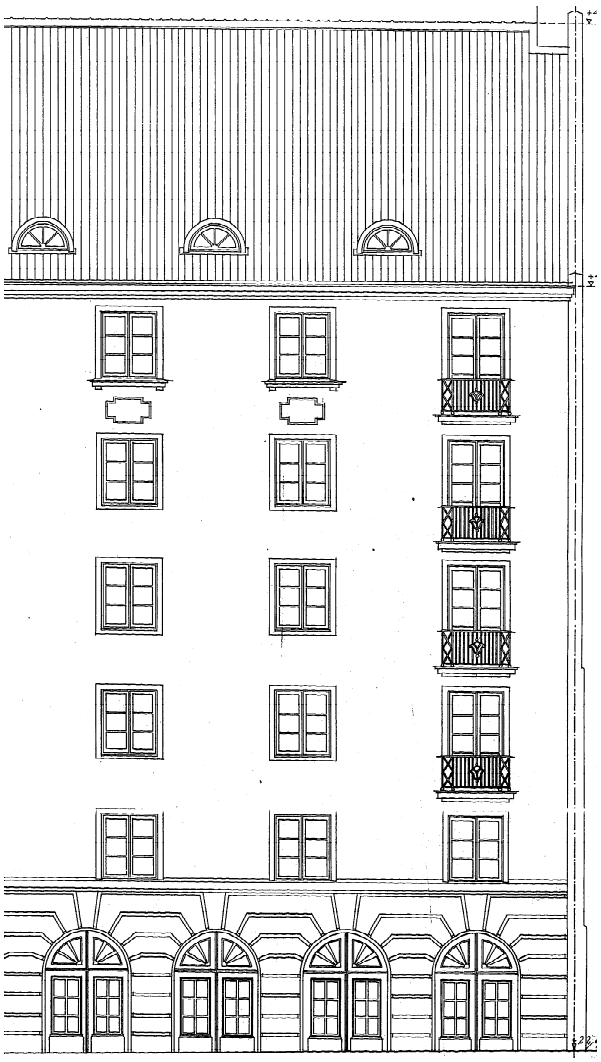
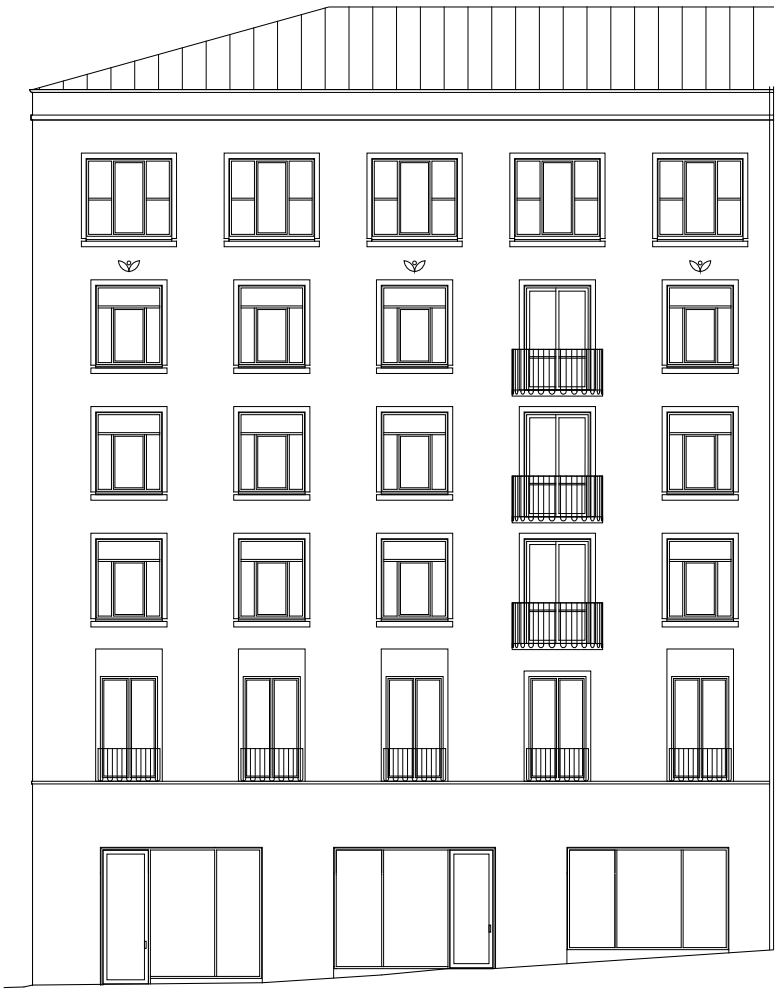
IN PRAISE OF MAINTENANCE

EXPLORING CONTINUITY IN THE ARCHITECTURE OF AN URBAN BLOCK





Erik Hedborg 2017

Chalmers School of Architecture
Examiner Björn Gross
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In Praise of Maintenance
Exploring Continuity in the Architecture of an Urban Block

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CHALMERS

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Abstract

Radical innovation, technological leaps and finding new modes of thinking is today common ambitions by practitioners and academia in architecture. This endeavour is also incentivised by state funding and support. However, it is probably the building of everyday objects that has the most impact on people's daily lives. This conflict was the starting point of the thesis, and the aim is to expand the discourse on designing sustainable buildings.

The first part of the thesis contains the theoretical framework. A connection is made between our accelerating culture, late capitalism and the ideology of innovation. As an alternative, a case is made for a rooted architecture that strives for continuity. But building for a long life brings an interesting paradox: the most certain part of a building's life is the constant change. Therefore, different kinds of longevity needs to be addressed, from both cultural and technical aspects. This part of the thesis ends with seven criteria for a maintainable building: 1. Continuity, 2. Roughness, 3. Restrained weathering, 4. Soft joinery, 5. Small modules, 6. Forgiving detailing, and 7. General spaces.

The second part of the thesis tries these principles out in a proof-of-concept building. It is located in Gothenburg, Sweden, at the site of a parking garage from 1972. The program accepts commercial spaces on first and second floor with residential units on top. The surroundings are characterised by notable brick buildings from the early 20th century and the project attempts a continuation of the load bearing brick building tradition through a revival of the diaphragm wall.

It is necessary to phrase and think about long term implications of the built environment. Today we praise the innovators as the heroes of society and our hope for the future. But is it not the ability to persist in the long run that makes a society sustainable? Exploring an architectural culture of maintenance, or long-term-ness, is an important part of the thesis.

Contents

I. Thesis design

Background

Most things we do are maintenance. Practices that support our main goals or functions in life. We sleep to regain energy. We go to the gym to maintain the body. We do laundry, clean the house, or work in the garden. At the workplace, much time have to be allocated to scheduling, planning and memos. These tasks are needed to support the actual work that is to be carried out but in of themselves are not productive. Maintenance is necessary, but boring. People with money hires staff, people without endures.

"No wonder people get in a permanent state of denial about the need for building maintenance. It is all about negatives, never about rewards. Doing it is a pain. Not doing it can be catastrophic. A constant draining expense, it never makes money. You could say it does save money in the long run, but even that is a negative because you never see the saving in any accountable way."
Stewart Brand (1995)

Why should building maintenance be of any interest to architects and urbanists? The average city replenish about 3% of their total building mass per year (Brand 2009). That means a total replacement of the material in about 24 years. Obviously, that is not all the buildings' components, so some parts change more often. All this matter and energy puts a lot of strain on the planet's resources, and to reduce waste and improve repairability is imperative. Designing for maintenance is designing sustainable.

"The problem is world-scale – the building industry is the second-largest in the world (after agriculture)" *Stewart Brand (1995)*

But designing maintainable houses makes no sense if we start tearing them down prematurely. The whole picture is needed to be understood and cared for. Finding a cultural acceptance and usefulness is perhaps the most important aspect. As will be further discussed in the thesis, designing maintainable built environments may help create continuity in our societies. It is a type of self-inflicted restriction, promoting the slow over the fast, and the long term over the short term.

Questions

How can we, in new construction, though the use of a technical and cultural context, create continuity in the urban fabric?

How can the aspect of maintenance be incorporated into the building design?

What kind of implications for the tectonics and atmosphere of the building will a maintenance based perspective have?

Aim

The overarching aim is to provide insight and expand the discourse on how to design buildings for a sustainable society.

The sub-goals are:

Establish principles on architectural design for low and/or easy maintenance.

Explore an approach for a historically rooted architecture.

Explore the criteria for longevity in buildings.

Showcase a site-specific implementation in a design project.

"My purpose is to help stir up some creative thinking, now lacking, about the effects of time and change on city neighbourhoods Above all, to stir up thinking on how to enlist time and change as practical allies, not as enemies that must be regulated out and fended off on one hand, or messily surrendered to on the other." *Jane Jacobs (2001)*

Method

"City planning used to imitate architecture, and it failed because of that. If architecture now began to imitate city planning, it could learn to succeed better." *Stewart Brand 1995*

The main theoretical support will be literature. Books, reports, papers, and digital sources. The secondary support will be references. These buildings or projects are chosen either to represent a concept, an abstract thought, or to act as analogy for what the project can be.

The synthesis, or design project, is done in an iterative design process. The content is constantly created, observed and evaluated, in order to create a coherent whole.

Delimitations

The main interest of this thesis is the form of the building and its environs. That includes overall shape, materials and details. The function (or program) is secondary, but still explored. All building design should be holistic, and no parts can therefore really be delimited. Furthermore, this thesis aims to show that function can follow form to a greater extent than is usually accepted.

The site for the design project is located in Sweden, Gothenburg, and this also sets the delimitations for climactic considerations. It should be clear from the text where arguments are given to a site specific deign consideration or if it is to be generally interpreted.

Perhaps the most important aspects of the maintainable building will unfortunately have to be discussed in another thesis or project. That is the influence of building regulations and legislation, the construction industry and the economics. Although these driving forces have a huge importance on which types of designs that are demanded and developed, the design aspects can be studied in relative autonomy, which is the ambition of this thesis.

"It must be remembered that there is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than a new system. For the initiator has the enmity of all who would profit by the preservation of the old institution and merely lukewarm defenders in those who gain by the new ones." *- Machiavelli*

II. Theory: How to think about longevity

Innovation as the norm

"There exists a mania for innovation, or at least for endlessly repeating the word innovation" (Russell, Vinsel 2016)

Most people wants to be innovative. It has an air of positivism and forwardness. But what does it mean? An academic usually talks about two kinds of innovation, radical and incremental. In daily conversation, "innovation" usually refers to "radical innovation" while "incremental innovation" is referred to as "improvement" or "development". No other school of economics have been more interested in radical innovation than the one created by Joseph Alois Schumpeter. According to the Schumpeter school, innovation trumps the refinement and improvement by replacing it with tomorrows "different next thing" (Śledzik 20, p. 89). As with all economic theory, it quickly leaves the descriptive realm and threads into the prescriptive.

In an essay written for the online Magazine Aeon in 2016, Andrew Russell and Lee Vinsel (both historians of science and technology), writes that society have gotten obsessed with innovation. Not just in engineering and business, but also in social sciences, arts and humanities. According to Russel and Vinsel (2016) that makes it an ideology, which is embraced in America by Silicon Valley, Wall Street and Washington DC. The authors trace the origin to the cold war polarized ideologies, where the open, liberal, free-market west was posed against societies characterised by closeness, uniformity and order (mainly the Soviet Union). In the face of the Vietnam War, environmental issues and terrorism, a more neutral concept had to replace faith in moral and social progress. That concept became innovation, a way to celebrate societal accomplishments of a high-tech age, without having to link it with squishy subjects such as morality or social order. A concept turned into an ideology that dictates priorities, sets norms and social status. Is there something wrong with this? The authors of the essay argue that it paints a false image of technology and improvement, and calls for "a better way to characterise relationships between society and technology" (Russell, Vinsel 2016). A way that acknowledges the "boring" mundane reality of societal building and upkeep.

