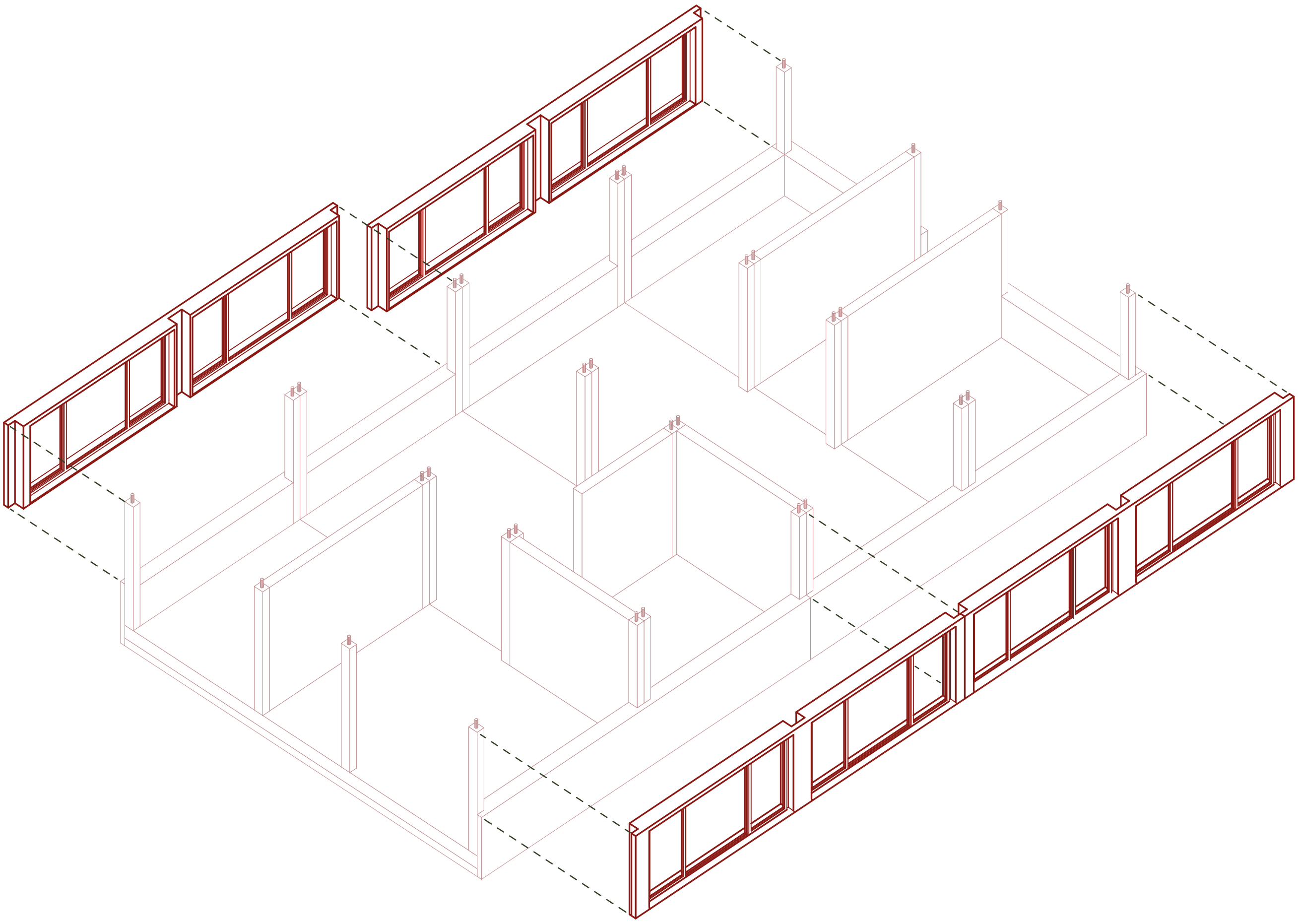


FIG 102. Structural assembly- step 3: windows

Step 4- Floor stacking

Once the structural frame and façade elements are in place, the next level of slab modules is installed and the process repeats. This floor-by-floor assembly logic creates a repetitive and efficient construction rhythm, reducing complexity on site and enabling rapid vertical progression. The system allows the building to be assembled in a predictable manner while maintaining the advantages of prefabricated timber construction.