"What happens after innovation, is more important. Maintenance and repair, the building of infrastructures, the mundane labour that goes into sustaining functioning and efficient infrastructures, simply has more impact on people's daily lives than the vast majority of technological innovations." (Russell, Vinsel 2016)

Probably, innovation and maintenance are not strong opposites. Rather, they stand in relation and complement each other. Creating a false dichotomy here might be counterproductive. But that being said, one force in this yin and yang relationship is engulfing the other. Radical innovation cannot replace maintenance and incrementalism. In an unexpected twist, now that innovation is the norm, incrementalism becomes the new radical concept and the search for a slower, thoughtful and pertinent culture of building would seem appropriate.

The search for continuity

The modern movement of the early 20th century sought to redefine and reinvent building. The look, construction and organisation were to be based on the optimum, not on the old, way of doing things. This ideology resulted in aesthetic ideals that made a lot of people sceptical to the new architecture. Having a building look like the building next to it would be praised by the general public, but deplored by the intellectual elite. This dichotomy still survives to a certain extent, in both academia and practice. It surely cannot be a healthy divide?

One architect who spent his career developing a sense for design with historical continuity was Ove Hidemark (1931-2015). Many of his most famous projects was restorations of churches and cloisters. Here questions on authenticity arise as integral part of the design challenge. When something needs to be added, should it contrast, or blend in with the old building? Should the restoration return the object to a former glory or should wear and tear be shown? Hidemark lectured and wrote on the topic, and developed a practice in line with his ideas. The goal was to create and preserve the material whole in the building (Nyborg 1991, p. 49). That meant making design decisions that sometimes approached the ideological camp of Viollet-le-Duc (with his pristine restorations), and sometimes of John Ruskin (who saw restoration a crime towards culture). What he stressed however was always that a careful technical and historical research had to be carried out before each project, and that this was the base on which to take all further decisions. Hidemark was a proponent of the idea that the similar aspects were relevant for new construction. That context could be read the same whether one worked on what's already there or virgin soil. He claimed that time was an excellent quality control and promoted proven techniques over novel whenever he could. This is what he writes about some design decisions for the building of Lilla Aska crematory:

"The design development also led to a discussion on our contemporary way of building in technical terms. I was looking for a consequent stance. Massive brick walls, sometimes six stones thick, gave an architectural effect in sculpture and pattern, but also a technical quality: a climate buffering and maintenance simple wall just like the old ways of building. Lead and zink replaced our contemporary plastic coated sheet metals, which future maintenance nobody

FIGURE 1 ***European post war development is haunted by stigma and alienation but also technical difficulties. When repairs can no longer be made, and is no longer wanted, drastical structural changes has to be made. (Mills 1994 p.145)***

can guarantee. Doors and windows are made in oak, which is allowed to turn gray through natural weathering. Also the eye demands a logic of constructive sort to be able to see and appreciate materials in their sensitive forms. Old houses have a lot to say about sound technical morals. " Ove Hidemark (Nyborg 1991, p. 31).

A contemporary example of an architectural practice that is interested in time and continuity, is the office of Caruso St John. They are based in London and more recently, Zürich. Dominiqe Boudet uses similar phrasing as Ove Hidemark did when he in the 2015 edition of A+U magazine writes "The architecture of Caruso St John is sustained by the pursuit of a double dialogue: with the city, and with history" (2015, p.12). They to stress the importance of "as found" qualities of a place, stressing "sensitivity to materials, extreme care to construction, importance of the façade and attention to the atmosphere of the interior space" (2015, p.14). Caruso St John makes no pretence of novelty, yet their architecture is a breeze of fresh air for the European scene, embracing traditional building qualities, material expressiveness and ornament. Their buildings have a timelessness to them, in the sense that they never are locked in to one certain idea or concept. They are open ended and a bit ambiguous. This dovetails the new with the complexity of what is already there, at the same time as making future change possible.

"Architecture is… (you know I did not make this up)… our collective memory. […]The European city is one of the great human inventions. Its this collective endeavour. It requires an enormous effort to make it. It requires an enormous negotiation and consensus. And they are there! It has coherence, variety, flexibility, adaptability. [...]The physical thing, built with a particular intention, has all of this other potential in it. It's like magic, like alchemy. […] Today's buildings are built as objects with only one purpose, to stand out, with none of the open-endedness of historic architecture. Architecture becomes a commodity, a fantastic expression of late capitalism. To me that's the opposite of architecture." – *Adam Caruso (2017)*

Modernity can be defined in many different ways. It has an intuitive meaning of whatever is new or contemporary. It has historical connotations to an art and architecture movement of the early 20th century. One can argue that a modern movement is a development towards more layers of abstraction and reductions. This does happen very clearly in the technical reality of building. In the vernacular tradition, architecture was very direct. Often built by the users themselves, decisions were made based on direct contact with buildings and memory thereof, and evaluation happened naturally through usage. In his book on design called "Notes on the synthesis of form", Christopher Alexander called this the unselfconscious way (1964). Today, the approach is very much a different one. A complex financial system is connected to a complex building industry which is connected to a complex sphere of planning, consulting and project management. Abstraction becomes a natural part of this. The strength of abstraction is its universality, and intellectual rigour. The weakness is its alienation, and its emotional

FIGURE 2 Lilla aska crematorium by Ove Hidemark. Built with soft mortar and thick massive brick walls. Photo credit: Wikimedia commons

FIGURE 3 The new stairs that connects the basement to the upper floors in the Tate Britain by Caruso St John (Boudet 2015)

coldness. When the postmodern movement appeared in order to oppose the modern, it kept the abstraction. It got rid of the historical taboo, the certainty and the claim of rationality. They deplored the purity and coldness of the white clean façades of stucco and glass. But it kept an aesthetic of the abstract. History turned into symbols and references. Colours where brightly picked from the palettes of chemical self-indulgence, not from the urban or natural setting nearby.

"Buildings are about many things. Their design develops out of a set of complex and changing circumstances and once built, the 'meaning' of a good building can shift and remains relevant as its social and physical situation changes. Attempts to use individual buildings to illustrate singular themes always run the risk of over simplifying the significance of that building."
(Caruso 2009)

But there is an alternative to further abstraction. A counter trend to business as usual in architecture is towards craftsmanship and quality. It has probably arisen as one of the many responses to our environmental dangers of today. There is also a cultural rebound. What once was old and boring, again becomes exiting and new. Old techniques for timber framing gets rediscovered as new, and their qualities again explored. The idea of decentralised production, with local materials, seems very fresh and modern, even though that has been the norm throughout most of world history. This counter trend is a type of empowerment of the masses. We should accept a certain loss of some forms of efficiency, to the gain of others. Economies of scale have brought a tremendous prosperity to the world, but also a blandness and universalism that is not always appreciated.

The invasion of building services

"Asbestos went from being very good for you to very bad for you. Fire codes and building codes discovered new things to worry about, and old buildings were forced to meet the new standards. Access for the disabled transformed toilets, stairs, curbs, elevators" Stewart Brand (1995)

When Andrea Palladio designed Villa Rotunda, he did not have to plan for any toilets. Today, anything from 20% to 35% of the production cost is in services (ÅF Bygganalys 2016). The oil crisis of the 1970ies resulted in buildings that was bolstered up in insulation which radically complicated the way buildings could be constructed. Rapidly increasing regulations often require buildings to be planned with heat recycling systems, which doubles the amount of ductwork in one decision. Alarms for security, fire, smoke. CCTV. Broadband through wireless, copper and fibre. Telecom and television. Sprinkler systems and smoke evacuation. Sensors and actuators for ventilation and automatic blinds. Hot and cold water. Heating, cooling, electricity. The complexity of all these systems becomes big for the designer to handle, but one must make

room for it. We have moved from naive simplicity to necessary complexity, but the goal must be to achieve an informed simplicity, that can solve as many design constraints as possible, without ruining the whole assembly.

Different kinds of longevity

"Buildings keep being pushed around by three irresistible forces – technology, money and fashion" *Stewart Brand (1995)*

What makes a building last? The intuitive answer is durability. As defined by Vitruvius in "ten books on architecture", the three criteria for good building were Firmitas (Durability), Utilitas (Convenience), Venustas (Beauty). Durability to Vitruvius was assured when "foundations are carried down to the solid ground and materials are wisely and liberally selected" (Morgan 1960, p. 17). Wise materials meant that they did not deteriorate over time and could take a punch (the Roman architect was primarily a military engineer). These criteria are still relevant today. Mills (1994) defines five causes of deterioration: 1. Moisture, 2. Natural weathering, 3. Corrosion and chemical action, 4. Structural and thermal movement, 5. User wear and tear. All these have to be accounted for to make the building last. Detailing is key.

But it is still not enough. There is a paradox inherit in firmitas. Most buildings are, with upkeep, potentially eternal. Yet many buildings do not last even half the life of a human, claims Stewart Brand in his book "How Buildings Learn" (1995). According to Brand, the most certain aspect of a building is constant change. New users, new functions or new technologies mandate that buildings adapt. For some programs such as Offices and Hotels, this happens very often. Brand encourages the designer to think of the building not just as one thing, but a collection of parts. He uses and expands on a model by British architect Frank Duffy, called Shearing layers. Here, the building is divided into separate layers which all have their respective rate of change. To allow change, these layers must not be to rigidly connected, both in an abstract and concrete sense. Designing for firmitas will be more necessary in the structure than in the stuff. Also within the layers there are hierarchies. Both the roof and façade of a building is a part of its skin, but Brand himself argues that the roof should be as maintenance free as possible, since it is not inspected as much as the façade, that people interact with daily (1995).

"Our basic argument is that there isn't such a thing as a building. A building properly conceived is several layers of longevity of built components." *Frank Duffy (Brand 1995)*

”We live in a time where the engineer and the humanist are faced against each other. The engineer wants, with some exaggeration, stop the time with his art, make the material strong and invincible, while the humanist instead wants to keep the appreciation of time, enhance the emotional response with the inevitability of time. They are two very different perspectives with clear differences in outcomes.” *Ove Hidemark. Own translation from Edman (1999, p. 185)*

Another aspect in building longevity is its maintainability and repairability. If a carpet is glued onto a subfloor it becomes several times more costly to be replaced than if it was tacked down. If the building is seen as a process, or better, layers of processes, it is clear why maintenance free becomes a Faustian bargain. Whatever is maintenance free is also usually impossible to replace or repair. Traditionally, in the unselfconscious process, one did not have to be a good designer to create great design, Christopher Alexander claims (1964). The simple act of accepting tradition, and trying solutions in continuous full scale trial and error, created these vernacular environments. Error would be obvious to the builder, designer and user, since it was the same person. Piecemeal, a pattern would emerge, where a complex web of criteria all ends up in a state of good fit. That is to say, everything from social function to maintenance of the roof is satisficed in the design. Alexander tells a design story about the Mousgoum hut and its builder. How the hemispherical shape of the hut provides the most efficient surface to heat transfer, and keeps the inside protected from the sun. How the ribs not only help the structure vertically reinforced, but also guide rainwater and act as steps to climb up on during building. Instead of constructing disposable scaffolding, it is a part f the structure. And it stays there, months later, when the Mousgoum needs to go up and repair the hut.

“The Mousgoum cannot afford, as we do, to regard maintenance as a nuisance which is best forgotten until it is time to call the local plumber. It is in the same hands as the building operation itself, and its exigencies are as likely to shape the form as those of the initial construction. “ - Christopher Alexander (1964 pp.30-31)

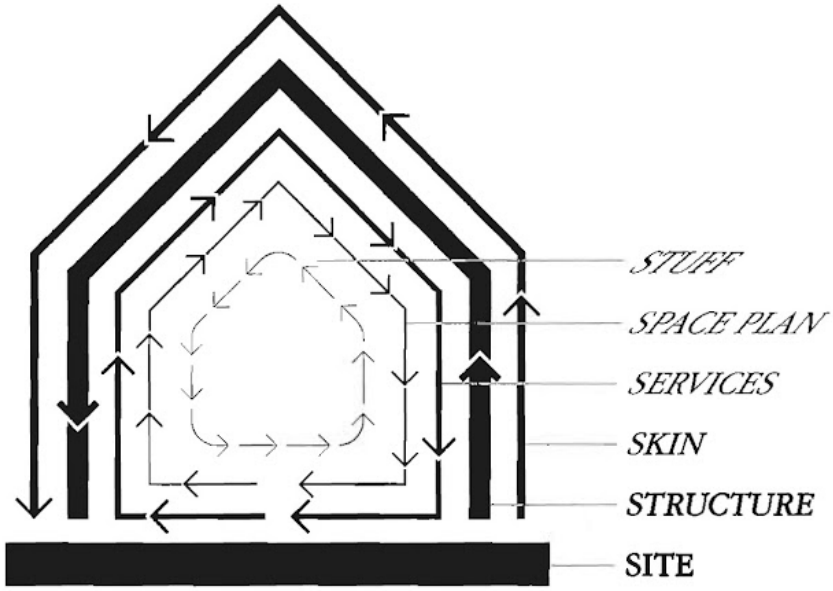


FIGURE 5 The shearing layers diagram from "How Buildings Learn" (Brand 1995)

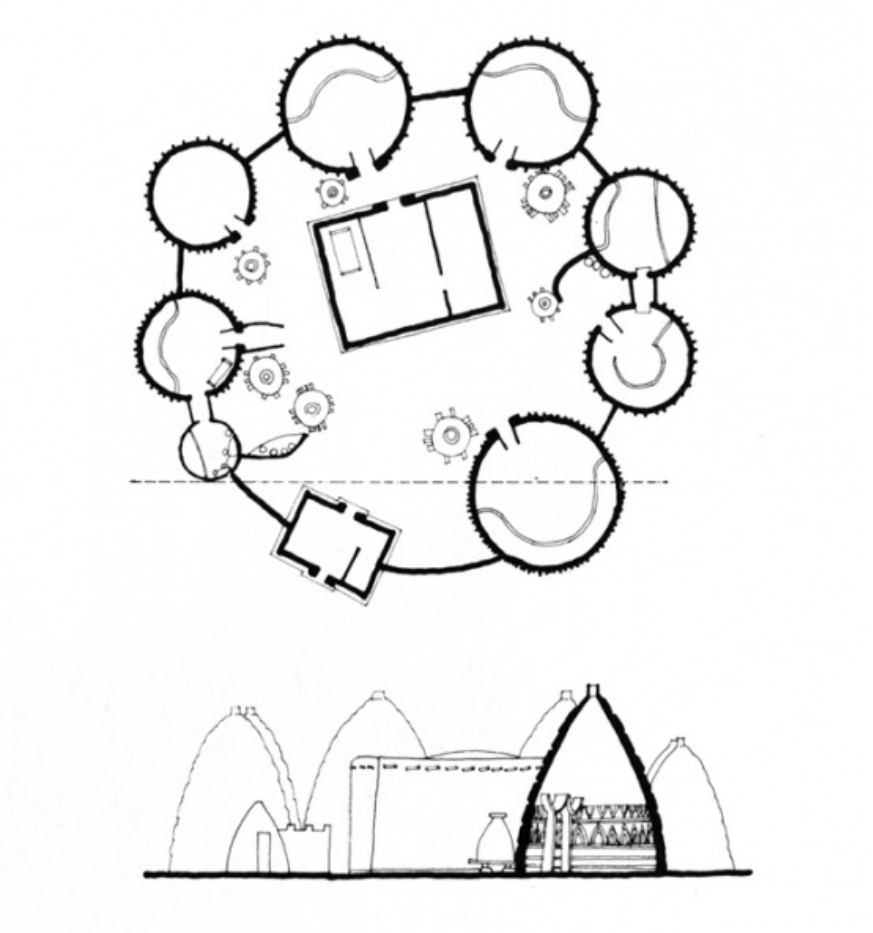


FIGURE 4 The Mousgoum hut, designed without a designer, piecemeal adapted over time. Image credit: wikimedia commons.

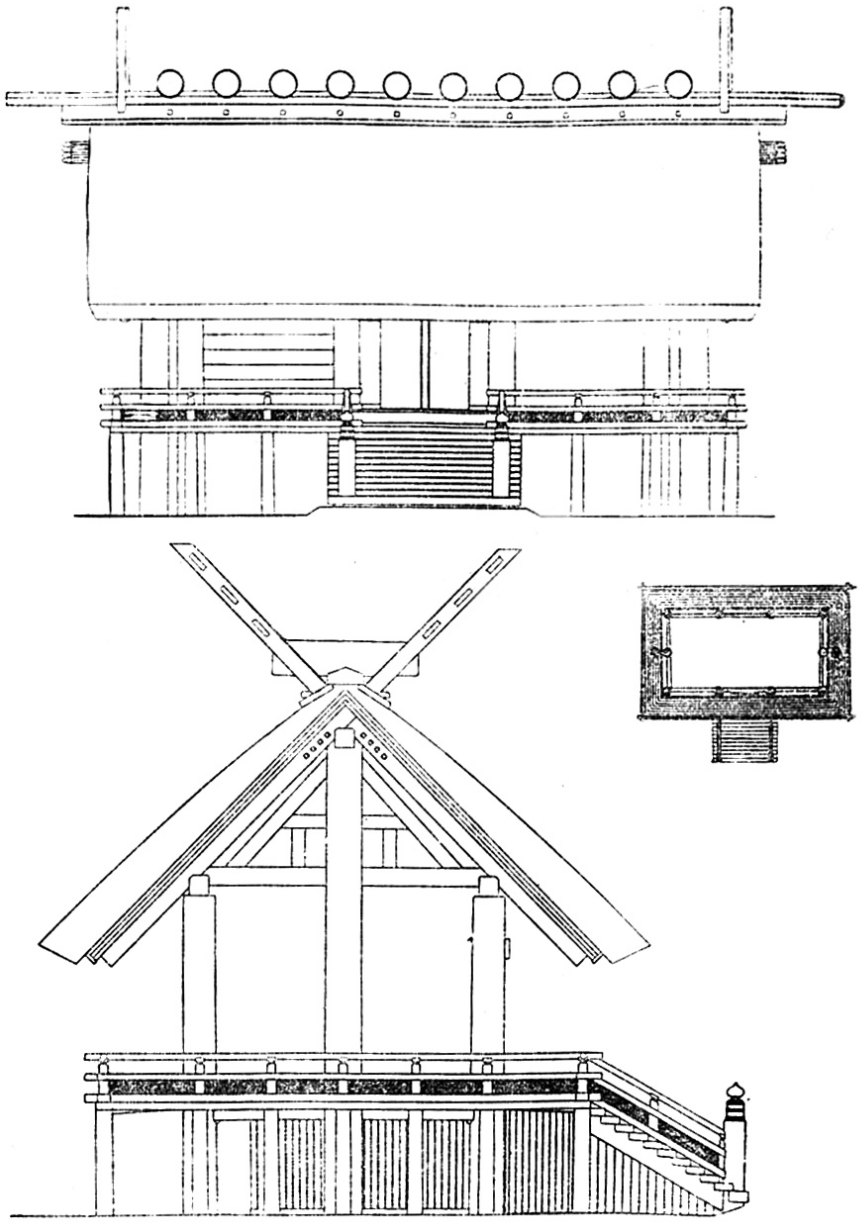
II. Synthesis: Maintenance as a useful design concept

"The romance of maintenance is that it has none. Its joys are quiet ones. There is a certain high calling in the steady tending to a ship, to a garden, to a building. One is participating physically in a deep, long life."

- *Stewart Brand (1995)*

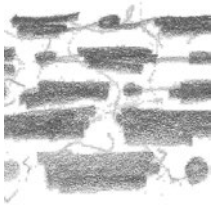
I. Continuity

First criteria for an architecture of maintenance would be that it gets a cultural acceptance. This will help it last. If we do not care for our buildings, they easily fall derelict. This is a tricky commandment indeed, and something probably never fully accomplished. Some friction will have to be expected, between old, new, future. Between young and old, between cultures and sub-cultures. But that is not to say it is entirely ambiguous. One can strive for a target without having it clearly defined in mind at all times. One way to do this is to be conservative, to use tested solutions, forms and arguments. Another way to put this is to accept a tradition. But when and how should change occur? How do we challenge unwanted norms? Borrowing Stewart Brands shearing layers diagram, it can help us as designers make decisions not only on the technical aspects of our buildings, but also on the cultural. Since the structure is such a slow part of the building, it would seem useful to act more conservative here than when designing services. Here we borrow, copy even, from history and tradition. The slowest part of all is the site. The urban situation is not something for radical experiments in big scale. But the interiors, the orifices, the organization is open for change. People change, values change and architecture changes with it. It is this tension between tradition and change which makes architecture interesting, beautiful and comforting at the same time. A stable backdrop combined with a provoking content.



The Ise shrine in Japan is rebuilt every 20th year. It is in line with the Shinto belief of the death and renewal of nature and the impermanence of all things, but also as a way of passing building techniques from one generation to the next. Useful longievity means culture, in this case very deep culture.

FIGURE 6 Drawings for the main building "Naiku". Photo credit: Wikimedia commons



II. Roughness

One design principle of the maintainable house is to give it a certain roughness. That will help in almost all other aspects discussed. Materials that are too fragile and precise will have trouble adapting to construction and usage later on.

a) A tactile design. Some materials have this property inherit (like sawn lumber or moulded brick), some need to be coaxed into it (as in the wire brushing of extruded brick).

b) Materials that can take a punch without breaking. This is especially important for outside corners and other places where tear is expected. Sometimes, building armour needs to be added, especially in hospitals and warehouses, where carts and packages daily bump into exposed corners. These details can be more or less well executed, and as always, care should be taken early in the design process to make them good.

c) Materials that can take a scratch without looking bad. This refers to materials that are homogeneous, like natural stone, or has a pattern to it, like the marbling of the classical linoleum floor.

"The question is this: do you want a material that looks bad before it acts bad, like shingles or clapboard, or one that acts bad long before it looks bad, like vinyl siding?" *Stewart Brand (1995)*

FIGURE 7 *Cottage in Stornoway, Outer Hebrides, Scotland. Stone, concrete and lime render. Built to last, but more importanly, built to age. Own photograph.*

III. Restrained weathering

"The root of all evil is water. It dissolves buildings. Water is elixir to unwelcome life such as rot and insects. Water, the universal solvent, makes chemical reactions happen every place you don't want them. It consumes wood, erodes masonry, corrodes metals, peels paint, expands destructively when it freezes, and permeates everywhere when it evaporates. It warps, swells, discolors, rusts, loosens, mildews, and stinks." *Steward Brand (1995)*

Most technical problems in buildings come from water in one way or another. Proper care needs to be taken for the roof, façade, windows to repel, expel, reject water in all ways they can. This is taken care with by the use of slanting wash, overlapping materials, capillary breaks, drip and overhang, drain and weep (Rand & Allen 2016). Getting these details to look good, function well over time and be easy to build is not a simple task.