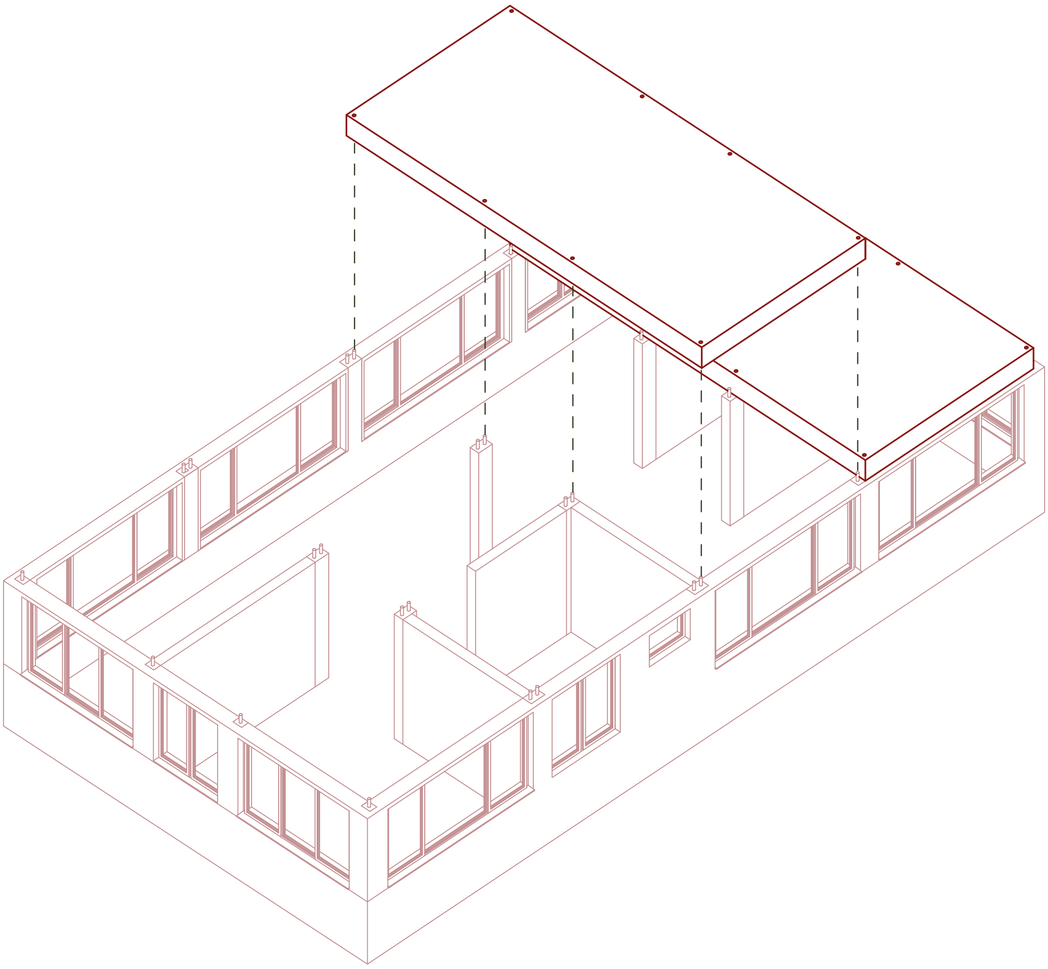


FIG 103. Structural assembly- step 4: floor stacking

Structural assembly | Top up

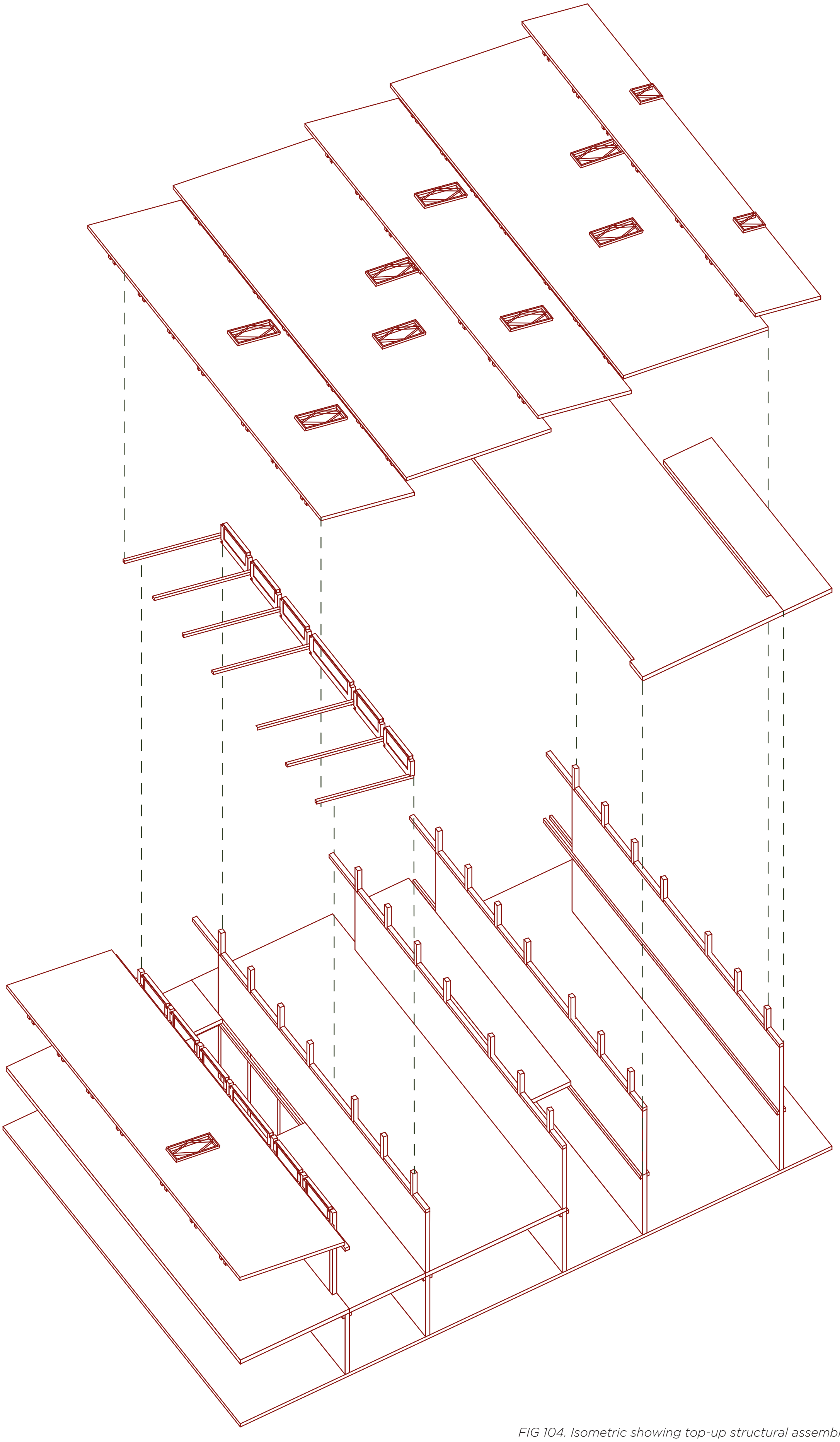


FIG 104. Isometric showing top-up structural assembly logic

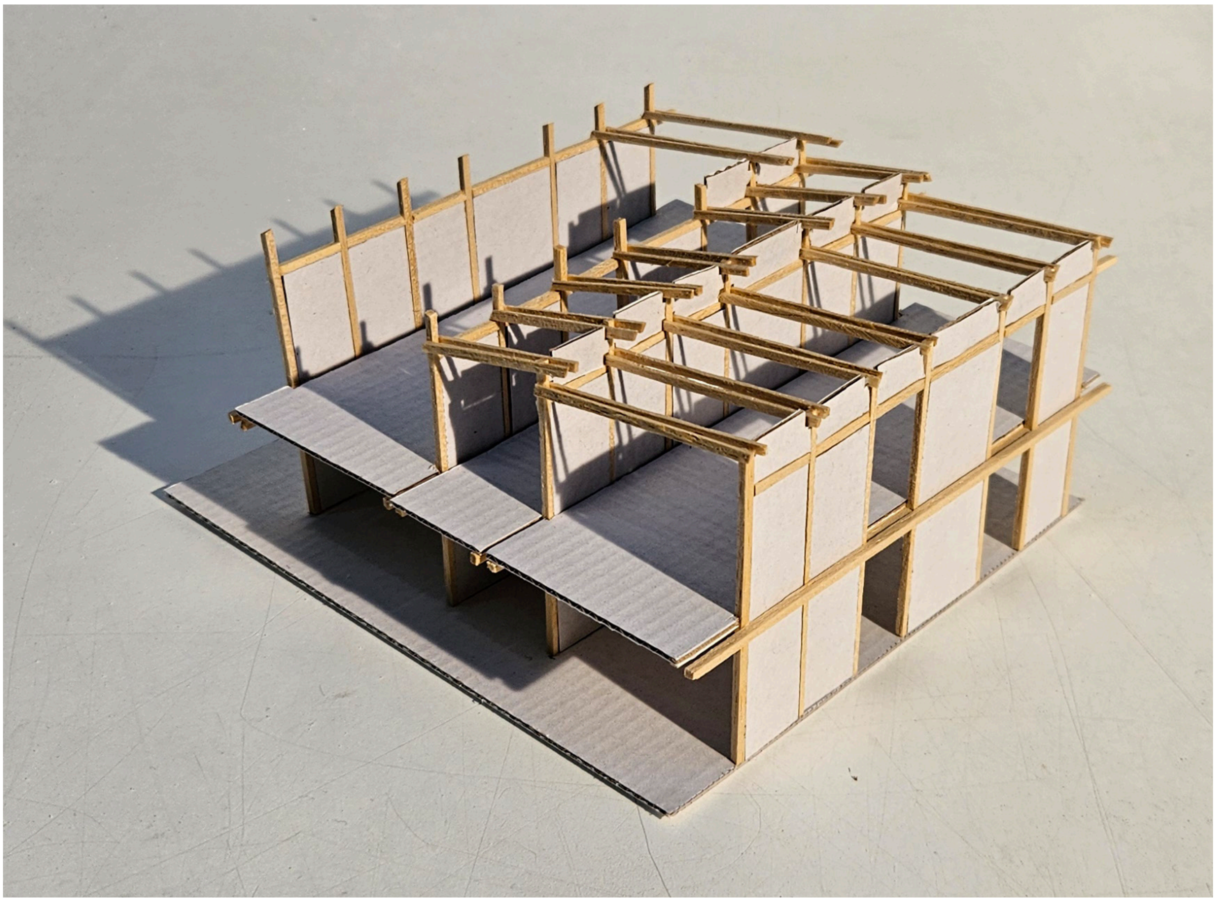


FIG 105. Top-up structural assembly logic | study model (scale 1.100)

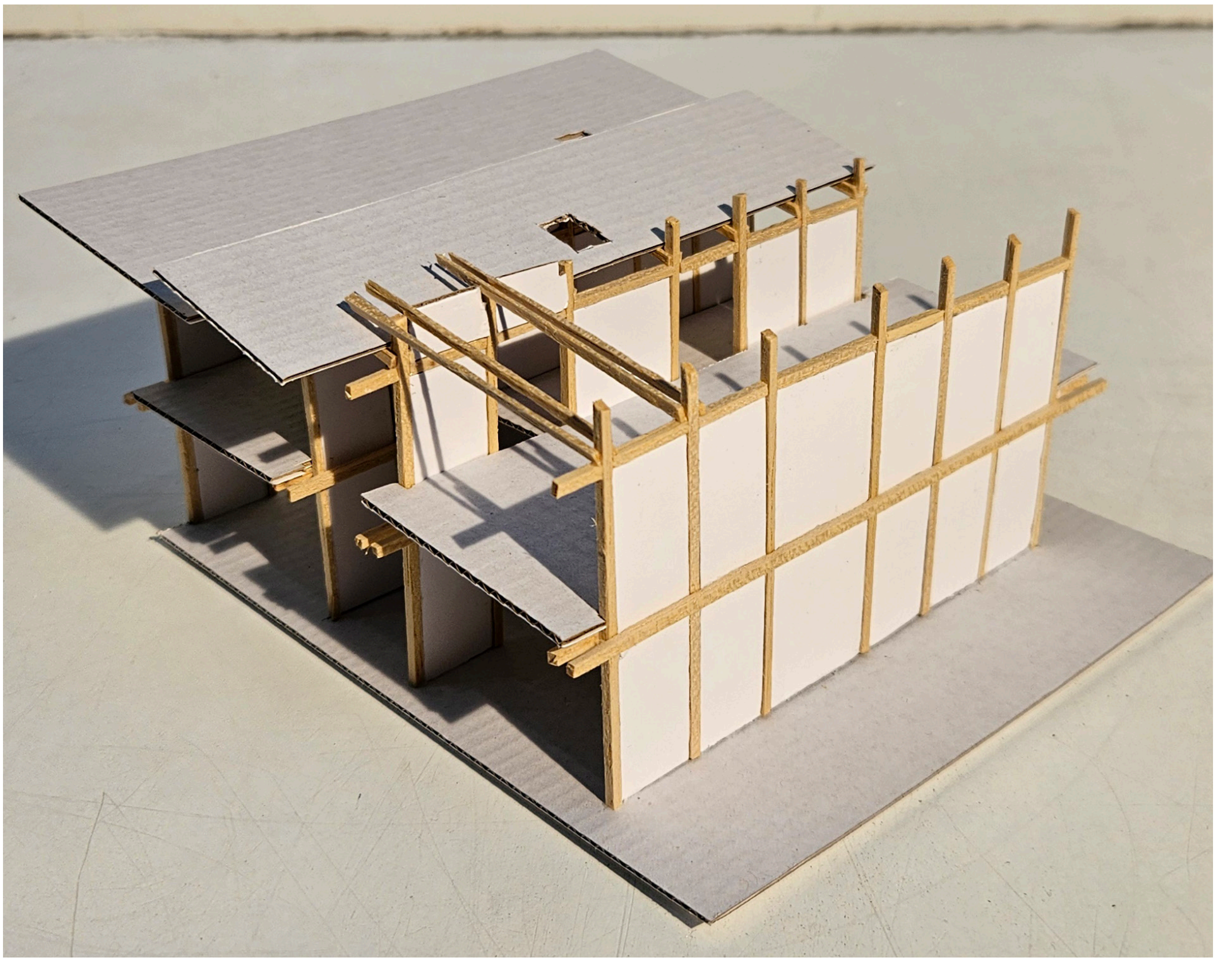


FIG 106. Top-up structural assembly logic | study model (scale 1.100)

6.7 Terrace structure

Structural logic

The terrace extension is conceived as a lightweight bridge-like transfer structure rather than a conventional cantilever slab. A hierarchy of glulam members distributes loads from the floor deck through secondary beams into primary members and structural collector beams, which transfer forces directly to the existing reinforced concrete shear walls below. A deep edge beam simultaneously acts as a perimeter girder and terrace balustrade, increasing structural depth and contributing to the overall stiffness of the system. The triangular beam arrangement responds to the irregular geometry of the extension while maintaining a clear and repetitive load path.

Materiality

The structure is proposed in glulam due to its high strength-to-weight ratio, dimensional stability, and suitability for long-span applications. Its lightweight characteristics reduce additional loading on the existing building while allowing larger structural depths and prefabricated elements. The use of glulam also maintains material continuity with the broader timber construction strategy of the project and enables an expressive structure in which structural logic remains visible and legible.

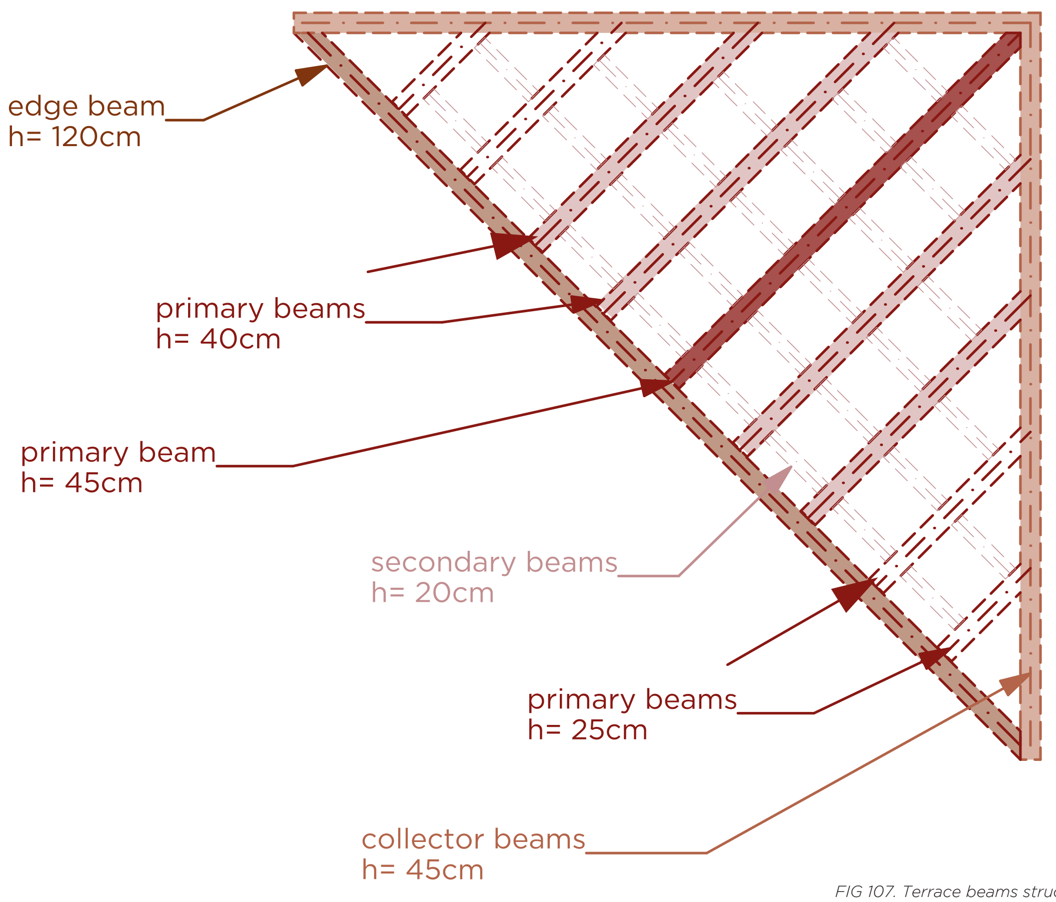


FIG 107. Terrace beams structure | plan

Joint logic

Connections between the secondary and primary glulam members are conceived as concealed steel plate joints integrated within the timber sections. Steel knife plates and bolted connections allow loads to be transferred efficiently while maintaining a predominantly timber expression. The concentration of forces at key nodes, particularly where multiple primary members intersect, may require more specialized steel connection details and further structural refinement.