"More pernicious now in most buildings is internally generated water vapor. Every year since the energy crisis of 1973, buildings have been made more airtight and better-insulated to save on energy costs. But keeping in the nice warm air (or the nice cool air in hot seasons) meant also keeping in all the moisture that humans, kitchens, and bathrooms constantly exhale." *Stewart Brand (1995)*

Water vapour is not as intuitive to a designer as liquid water. It transports through the building by diffusion and convection. It causes slow deterioration through it's presence at high relative concentrations, and can drastically cause damages if the dew point occurs and you get condensation. In cold climates, we mostly have the moisture pressure from the inside and out. Traditionally, these problems have been solved through leaky, diffusion-open buildings and fire based heating. Today, they are mostly stopped with vapour barriers (plastic) and mechanical ventilation.

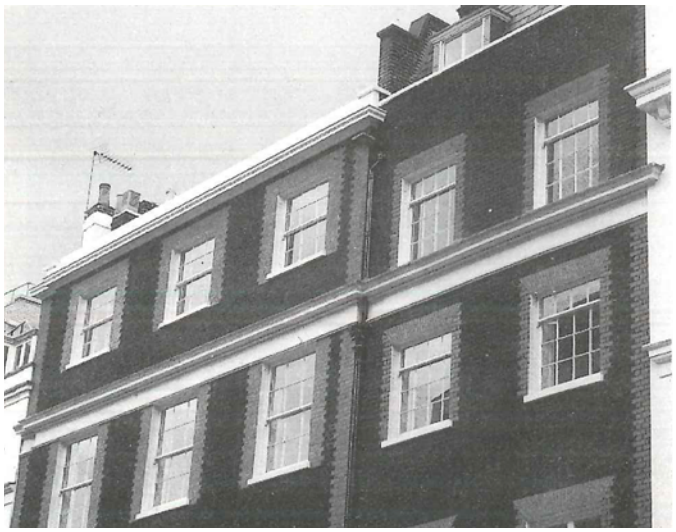


FIGURE 8 ***Traditional way of facade water managment with copings and cornishes. (Mills 1994)***

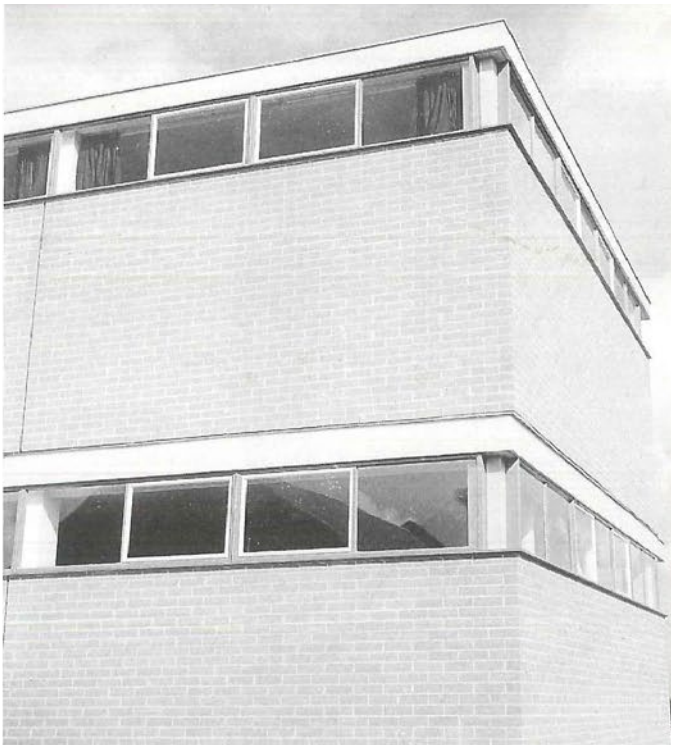
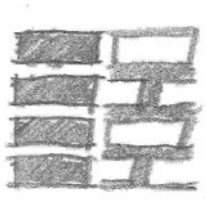


FIGURE 9 ***The modern way with flashings out of sheet metal (Mills 1994).***



IV. Soft joinery

One should avoid unnecessary composites. Things must be able to be taken apart. An example of this is when too much cement in the mortar makes the brick break before the joint. That means no whole bricks can be modified or reused. The principle of a soft mortar and strong stone has been obvious to builders throughout the centuries, but not any longer. The amount of construction adhesive used today, in all parts of a building, is almost scary. Sure, the glues of today are manifold, specialised and high performing. But they all make repair and disassembly extremely difficult. Screws are better than nails, because they are more easily removed without damaging the boards. But there are places where composites are necessary. To make a fire and noise resistant flooring system for a residential building for example, not much beats reinforced concrete. The combination of steel for tension and concrete's compressive strength is difficult to replicate in a layered system.

"If you aim for a life of about thirty years for a building, like we did during the fiftees, then not much needs to happen except for the odd furnishing job and maybe faucet gaskets, but if you want it to last sixty years, then repairability becomes an important quality. In the old building techniques, the joint was weaker than the material, in the modern technique it is the opposite. It is therefore about making the joint weaker than the parts, to make the mortar weaker than the bricks. […] Long life requests maintenance. Maintenance requests repairability. Repairability requests that materials can be taken apart. 'As one join one gets waste!'" *Hans Isaksson (Lööf, Isaksson, Södergren, 1994)*

Reference Halen/Siedlung

Bunkers are made out of concrete. It is strong and hard. It does not burn. Unreinforced it does not rust. It is watertight and sanitary. It is a durable material no doubt.

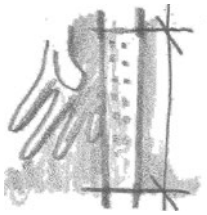
The famous building complex of Halen/Siedlung by Atelier 5 is realized almost exclusively in concrete. Built in the 1960ies, concrete is used as a load bearing material, as façades, and as interior finishes. Lightweight (aerated) concrete is used as an insulator. In the lush setting, and the extensive use of greenery on the roofs and walls, the patina is now, 60 years later, well developed. That does not mean it looks shabby – the walls have gained a richness in color and texture, without there being any damages.

But there have been problems. The delicate window frames that were have long since broken down, and replacements are impossible to find. The buildings are terribly insulated, and the very precise architectural language is difficult to add extra insulation to in any satisfactory way. The reinforcements have to this date been adequately protected by the concretes alkalinity, but it might be a worry for the future. It is also worth to notice that while Portland cement is rather abundant on earth, its refinement and use is a huge emitter of greenhouse gasses.

Yet Halen/Siedlung is a still a flourishing housing enclave. Many artists and architects live here, and they accept the quirks of the place. They also love the simplicity, the order. In a chaotic world, we often seek calm in the objects around us. Minimalism promises a safeguard for the mind, an anti-clutter. Also, the relationship between nature and man, through the contrast of abstract controlled concrete and wild greenery becomes very direct. It is very interesting to see that despite the culturally protected facades, the users have themselves managed to extend the houses to the street by transforming the whole or parts of the enclosed garden. This in order to extend their kitchen, which in the original design is very minimal.

This reference is based on a site visit in 2016 and the accompanying presentation by one of the original architects from Atelier 5, Jacques Blumer.

FIGURE 10 Halen housing complex by Atelier 5. Picture credit: Wikimedia commons

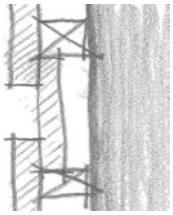


V. Small modules

A smaller module has the ability to be combined in many different ways, like the notes on a musical score or words of a language. An adaptable material like wood can be cut and modified continually. A bigger module, like a wall sized element, will be more difficult to adapt and reuse flexibly. Brick is one of our oldest building materials. It is a very simple module, sized for the hand of a bricklayer, which can be combined in many different ways. A building built out of smaller modules is also easier to repair piecemeal.

In a natural system, there are far many more small things than big things, and this relationship is fractal (Jiang & Brandt 2016). That is to say, patterns repeat throughout the scales. A tree resembles a trunk resembles a branch. This character of a natural system is so pervasive that it almost can be used to discern natural made things from man made. The fractility or continuous detailing of architecture is something that has been lost over time, and something that should be encouraged. There should always be intricacy left to find when an observer gets closer, it gives a richer experience.

FIGURE 11 ***Sullivan's Guaranty Building. The building is very complete and harmonious as one form, yet the intricacy is contnuing down the scales to each terra cotta tile. Drawings from Caruso ETH Studio***



VI. Forgiving detailing

Building is not machining. Whenever details require 100% precision, then it is the designer's fault if it does not perform according to specification, not the craftsperson. Traditional craftsmanship contains all these small finesses for covering up small mistakes. Trim is the most obvious, but there are many more tacit tricks that a craftsperson has up their sleeve to adjust imperfection. A sliding fit is simply easier to get right then a fit that needs to mate up to several different surfaces.

Even if details were to be made to a tenths of a millimetre's precision, things like thermal movement and ground set still makes the detailing fail in the long run. Therefore, details need to be forgiving, accepting tolerances without looking bad. That does not say we should not place demands on our builders for them to deliver a quality product. It is about putting effort in where it pays off.

Peter Märkli, professor at the ETH in Zurich, puts it this way:

"Design is about the structure and the proportions of the structure […] and I study that within a reach of about five or ten centimetres. […] That provides me with stability and even if a little mistake occurs during the building process things won't fall apart. But if you say a joint has to be a centimetre wide during a hundred meters, and if that isn't the case I will tear it down, then you are lost. That has nothing to do with an artistic expression. If you can think in a hierarchical way, the advantage is that you can see the way buildings can adapt life and can adept imperfections".- Peter Märkli (Schevers 2012)

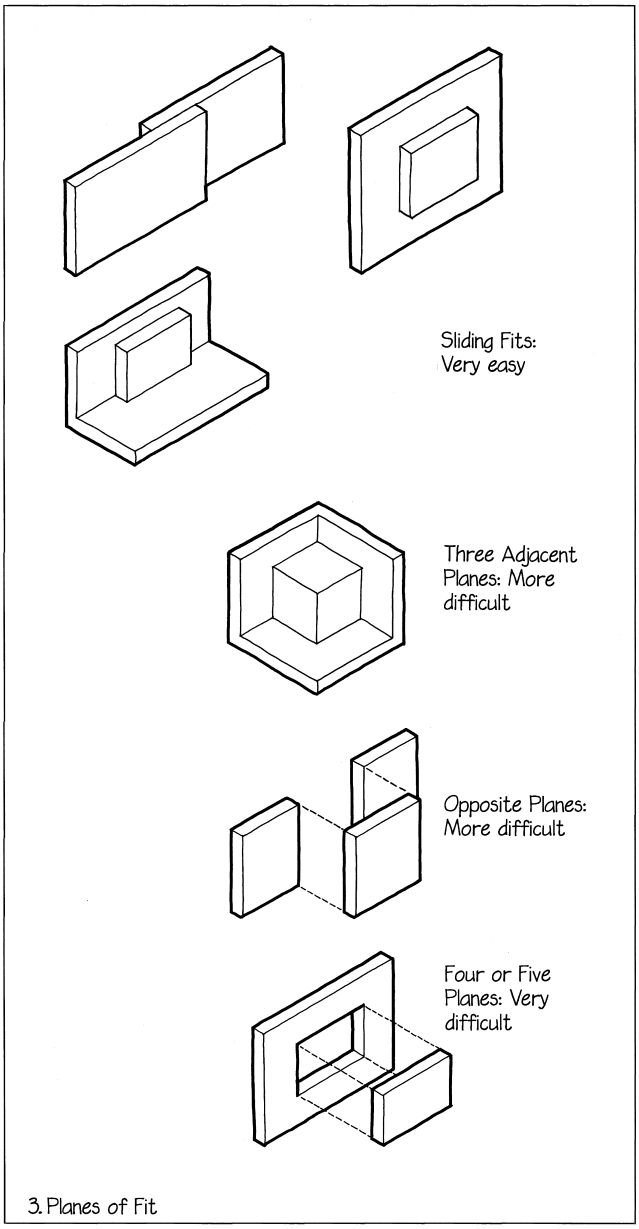


FIGURE 12 ***Not all details are made equal. How some things fit together more easely (Rand 2016, p. 198)***

VII.General spaces

"All buildings are predictions, all predictions are wrong" –Stewart Brand (1995).

In order to accommodate many different programs, space plans should be general and built loose fit. That means not to precisely tailor to specific functions. The rectangular rooms of even sizes of traditional architecture have proven themselves fully adequately to host offices, dental clinics, and many different family setups. Trimming the bedroom to precisely accommodate a certain bed size leaves little room for future adaptability. This is not only for residential architecture. An open endedness in space plan will be healthy for public buildings, offices, industry. As long as there is a certain structural logic to lean back on. It does not need to be accommodated by a system of flexible partition walls or similar, each generation will want to have their own solutions and express their creativity.

"You cannot predict or control adaptivity. All you can do is make room for it—room at the bottom. Let the mistakes happen small and disposable. Adaptivity is a finegrained process. If you let it flourish, you get a wild ride, but you also get sustainability for the long term. You'll never be overspecified at the wrong scale." Stewart Brand (1995)

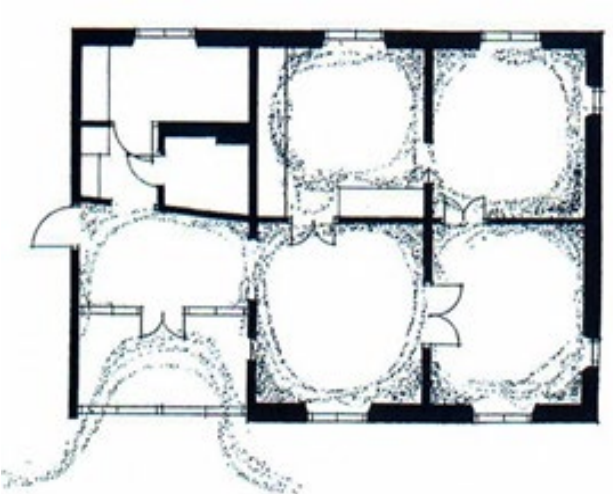
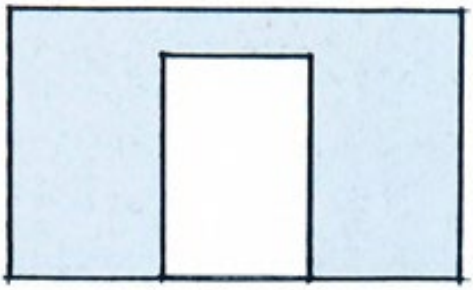


FIGURE 13 *Stumholmen*

This project by the architects Brunnberg & Forshed can serve as an example of flexibility through generality. The architects developed a module of 3.6 by 3.6 meters, which they since have used in many residential projects (Nylander 2002).

Also, care is given to not let openings between rooms get too big. This improves the sense of enclosedness and increases the ways furniture can be arranged.



Even though a module has been developed, exceptions are made. The first diagonal wall, or the washing rooms depart from the general module of 3.6 by 3.6.

Pictures from (Nylander 2002)

III. Design: Exploring the Urban Block

The title of the thesis, “in praise of maintenance”, might suggest an all-out pragmatist approach, but that would be a misconception. A maintenance approach to building acknowledges the non-rational aspects of human nature and culture, and although the final building should solve explicit design problems, tacit design issues arise and are solved implicitly also.

Since the research questions and theme of the project is related to tectonics, construction and building culture, or what we sometimes call “the building as matter”, questions of program is not in focus. However, designing empty shells is a bit underwhelming. Therefore, a program have been chosen in understanding with the tutor/examiner. Bottom floors of the building is designed as commercial spaces and the top floors will be residential and offices.

The project was presented in drawings, models and renderings during first a closed and then an open seminar. Here, the project is presented in text, renderings, model photos and diagrams.

The technical project is further presented in Appendix A: Drawings.

FIGURE 14 ***View down Johannebergsvägen of the design proposal.***

Site

The Site currently boasts a parking garage from the 1970ies. Sketches were made to see if the structure could be kept from the original garage, but due to the allocation of the columns, this ambition had to be left for another project.

The site stands in a slope of about four meters, which therefore becomes the height of the first floor, with an exception in the middle volume, which steps in accordance with the slope, to populate and activate the street. The setting and neighbours do not suggest any particular typology or spatial configuration. The building has to, in a sense, be treated as a solitaire. It does what it can to mitigate the ambiguity of the environs, and to bring qualities to a space that is to many extents a back alley. It relates to the heights of the surrounding buildings. The shape twists in order to meet the two different orthagonal systems. It steps away from the existing building of "Artisten", and creates a more resting space between the volumes, while allowing the residents to have views on the art museum. This space is terminated in a set of stairs that form a shortcut down to Johannebergsgatan.

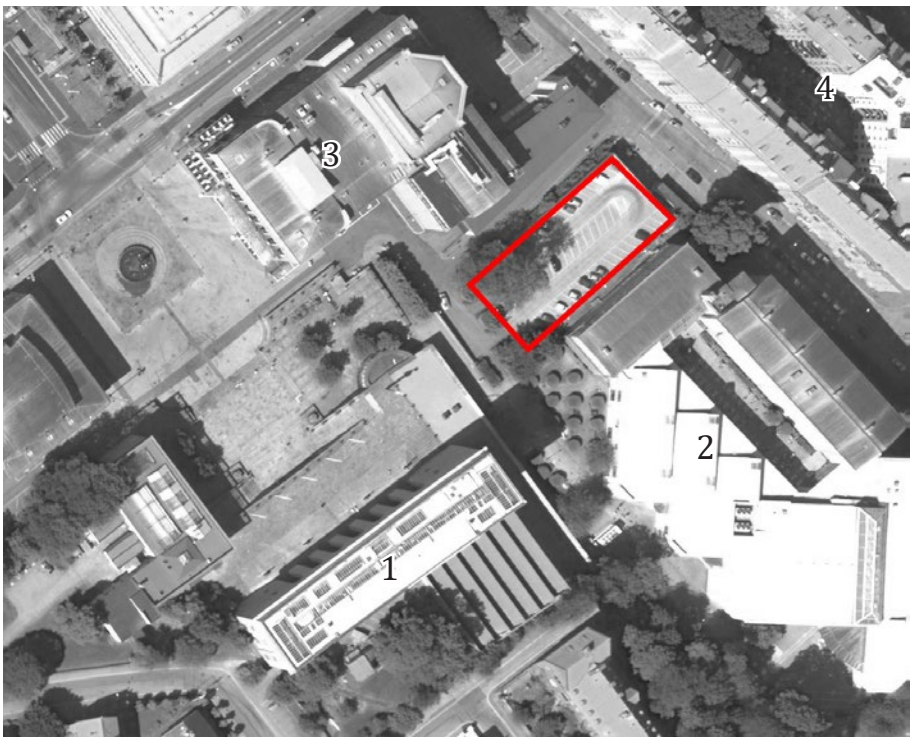
Structure

If the structure works, one might expect a long life from a building. Gothenburg is built on clay, and a lot of it is built by clay (Figure 20). The brick building tradition is extra strong in Lorensberg, with a lot of exposed brick in the national-romantic residential houses out of red brick and the Scandinavian neo-classicist institutional buildings out of pale yellow brick (Figure 15). Discussing longevity, maintainability and robustness in the thesis, the choice of brick was very obvious.

As a design constraint, an aim was set up to reduce the amount of steel reinforcement in the construction, or at least make it not dependent on the reinforcement (Figure 21). Many problems with cavity walls have been because of improperly designed or installed steel elements within the wall. When the steel corrodes, it expands up to six times its volume and fractures the wall. (FOU-Syd 2006 p. 16) If it is just a decorative façade, only economic harm is done. If a loadbearing wall fails, lives may be at stake.

In order to mitigate a long lasting wall with both the qualities of insulation and thermal mass, a diaphragm wall typology is used (Figure 19, Figure 23, Figure 24). These walls are not common today, but there are some examples (Schultz & Månsson 1994). Its main strength is that it can be used as relatively high and slender constructions, due to the stiffness in the cross section. The wider the cross section, the more it can resist wind loading and shear forces. The tubes of brick wall are what carries the load. Between the windows, bricks only clad the outer wall, while elements of cement bound wood strips make the interior structure, a good solid carrier for the interior render.

FIGURE 15 Lorensberg 24:2. 25 by 60 meters in size. The current Parking garage has three floors for parking, one from Johannebergsgatan, one from Gösta Rahms gata, and one on the roof. Own photographs.



1. Gothenburg Art Museum. It ends the city boulevard "Avenyn" with a brick built slab that stands on a wide base with stairs, trees and stone.

2. Artisten, Lorensberg 24:3,. The older parts are from 1935 and the transformation and extension for the Gothenburg Acadamy for Music and Drama was made in 1992.

3. The City Theatre, Lorensberg 30:2. Built in 1934, designed by architect Carl Bergsten. The part closest to our site is the garage entrance for goods.

4. City block across the street, Lorensberg 25:7 to 25:9.

Maintenance of a brick wall consists of cleaning and repointing. The mortar needs to be of a softer kind in order to make this repointing easier, but still needs to resist water and acidity of the city. The choice of a softer, lime based mortar, will also help in change and eventual demolition of the building: the bricks can be extracted intact and reused in the future.

Substructure is very important. The depth of clay is not so big here. It's only between 6 and 9 meters across the site (Lantmäteriet 2017). Since no sub-soil basement is planned, and the structure is heavy, no floatation problems is assumed to arise and a conventional compressive piling can be done all the way to bedrock.

Skin

The façade was designed with several criteria in mind (Figure 22). Proportion, durability, openness. Relief gives the building life, and helps mitigate water and dirt (Figure 18). At the top floor, the windows expand to form a top motif of the building. The building meets the urban setting with an openness, by again expanding, providing for displays and entrances. It becomes a socle motif out of lighter bricks that mark the base, just like the base of the art museum or the city blocks around (Figure 28). Up towards the institutional giants of the theatre and art museum, the more archaic vault is used. Towards the street and uban setting, straight vault or beams are used as load redistribution.

The windows are partitioned. It becomes a part of the ornamentation of the building, together with the brick (Figure 25). It also creates something to rest ones eyes on, before you look out, and it filters the light indoors. Eaves are set back in an enlarged soldier course and then crowned by the gutter, so the downpipes are as straight as possible (Figure 27). They are recessed into the wall. The roof is sloping 10 degrees in order to compromise servicability and water shedding qualities.

Services

Just like in a Roman bath house, the entire building mass is activated (Figure 29). Here it is done by using hollow tube concrete slabs. These transport the heated fresh air from the core of the building and let it out by the windows. The use of thermal mass in buildings are severely limited by the thickness of the walls, beyond a certain point, a more massive wall will not help since it cannot heat up and cool down over 24 hours. But hollow tubes increase the surface area and therefore also the usage of the thermal mass.

Leaning on the design practice of office complexes, ductwork is mainly in the centre aisle of the building, and distributed overhead. Vertical connections are bundled into the stairwells and technical spaces in the bottom floor handle the city connections. The goal is to have it intuitive.