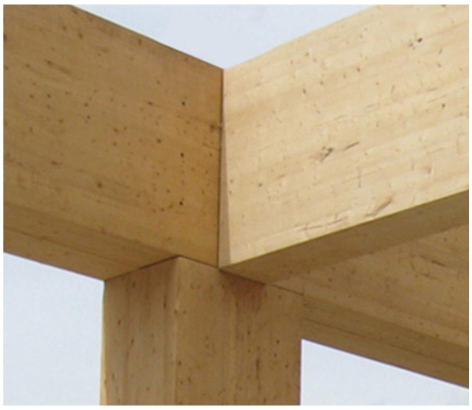


FIG 108. Photos of steel plates connections

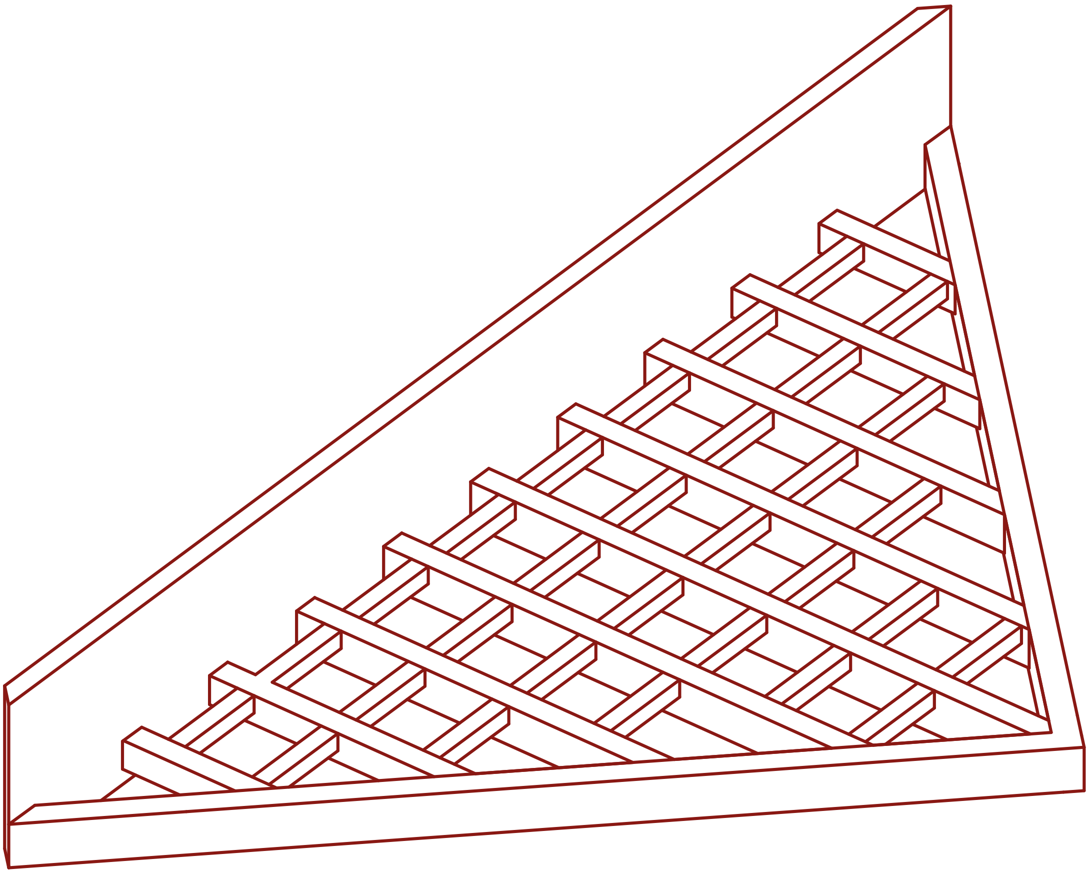


FIG 109. Terrace beams structure | isometric

6.8 Fire safety strategy

The top-up project relies on compartmentation between individual dwellings as its primary fire safety strategy. During incremental phases where façades may remain unfinished, the main concern shifts from internal fire spread to fire propagation along open façade edges. To address this condition, the project distinguishes between a professionally delivered fire-safe base building and resident-built adaptable elements. Permanent compartment walls extend beyond the enclosed dwelling and continue into the balcony area, limiting lateral fire spread between neighbouring units while simultaneously improving privacy between outdoor spaces. These elements ensure that a minimum fire-safe condition exists independently of later resident-built façade interventions.

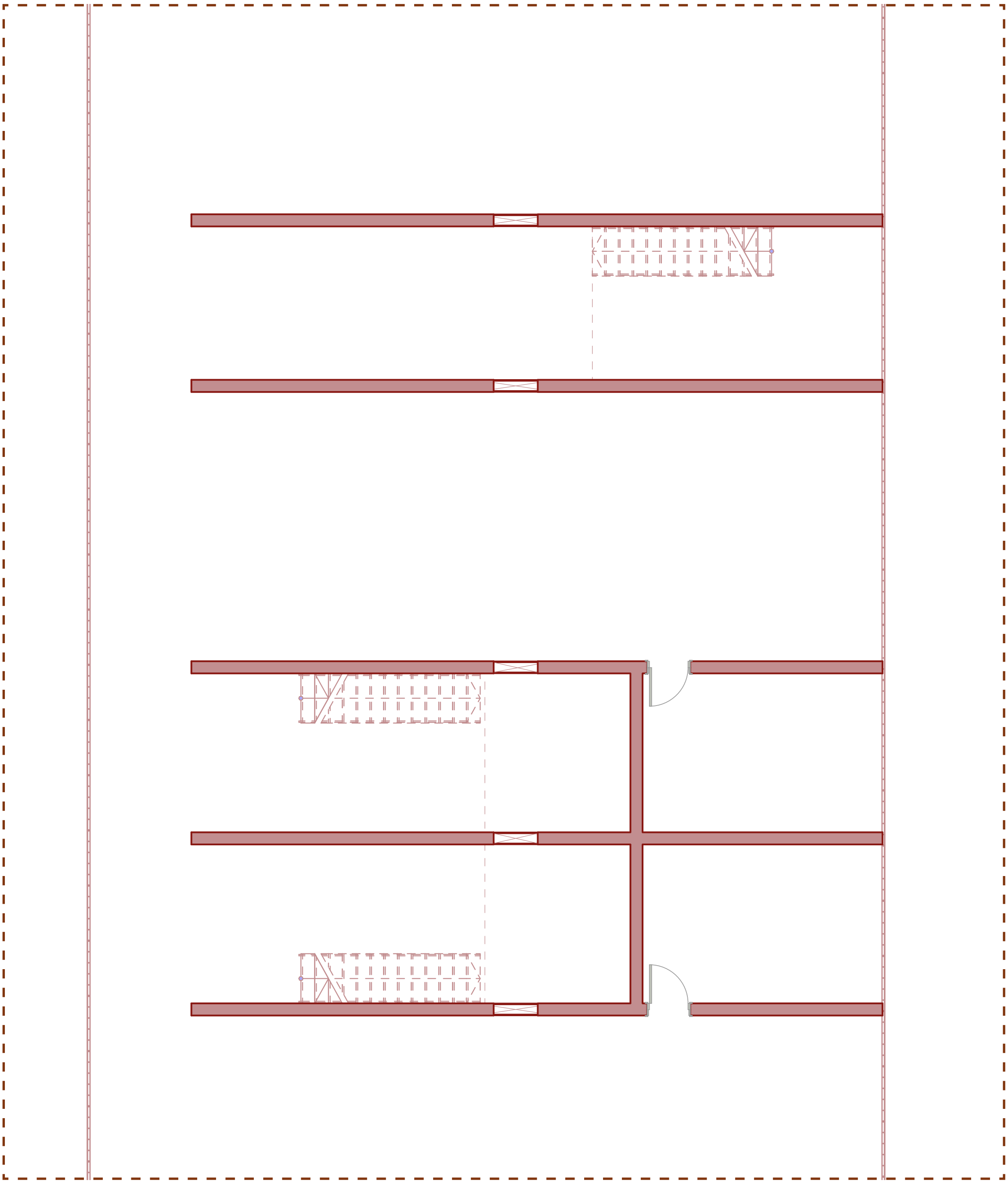


FIG 110. Plan of fire safety strategy | top up

In addition, temporary weatherproof and fire-retardant sheathing elements can be installed along the prepared façade lines until residents complete their façades, ensuring that the building is never occupied with a fully exposed timber frame. Fire-critical components, including compartment walls, escape routes, and structural protection measures, remain under professional control, while resident participation is limited to non-structural façade and partition elements. Once completed, the façade assemblies provide a continuous enclosure and further reduce the fire exposure of the primary timber structure.

The newly added shared dwelling floors follow a passive fire safety strategy based on compartmentation, protected escape routes, and the inherent fire behaviour of mass timber systems. The apartment itself functions as a single fire compartment, while the circulation core and access route are treated as protected elements separated from the residential space. Due to the relatively compact floor plan and direct access to circulation areas, travel distances remain limited and visual connection to exits is maintained. Structural timber elements are designed according to principles of sacrificial charring and/or selective encapsulation, ensuring that load-bearing capacity can be maintained during fire exposure. Smoke detection systems and fire-stopping at service penetrations are integrated to reduce the risk of fire and smoke propagation.

Similar to the broader project strategy, resident participation is limited to non-critical elements, while primary structural and fire-safety components remain part of the professionally delivered framework.

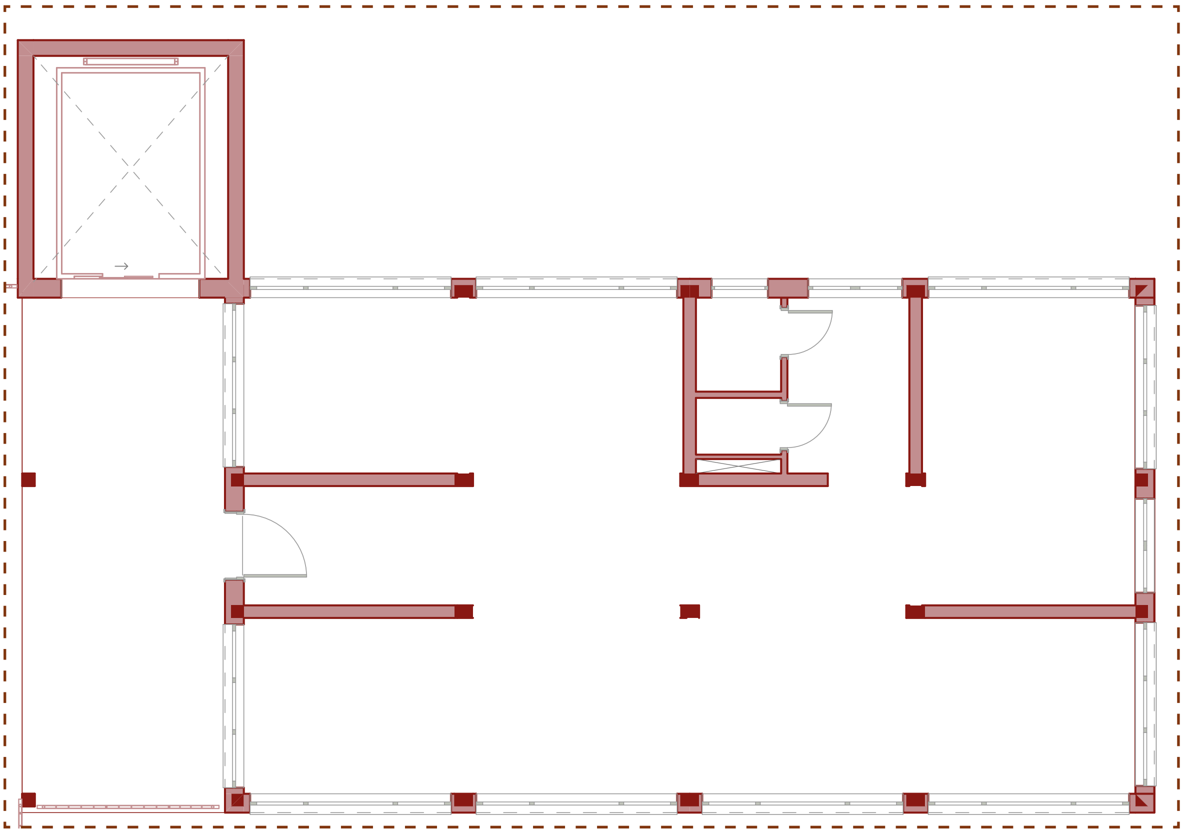


FIG 111. Plan of fire safety strategy | collective apartment

6.9 Catalogue of typologies

This catalogue presents a series of typological iterations developed through an ongoing dialogue between design and physical model-making. The process of testing, adjusting and reconfiguring study models proved essential in evaluating the spatial, environmental and structural qualities of each option.

By working iteratively, it became possible to critically assess the advantages and limitations of different apartment layouts, gradually refining them into more coherent and viable configurations.

Early iterations explored placing apartments on both façades; however, this approach revealed clear shortcomings, particularly for units relying solely on a north-facing orientation, which resulted in insufficient light and reduced spatial quality. In response, the typologies were reconfigured to improve orientation and livability, while consistently using the existing structural grid as a guiding framework and design constraint. This constraint did not limit the process, but rather anchored it, enabling the development of adaptable apartment types that negotiate between structural logic and spatial performance.