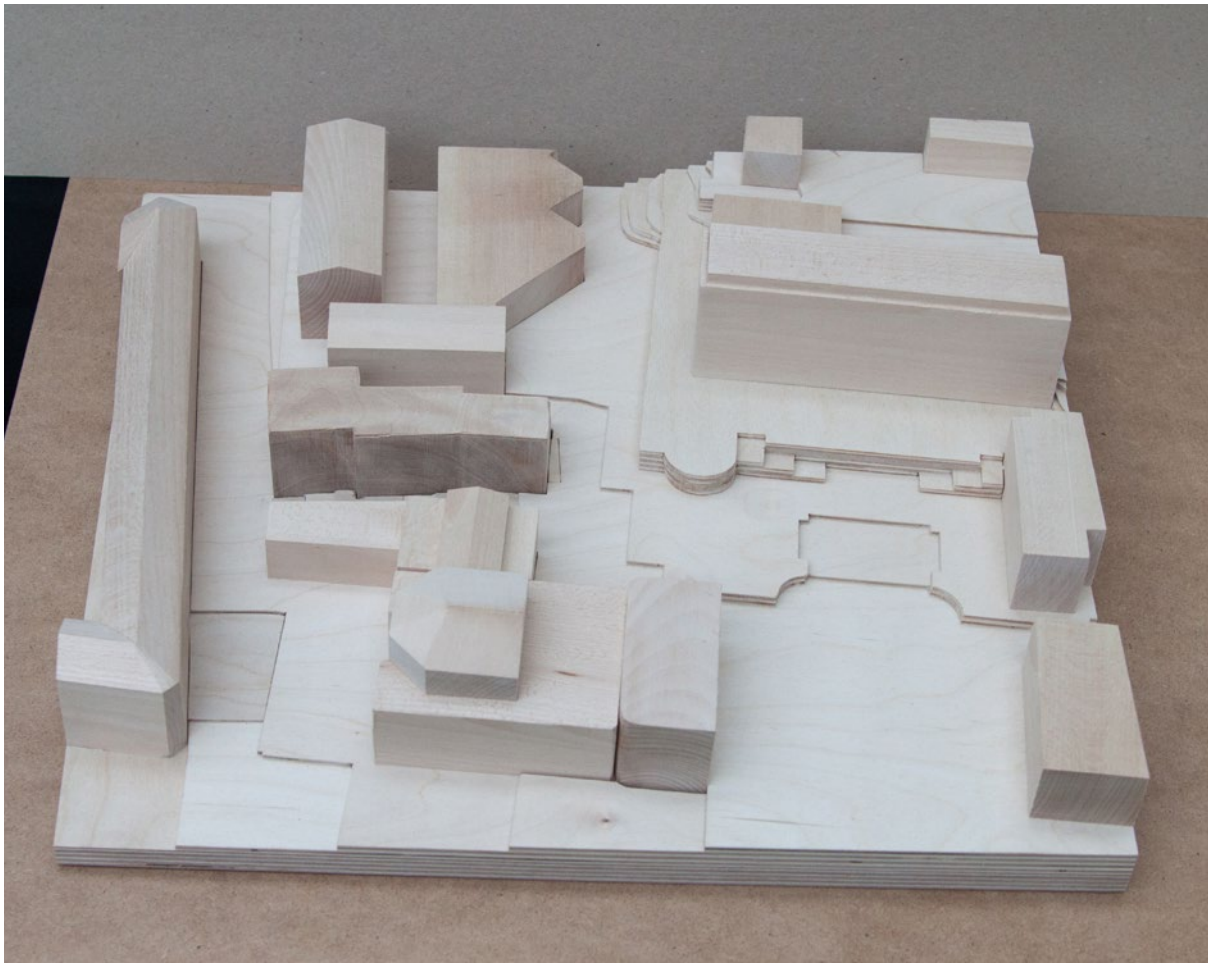


FIGURE 16 ***Site model 1:500***

This way of structuring services is common and therefore maybe a bit future proof. The presence of installations can be read in the ceiling height, and vertical shafts are bundled with other vertical functions.

Space plan

The space plan is designed with generality as the primary quality. Equally sized rooms, arranged in close access to each other, will assure no functions other than the bathrooms will be fixed (Figure 31, Figure 32, Figure 33). In the centre of the apartment is a big hall which becomes the central node. Movement happens through here, or by the windows, which helps the rooms share daylight and make for an airier daily experience, while preserving the enclosedness and distinctness of the rooms (Figure 36, Figure 35).

The rooms have a ceiling height of 2.7 meters and one may reasonably expect the building to be suitable for office spaces as well as residential. The stairwell is the most durable part of the interior (Figure 30). Solid materials like concrete and brick ensure a roughness and longevity. Soft materials like wood guides the hand. Contrast in flooring helps the one with a weak eyesight, and the acoustics are dampened with perforated brick.

Stuff

The final category of Brands "shearing layers" diagram is the stuff. The part that changes around the most quickly. The part that the architect has no control over. The relationship between the architect and control is an interesting topic, one that might have to be spared for another thesis altogether. But one can say that it is important to allow for differences in taste and living conditions fully on this scale. Should an apartment limit any type of expression? Also on the stability of the interior finish wall. How does one put up a frame or secure a cabinet in the wall without expert knowledge? These things should be intuitive and simple, when designing homes made truly as spaces for dwelling.

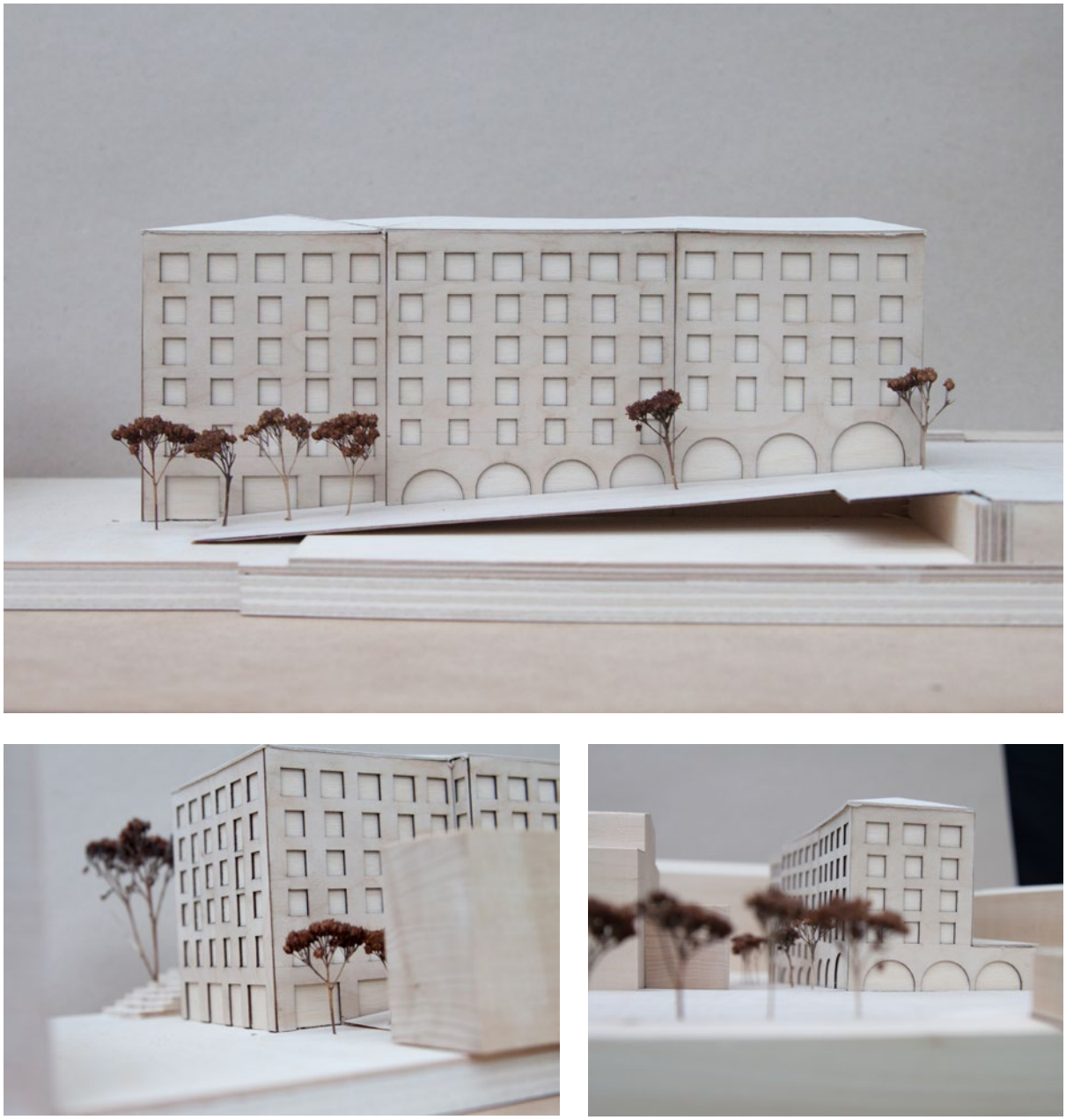
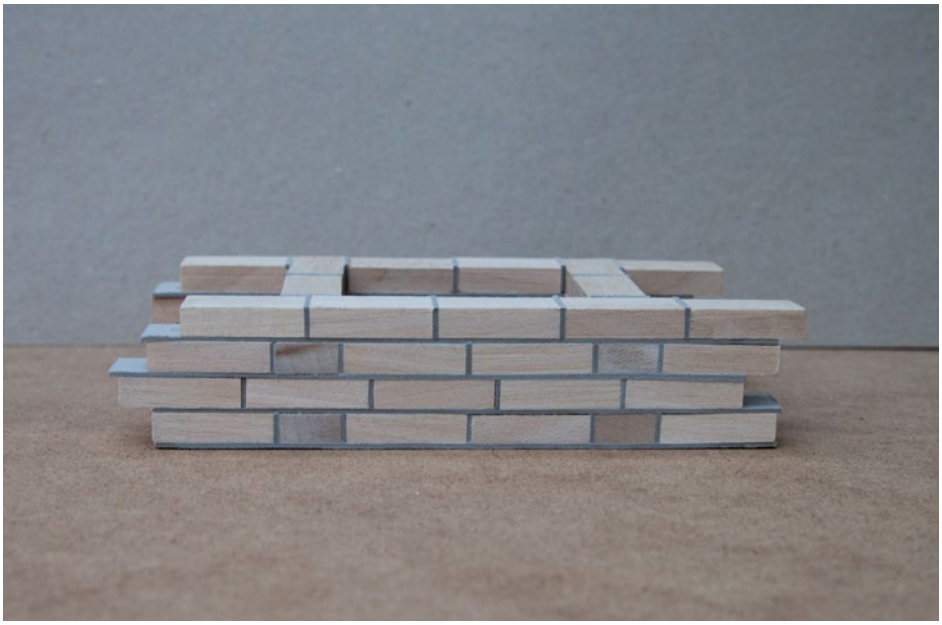