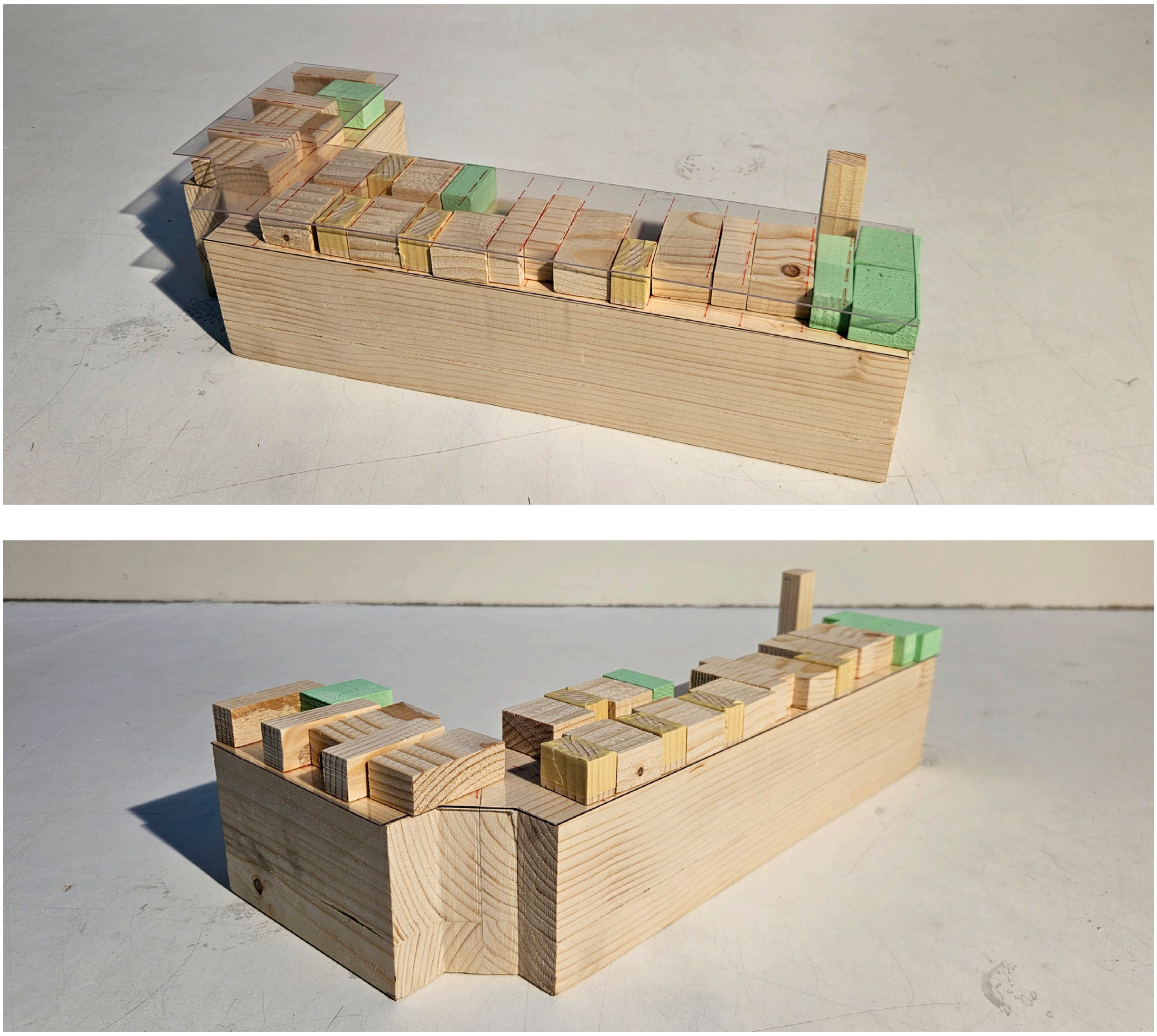


FIG 112. Photos of model making experimentation (scale 1.200)

FIG 113. Photos of model making experimentation (scale 1:200)

Collective apartment variant A| 120m²

The collective apartments are conceived as an alternative housing model that supports different forms of shared living across generations. On one hand, they may accommodate elderly residents who wish to downsize from larger family apartments, reducing loneliness through shared daily spaces while potentially freeing larger units for families within the neighborhood. On the other hand, they also offer a more temporary and affordable living arrangement for younger residents, students or newcomers, functioning as a flexible alternative to the more permanent self-built apartments.

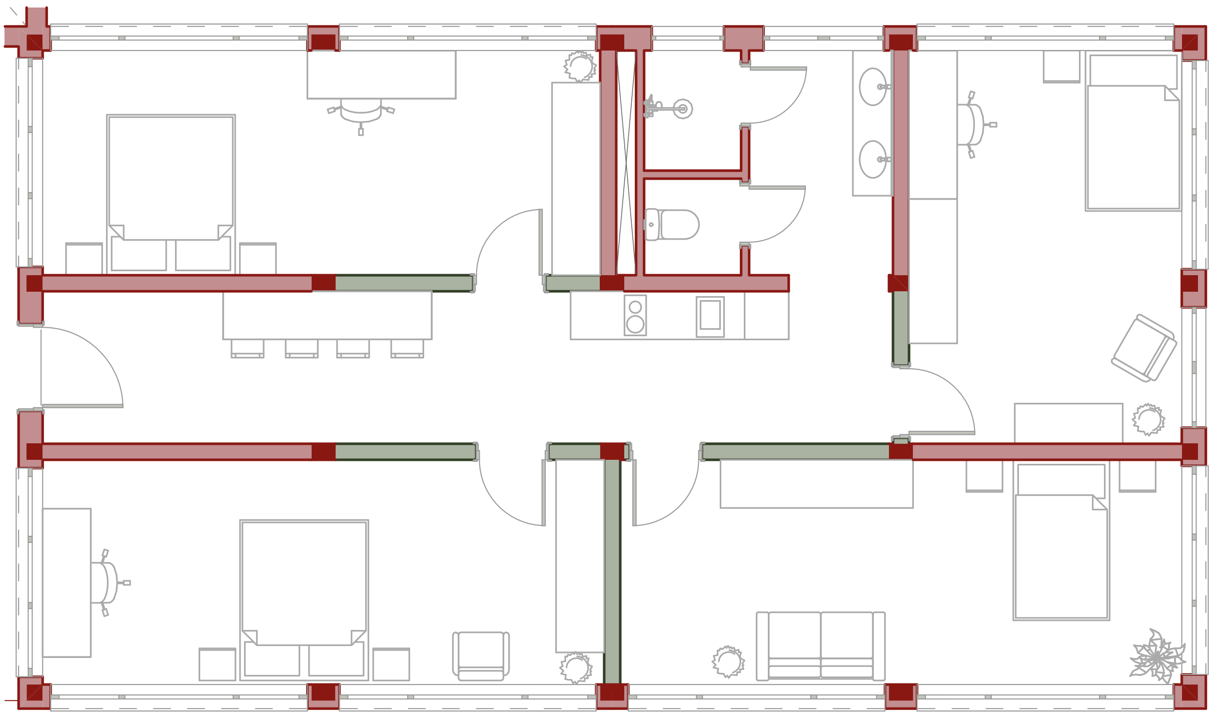


FIG 114. Collective apartment variant A | floor plan

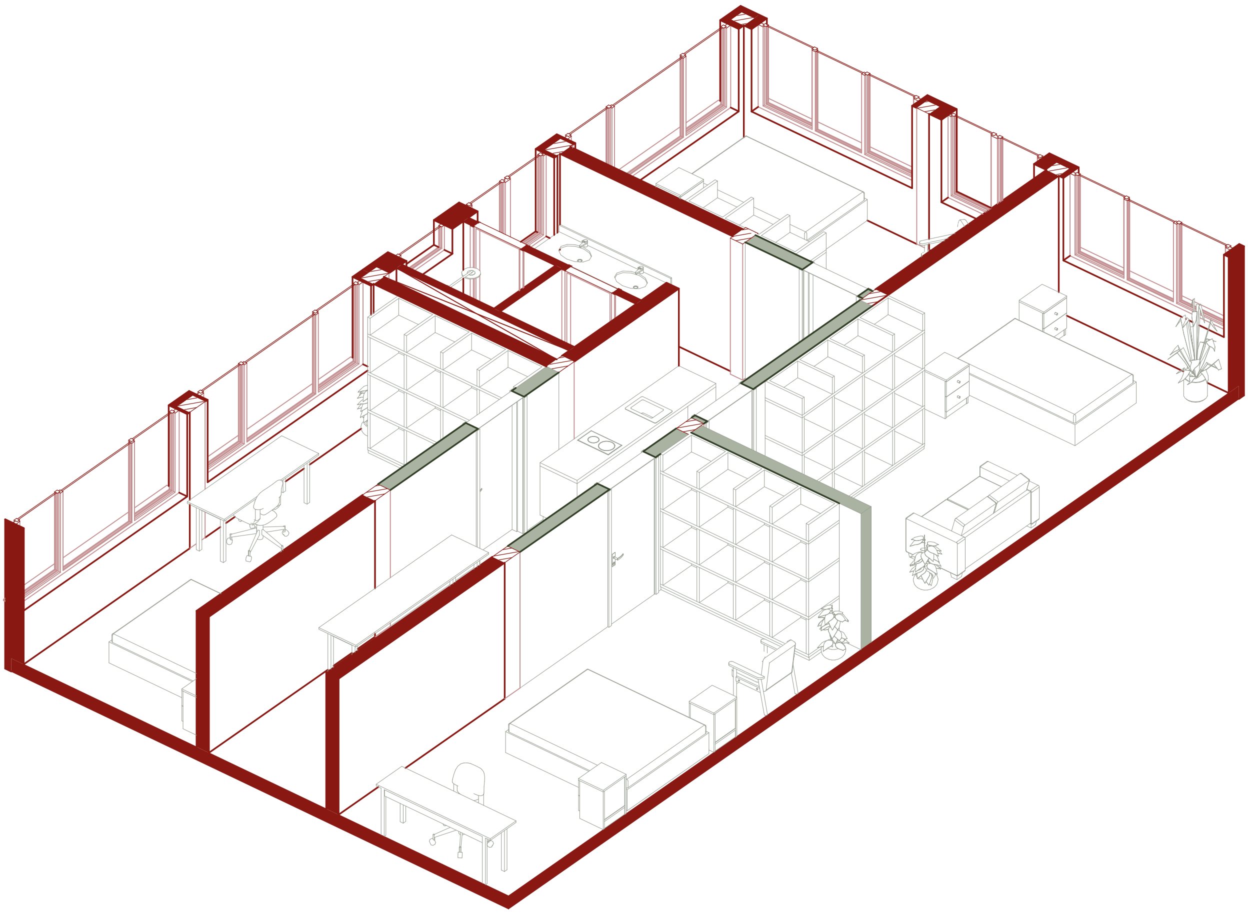


FIG 115. Collective apartment variant A | isometric

Collective apartment variant B | 120m²

Rather than prescribing a fixed domestic arrangement, the collective apartments are designed to adapt over time to changing needs and social dynamics. Movable internal partition modules allow residents to reconfigure the balance between private and shared spaces, creating either larger bedrooms or more generous communal areas. Additional wall modules are stored in the woodworking workshop and can be added, removed or relocated with relative ease, enabling the apartments to evolve alongside their inhabitants.

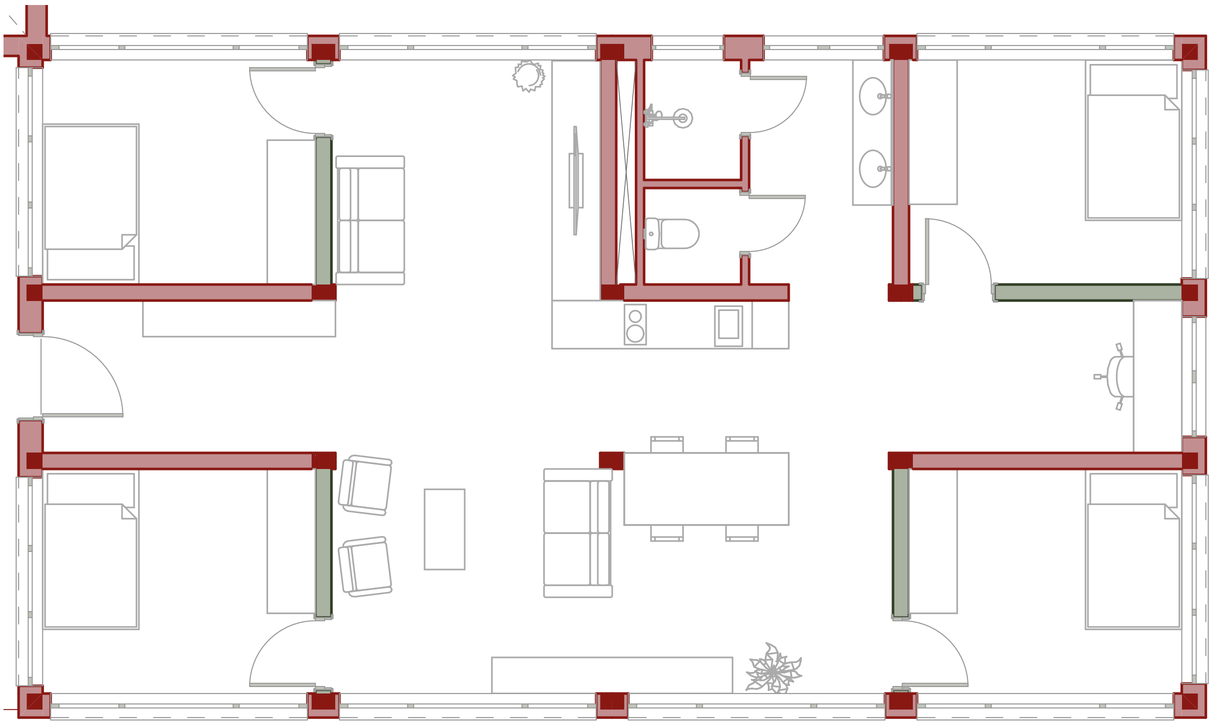


FIG 116. Collective apartment variant B | floor plan

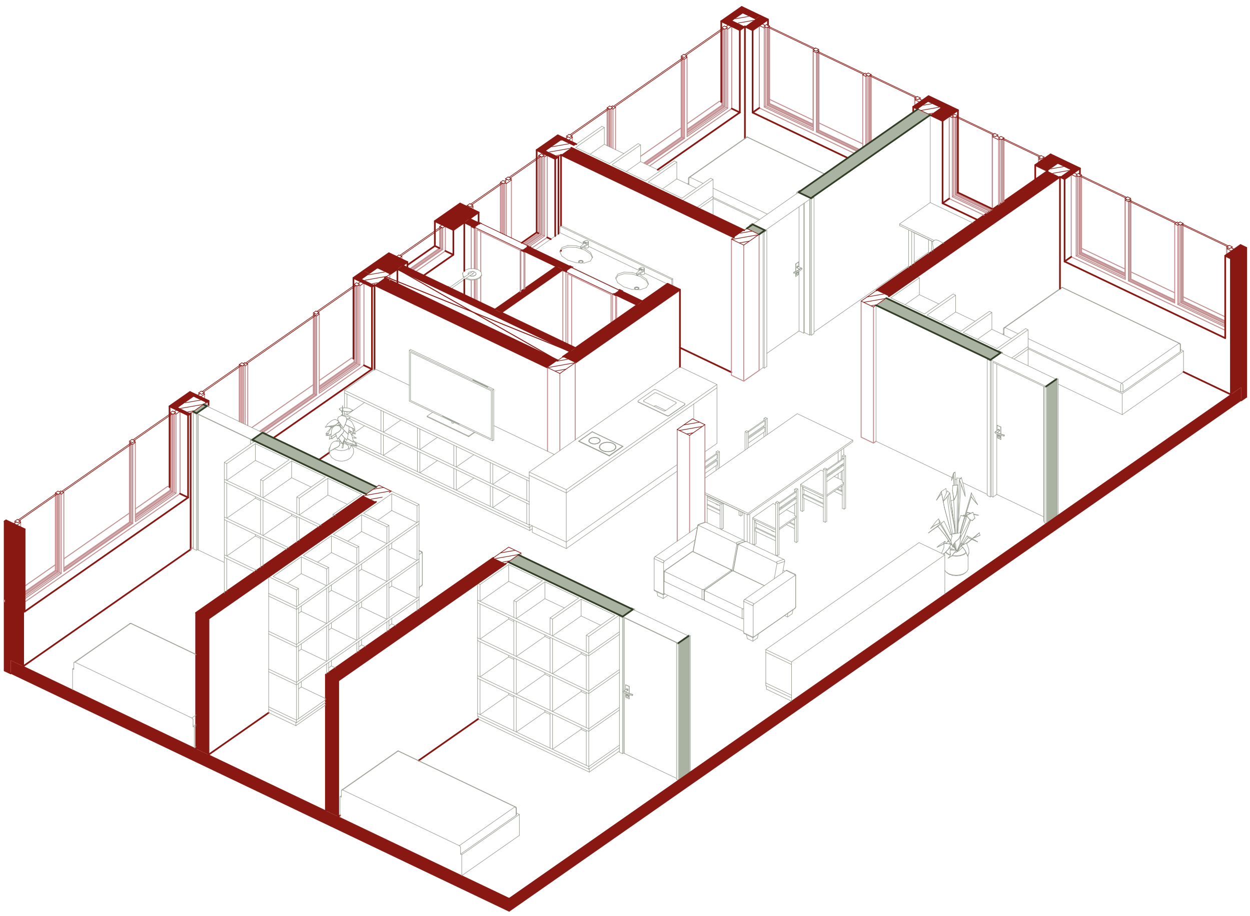


FIG 117. Collective apartment variant B | isometric

Base apartment | 61m²

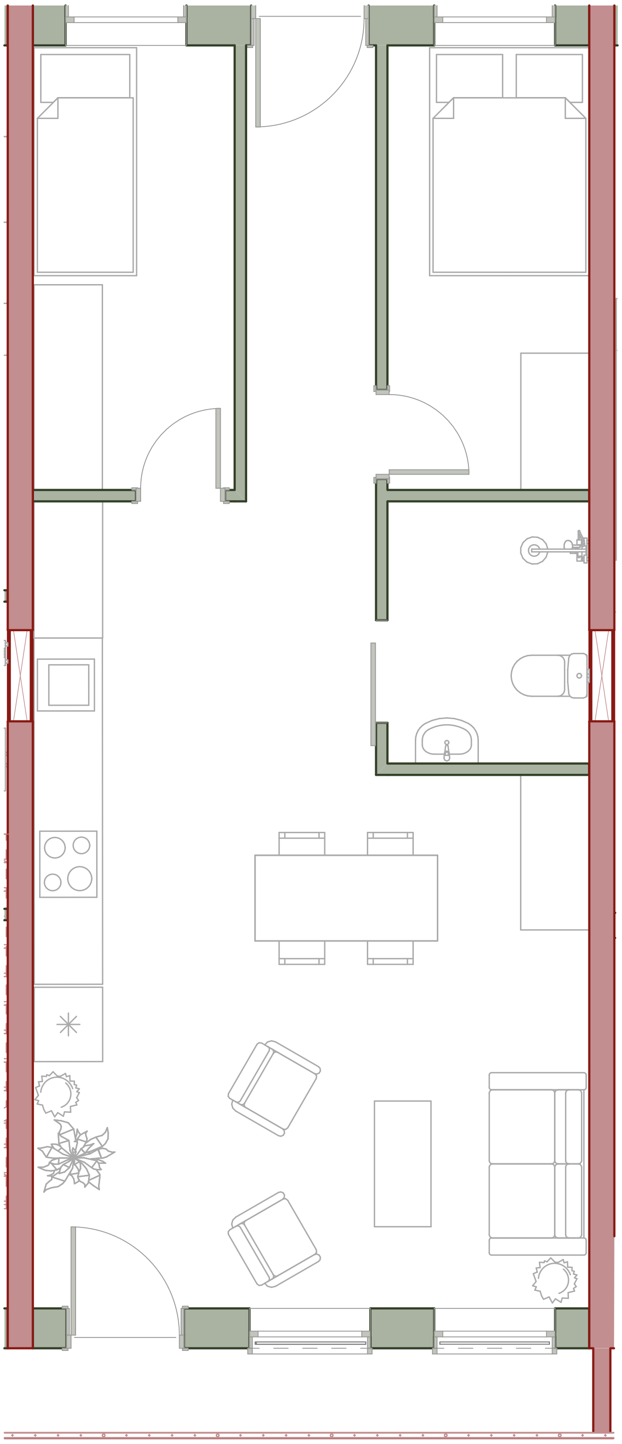


FIG 118. Base apartment | floor plan

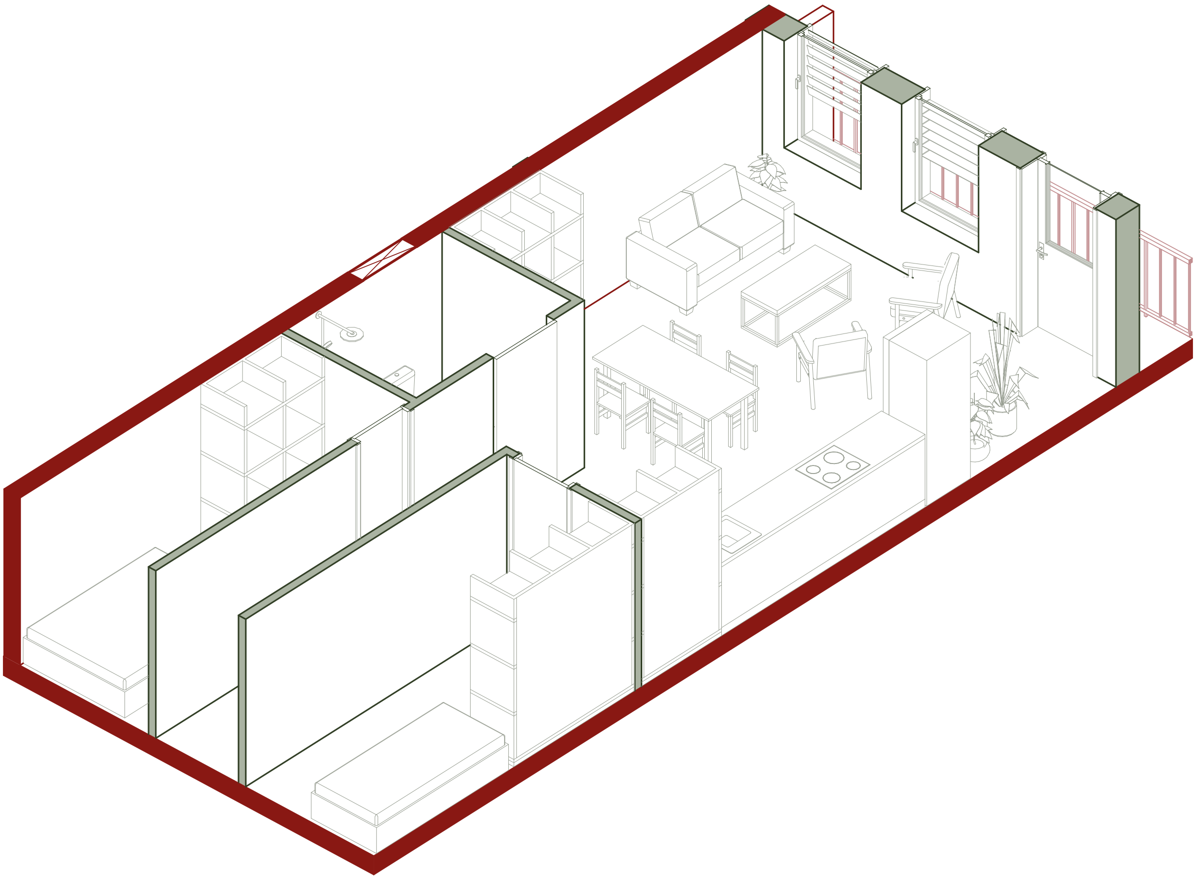


FIG 119. Base apartment | isometric

Extended apartment A | 73m²

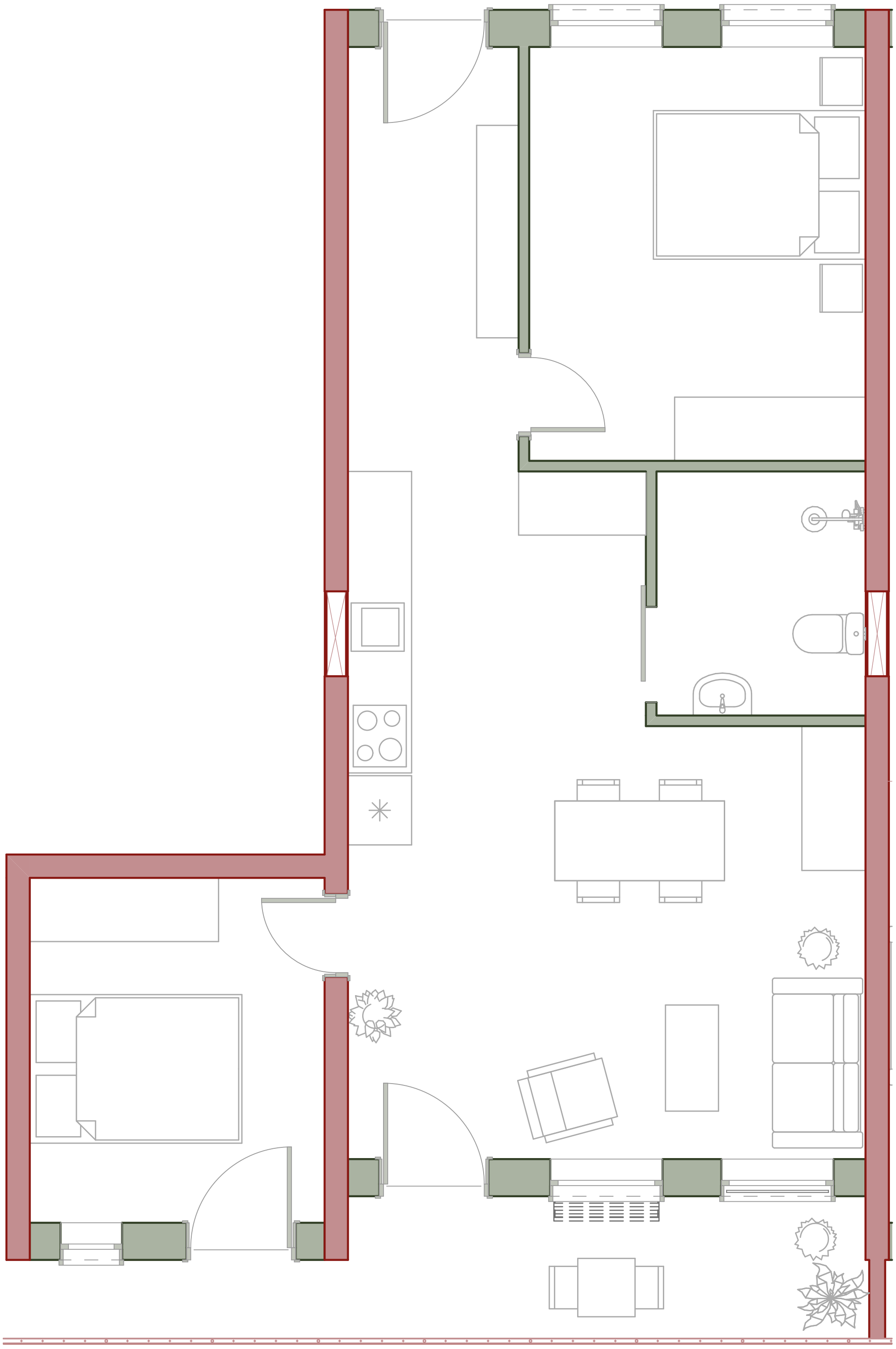


FIG 120. Extended apartment A | floor plan

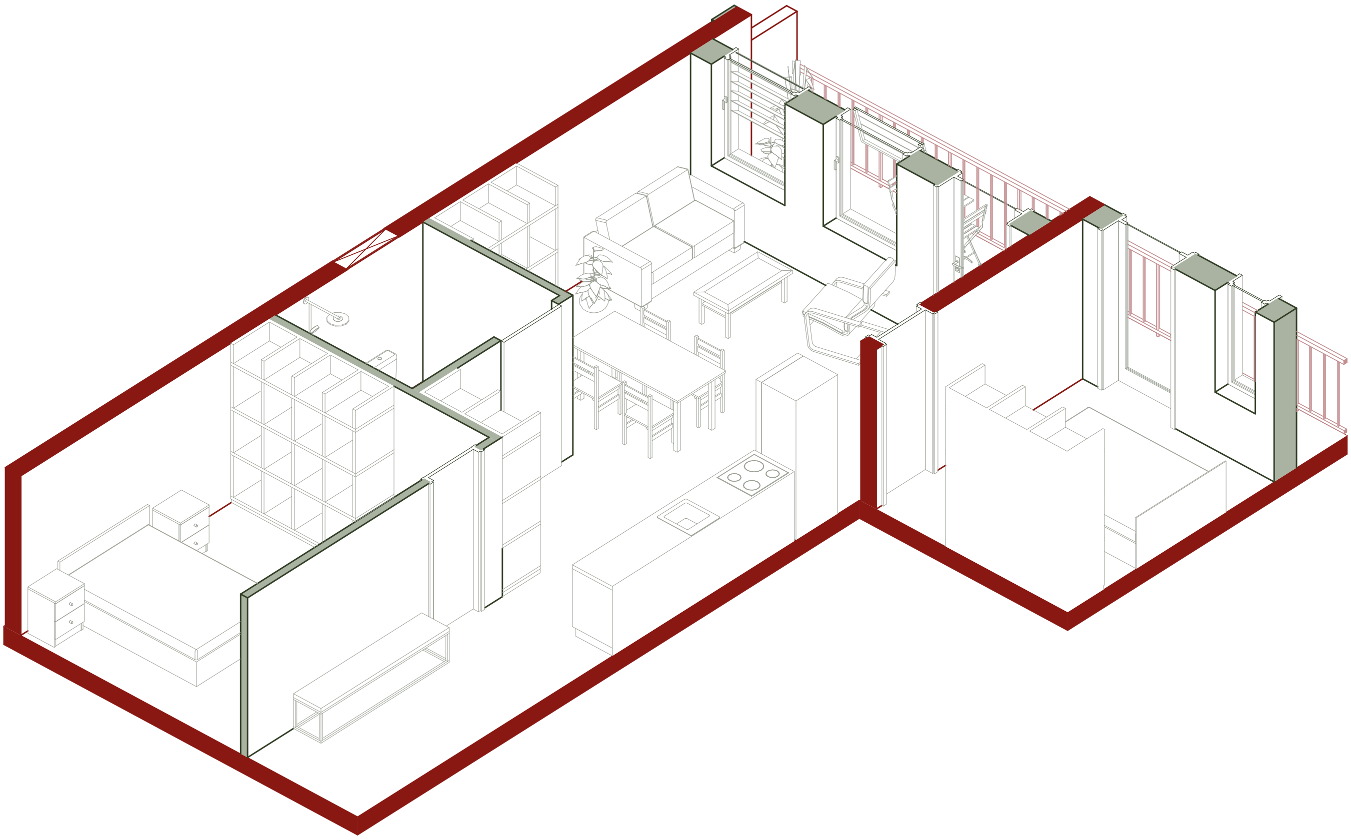


FIG 121. Extended apartment A | isometric

Extended apartment B| 73m²

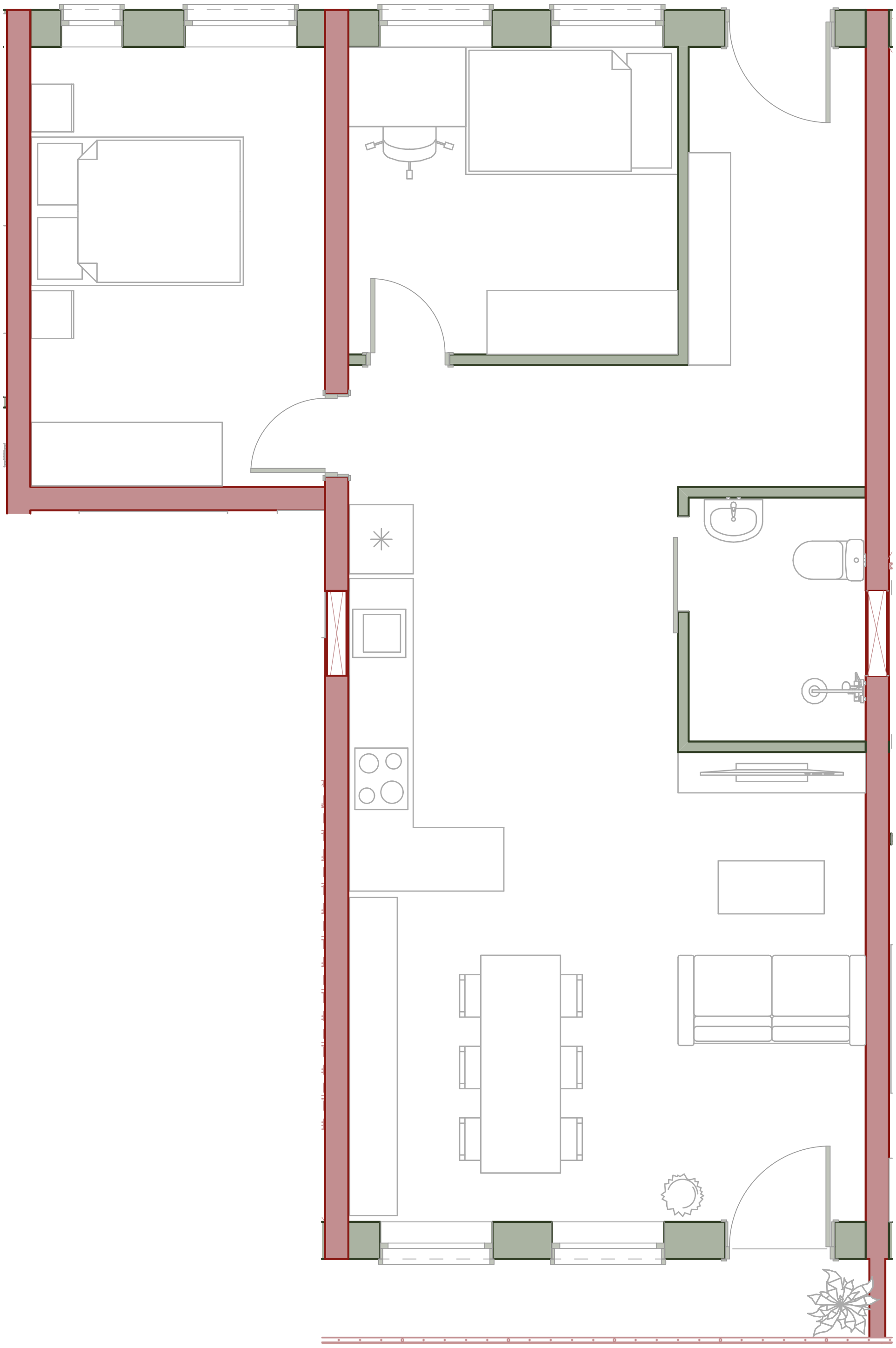


FIG 122. Extended apartment B | floor plan

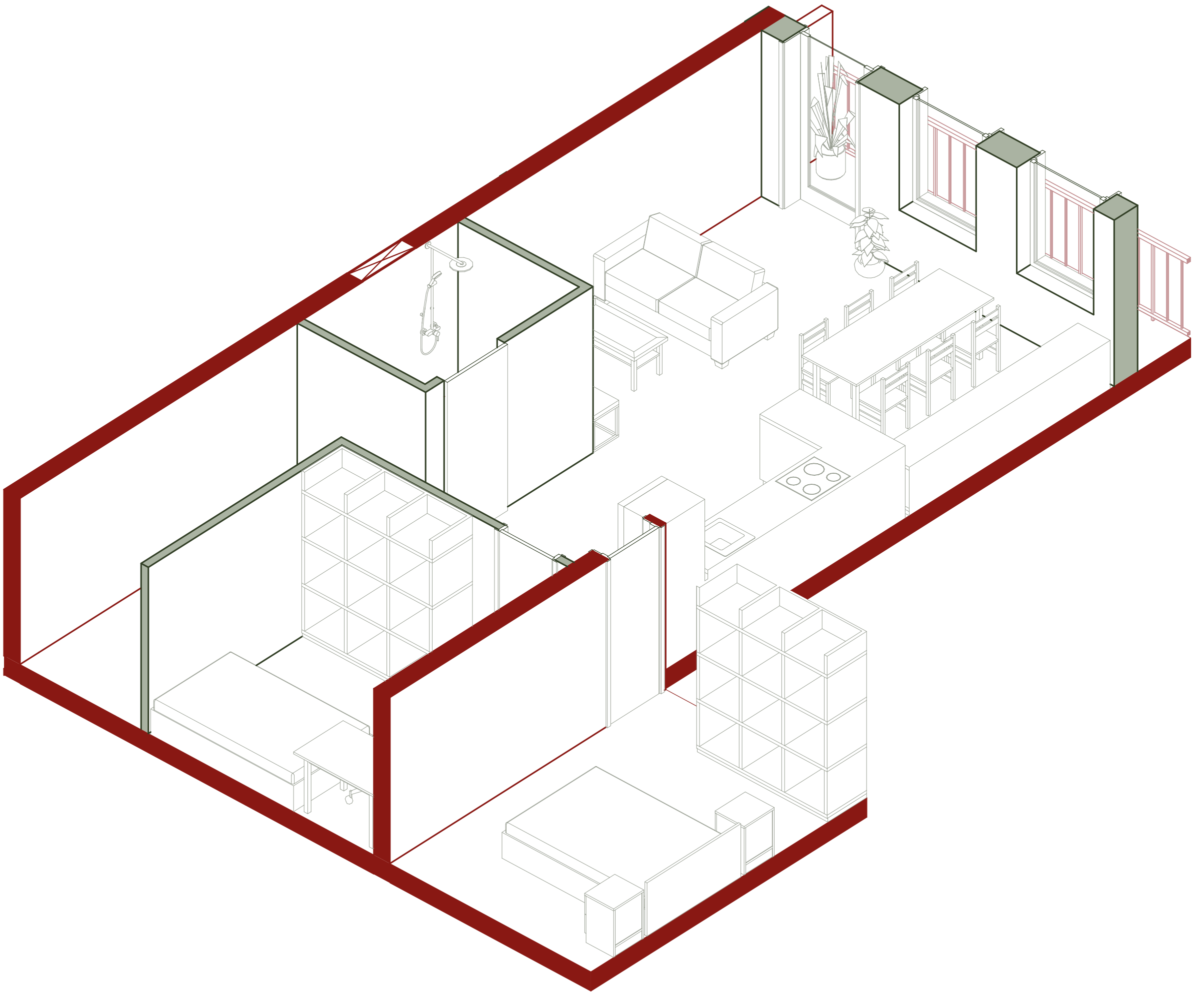


FIG 123. Extended apartment B | isometric

Loft sun| 41m²

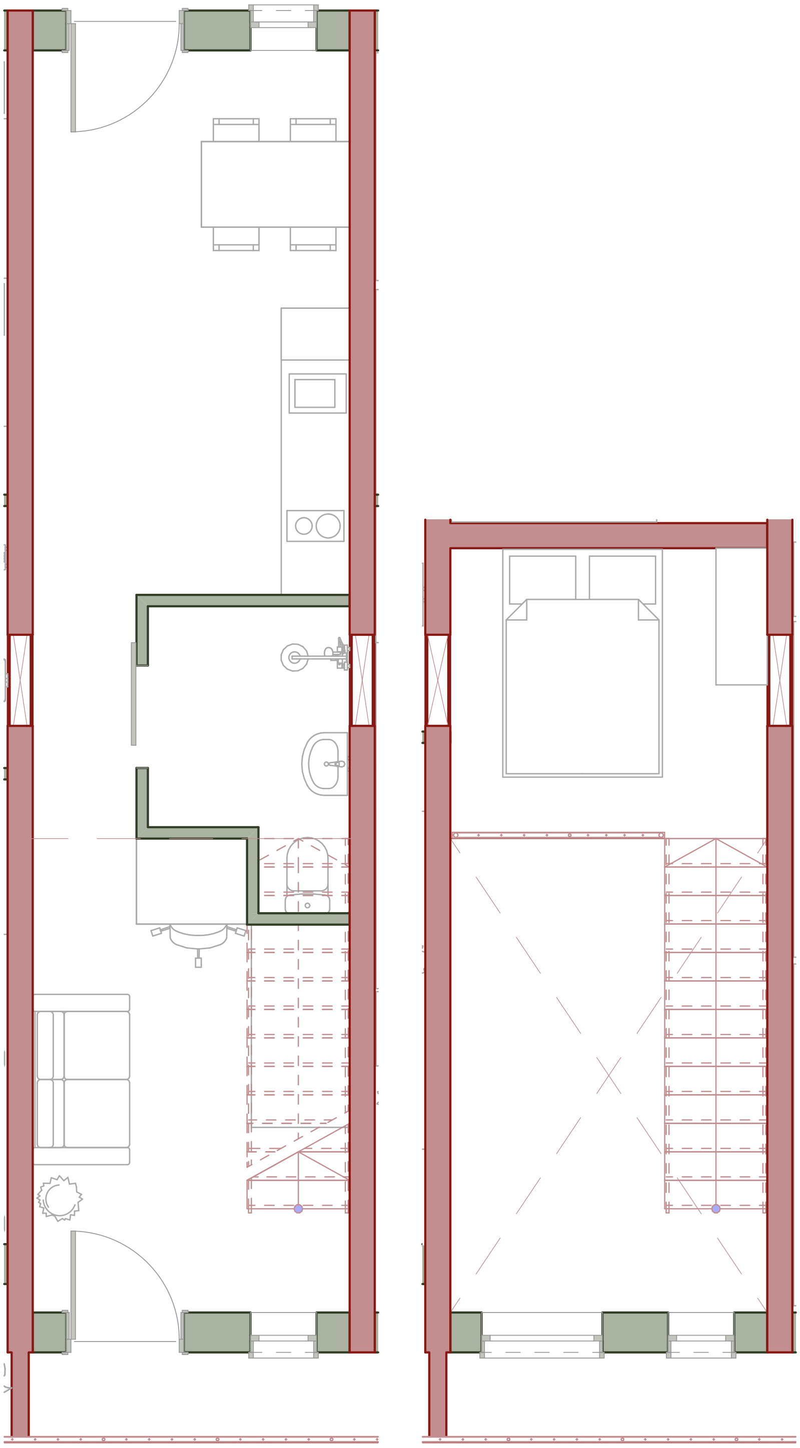


FIG 124. Loft sun | floor plan

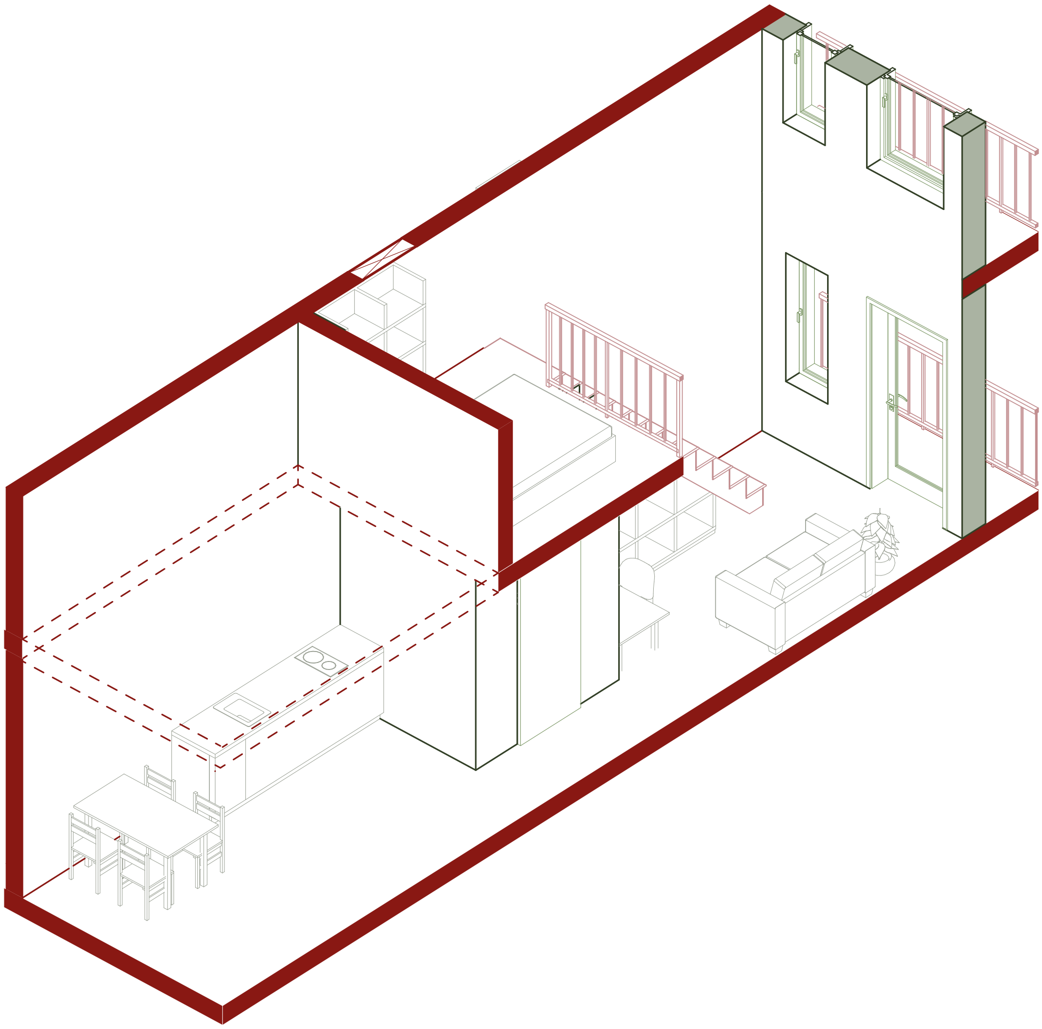


FIG 125. Loft sun| isometric

Loft gallery| 53m²

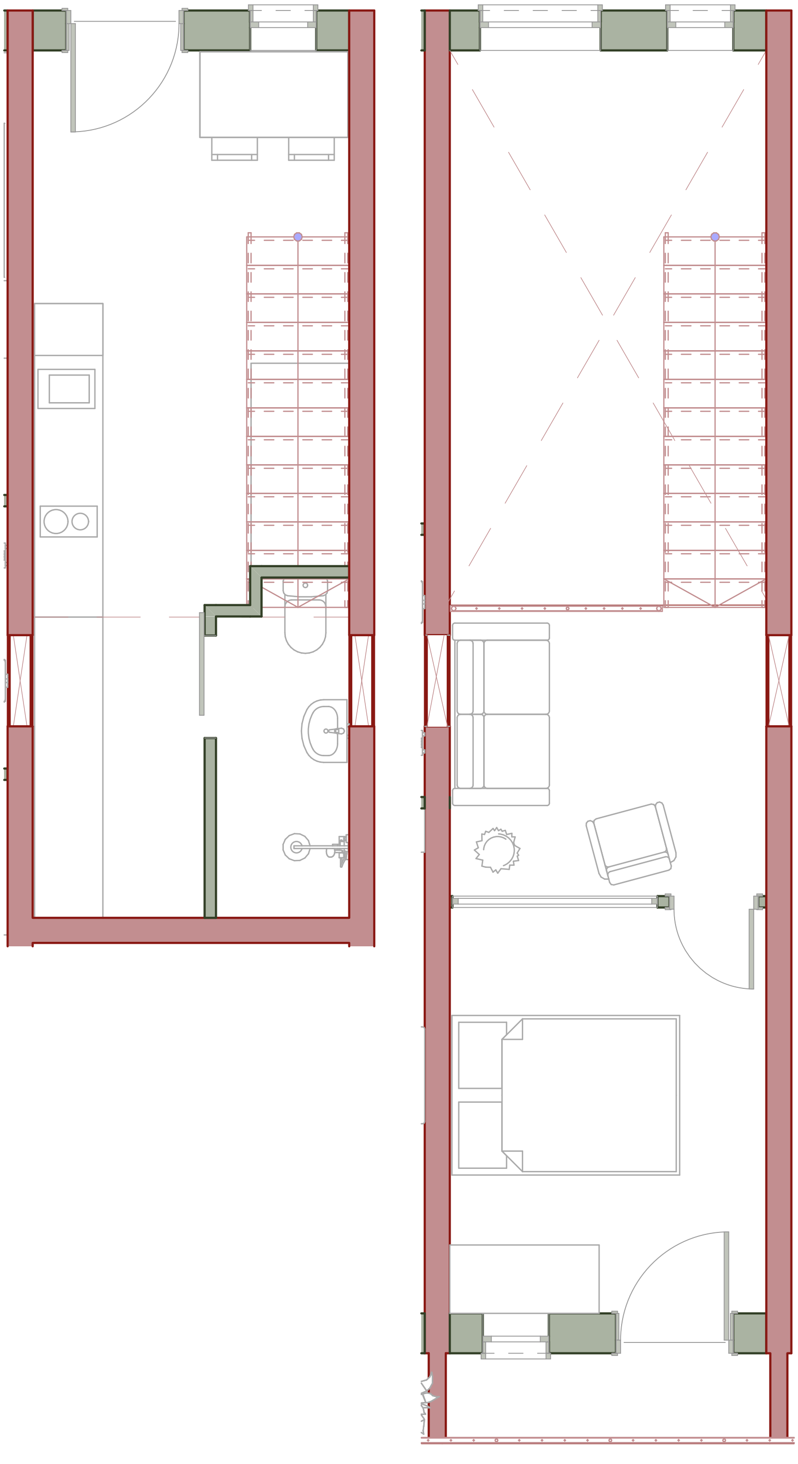


FIG 126. Loft gallery | floor plan

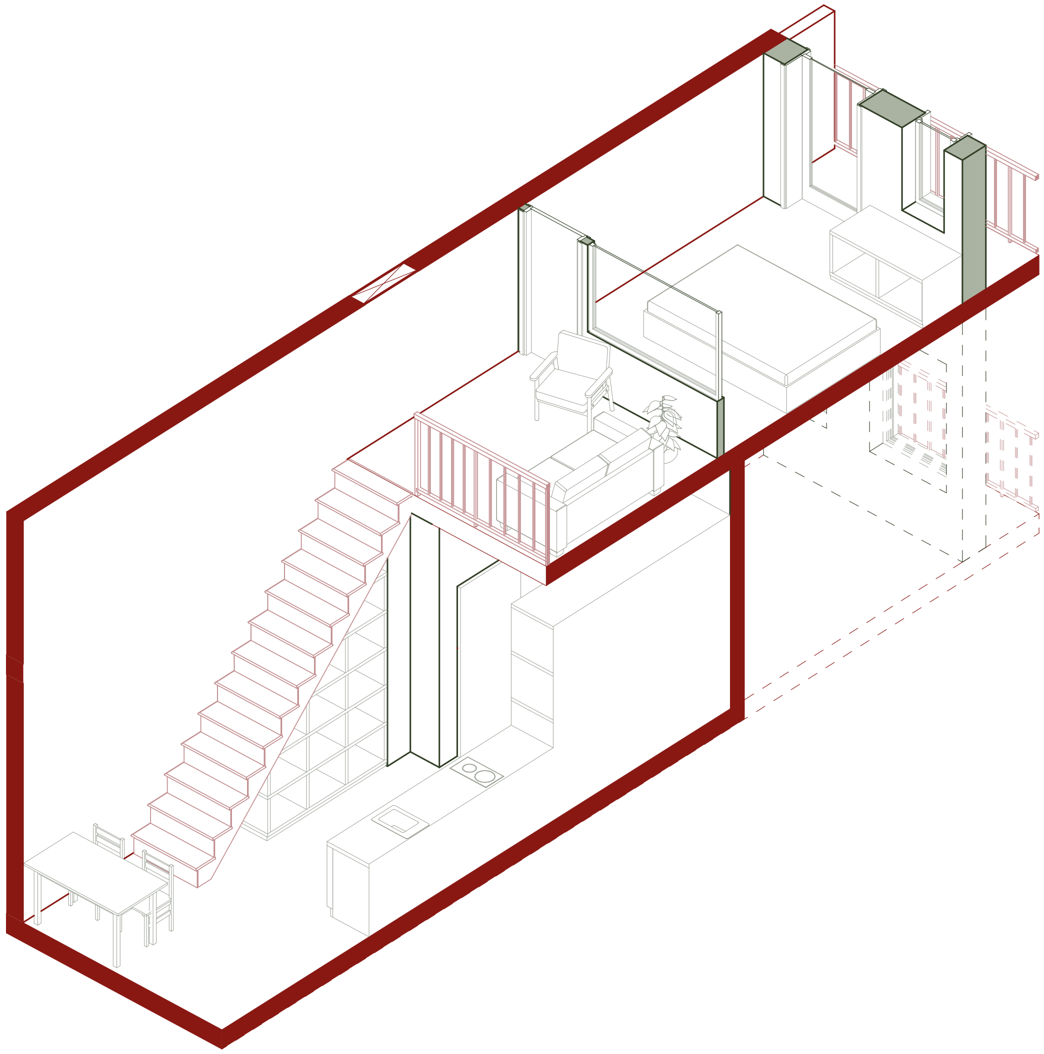


FIG 127. Loft gallery| isometric

FIG 128. Exterior perspective from across the canal | visual

FIG 129. Exterior perspective ground floor | visual

FIG 130. Exterior perspective from interior court | visual

FIG 131. Exterior top view from terrace| visual

FIG 132. Exterior perspective from interior courtyard | visual

FIG 133. Interior perspective from woodworking workshop | visual

7.0 Conclusions and discussion

7.1 Impact

The proposed system extends beyond the physical transformation of the building and aims to generate broader social, spatial, and educational impacts. Rather than treating housing as a finished product delivered to passive occupants, the project frames the dwelling as a platform for learning, participation, and long-term adaptation. Through the construction of façades and internal partitions, residents acquire practical knowledge of materials, assembly techniques, and building maintenance, fostering a stronger sense of agency, identity, and ownership.

At the building and neighbourhood scale, these individual learning experiences accumulate into collective outcomes. The capacity of residents to participate in the construction and modification of their homes supports a culture of collective making, where knowledge can be exchanged between neighbours and across generations. The building becomes an evolving framework rather than a fixed architectural object, capable of adapting to changing household needs while encouraging long-term care and maintenance.