FIGURE 17 ***Model 1:200 showing the building massing and immediate environs.***

FIGURE 18 ***Relief model 1:100***



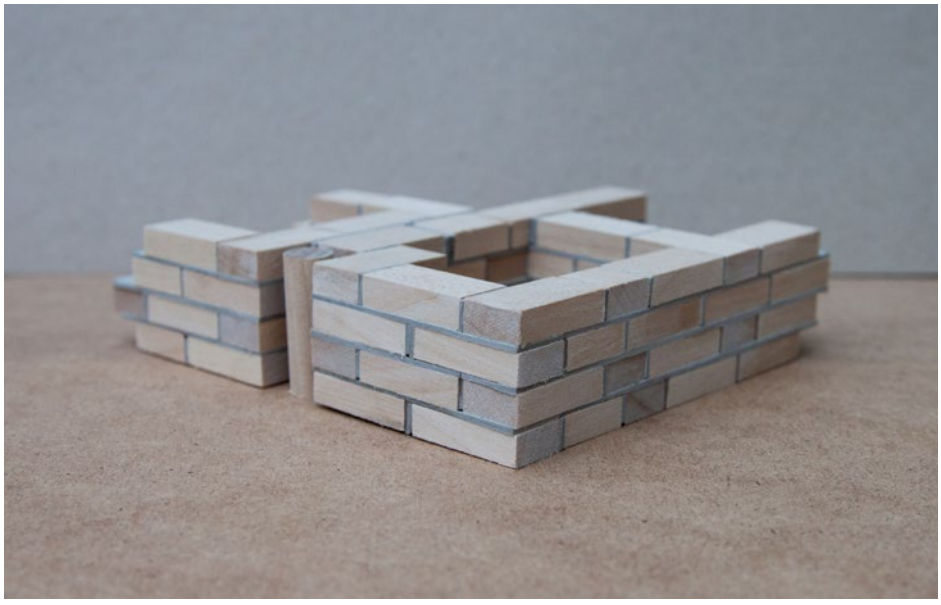


FIGURE 19 ***Models 1:7.5 Showing the diaphragm wall.***

FIGURE 20 *The soil composition of Gothenburg, it's Geology, have shaped the city. Own map based on data from Lantmäteriet (2017). The project site has quite favourable conditions with bedrock just 6-9 meters below the post glacial clay.*

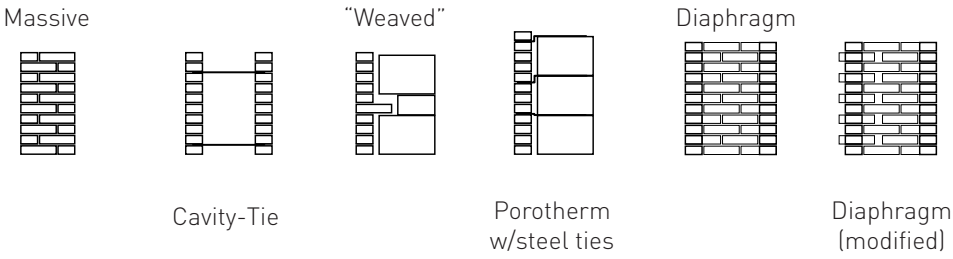


FIGURE 21 *Some brick wall typologies considered*

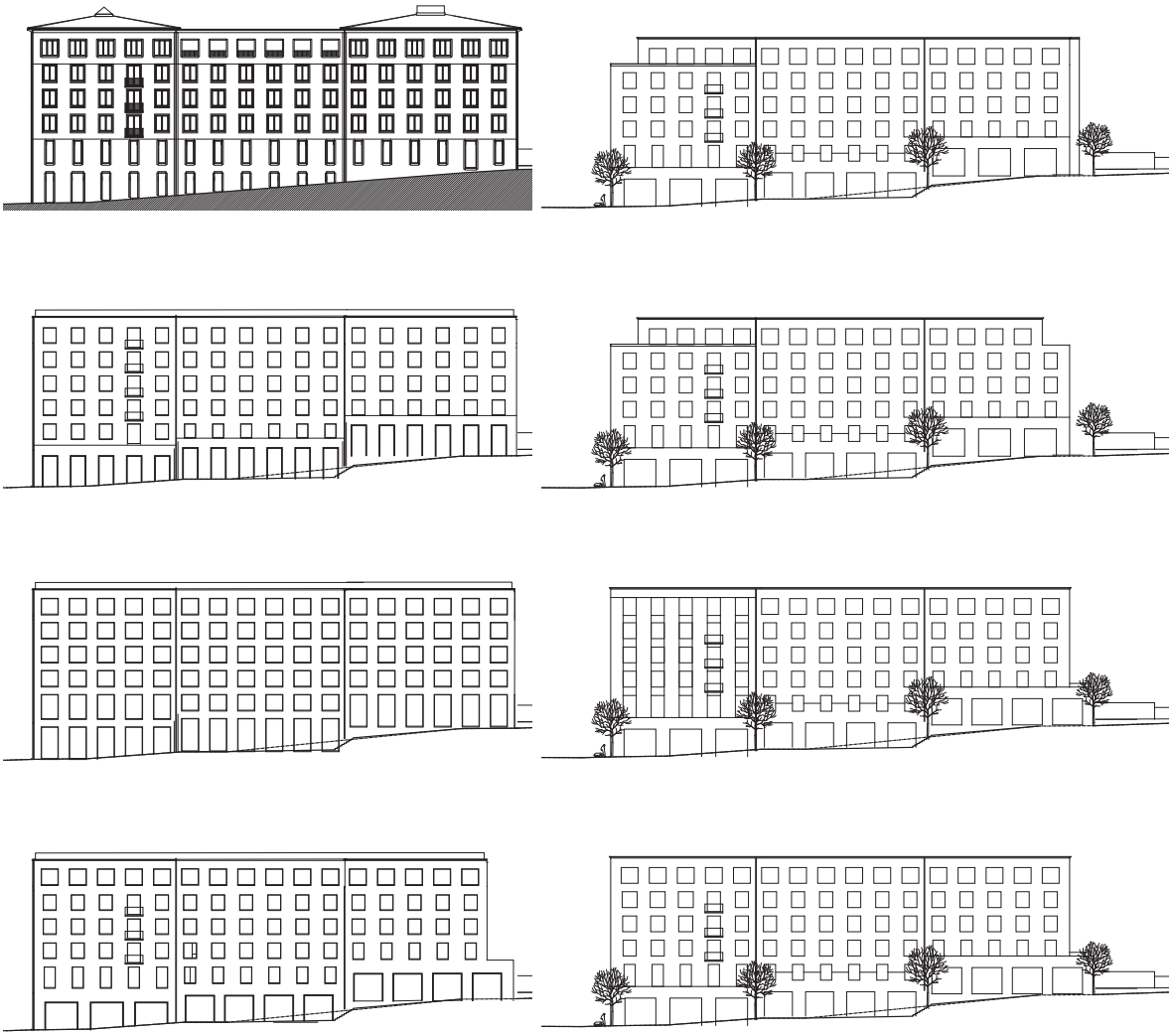


FIGURE 22 ***Some iterations on perforation and massing, before the final shape was settled.***