The impact of the system ultimately extends beyond the building itself. By enabling residents to acquire and share construction knowledge, the project contributes to local knowledge networks and strengthens community resilience. If replicated at a larger scale, such an approach could support local timber supply chains, community workshops, and repair-based economies. In this sense, the project proposes housing not only as shelter, but also as educational infrastructure capable of generating social value and practical knowledge over time.

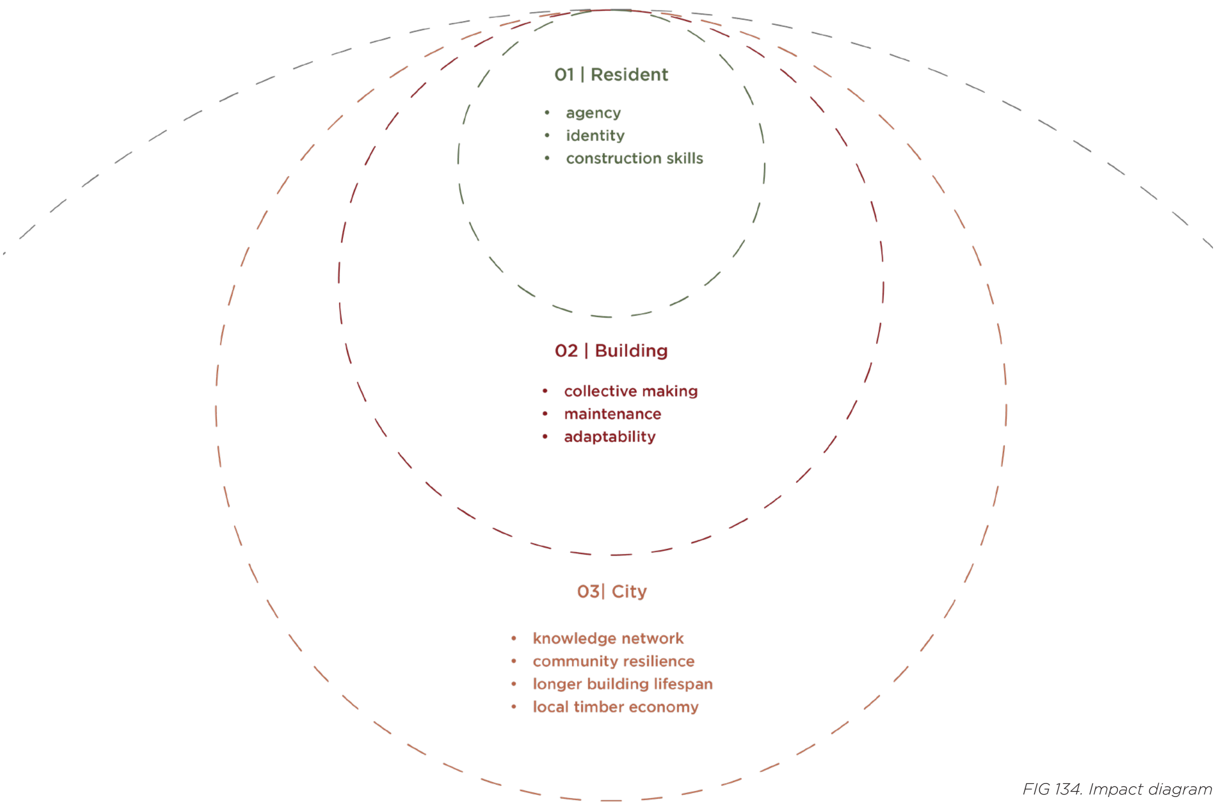


FIG 134. Impact diagram

7.2 Conclusions

This research investigated how timber topping-up can function not only as a strategy for urban densification, but also as a socio-material framework capable of supporting collective learning, participation, and long-term resilience. The central research question asked how timber topping-up could empower communities to collectively learn, build, and shape more socially and climate-resilient cities. The design question further explored how the spatial and constructive logic of a topping-up intervention could enable residents to participate in the making of their homes while retaining the ability to adapt them over time.

The findings suggest that the potential of timber topping-up extends beyond its environmental and structural advantages. Lightweight timber construction provides technical conditions that support participation through its dry assembly methods, modularity, manageable component dimensions, and capacity for disassembly and modification. However, participation does not emerge from material choice alone. Rather, it depends on how construction systems, spatial organisation, and decision-making frameworks are structured. The case studies demonstrated that high degrees of resident agency are often associated with accessible construction systems and opportunities for incremental change, while also revealing trade-offs regarding precision, reversibility, and architectural control.

The design proposal developed for Kattenburg translates these findings into an architectural framework that distributes agency across different building layers. While primary structure, fire safety systems, and technical infrastructure remain professionally delivered, residents participate through more adaptable layers such as façade modules, internal partitions, and future modifications. Instead of understanding housing as a finished object, the proposal frames architecture as an evolving system capable of accommodating changing needs over time.

Ultimately, this project suggests that socially resilient urban densification depends not only on increasing housing capacity, but also on creating conditions through which inhabitants can develop knowledge, attachment, and long-term stewardship toward their environment. Timber topping-up therefore becomes not simply an act of adding floors to existing buildings, but a framework for supporting collective forms of making and inhabitation.

7.3 Implications and Recommendations

The findings of this research have implications at both architectural and broader urban scales. First, the project suggests that topping-up strategies should not be evaluated solely according to metrics such as housing quantity, structural feasibility, or carbon reduction. Social dimensions such as resident agency, adaptability, and opportunities for collective participation should also be considered as important indicators of resilience.

For architectural practice, the research highlights the value of designing buildings as layered systems in which different actors engage with different levels of complexity. Rather than requiring residents to participate in all aspects of construction, participation can be focused on adaptable and lower-risk building components. This approach allows architectural coherence and safety requirements to coexist with opportunities for personalization and long-term modification.

The project also suggests that construction accessibility can function as a meaningful design driver. Decisions regarding material selection, module dimensions, assembly sequences, and detailing can significantly influence who is able to participate in the construction process. Accessibility therefore should not be understood exclusively as a social ambition, but also as a constructive and spatial criterion.

Several areas require further investigation. The project deliberately focused on architectural and constructive aspects while leaving broader socioeconomic and regulatory questions outside its scope. Future research could investigate

1. Governance structures and decision-making mechanisms within participatory housing models

2. Economic feasibility and cost comparisons between conventional and participatory timber topping-up systems

3. Structural optimisation and engineering validation of the proposed systems

4. Long-term post-occupancy studies analysing how residents actually adapt and transform spaces over time

5. Regulatory implications regarding fire safety, liability, and self-build participation in the Dutch context

The building manual developed alongside the project could also be expanded further into a more comprehensive design and construction guide capable of supporting real implementation scenarios.

7.4 Reflection

Throughout the development of this graduation project, the design process evolved from an initial interest in timber topping-up primarily as a strategy for sustainable densification toward a broader investigation into architecture as a framework for participation and collective learning. Rather than approaching design and research as separate processes, the project developed through repeated iterations between theory, precedent studies, community input, physical model-making, and constructive testing.

One of the main lessons emerging from this process was the realization that participation cannot be understood as an unrestricted transfer of control. Initial ideas often assumed a high degree of resident involvement, yet the development of the project revealed practical limitations related to safety, technical complexity, regulations, and construction feasibility. As a result, the project gradually shifted from a notion of complete self-building toward a more structured understanding of participation, where different actors assume different responsibilities.

The process also revealed tensions between accessibility and technical performance. Decisions intended to simplify construction frequently generated trade-offs regarding thermal performance, detailing complexity, or structural optimisation. Designing therefore became an exercise in negotiating priorities rather than coming up with one universal solution.

The engagement with residents and local actors, although limited by time constraints and a relatively small sample size, reinforced the importance of grounding design decisions in lived experience. While the survey results cannot be considered representative, they highlighted sensitivities, desires, and concerns that may otherwise remain invisible through purely spatial analysis.

Finally, this project reinforced a broader understanding of the role of the architect. Rather than acting exclusively as the author of a final object, the architect can also operate as a mediator responsible for creating conditions through which people, materials, and social relations interact and evolve over time. The value of architecture may therefore lie not only in the spaces it produces, but also in the processes and relationships it enables.

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