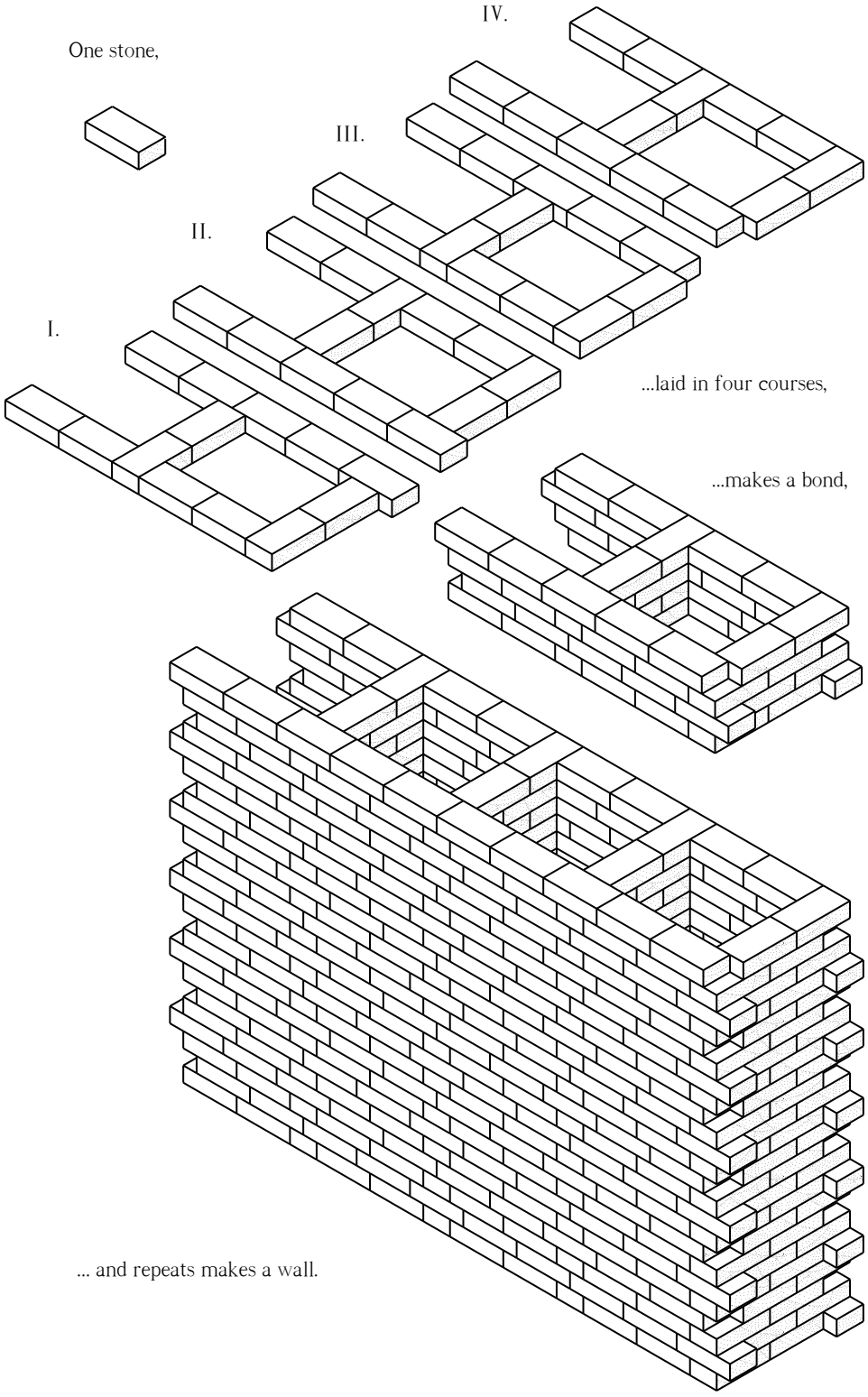


FIGURE 23 ***Axonometric diagram for the layout of the bond***

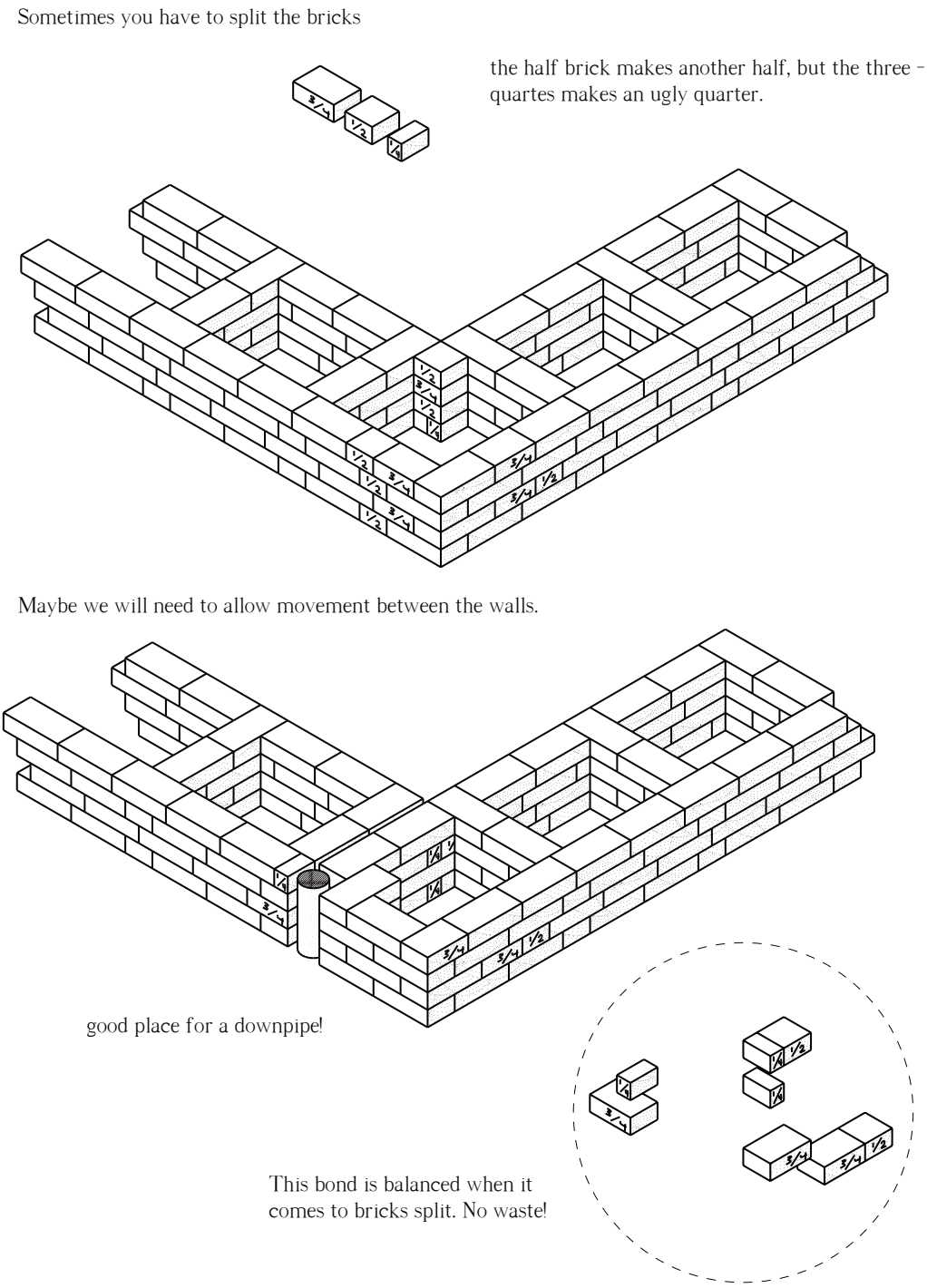


FIGURE 24 ***Axonometric diagram for corner layout***

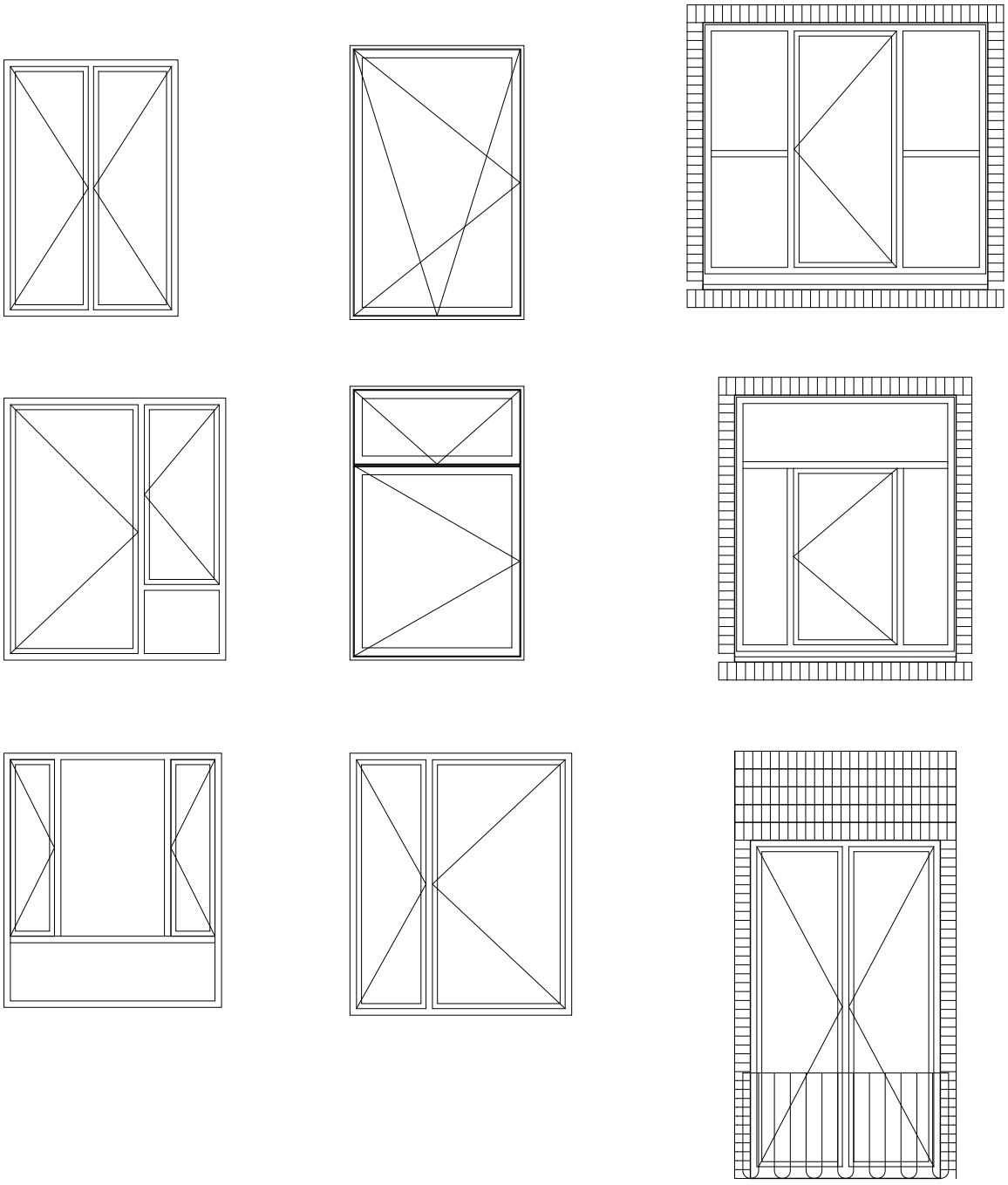


FIGURE 25 ***Explorations on window partitioning. Final layouts to the right.***

FIGURE 26 ***Facade excerpt***

FIGURE 28 ***Render showing the socle of the building***

FIGURE 27 ***Renderings showing the eaves of the building***

FIGURE 30 *The stairwell from above*

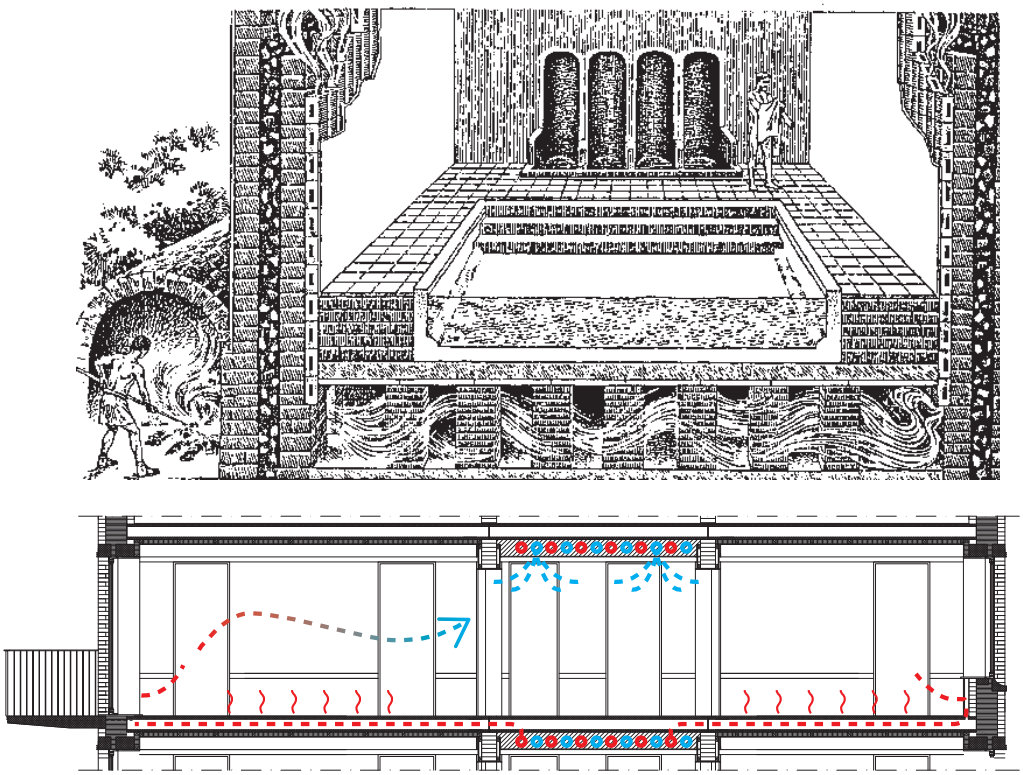


FIGURE 29 *Warm air i transported from the core, outwards and expelled by the facades. The entire building mass is activated.*

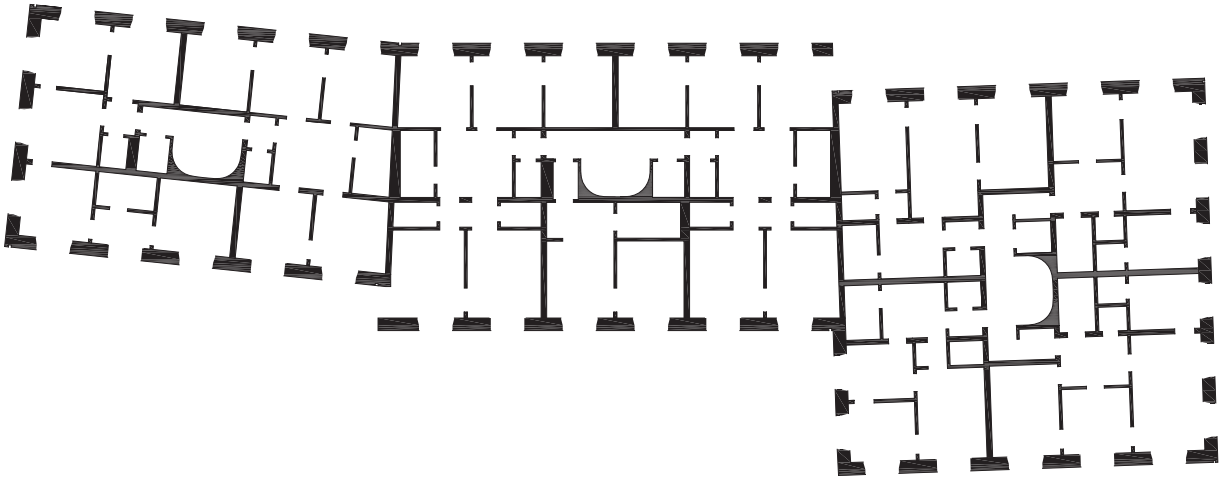


FIGURE 32 *Plan over Floor 3-5*

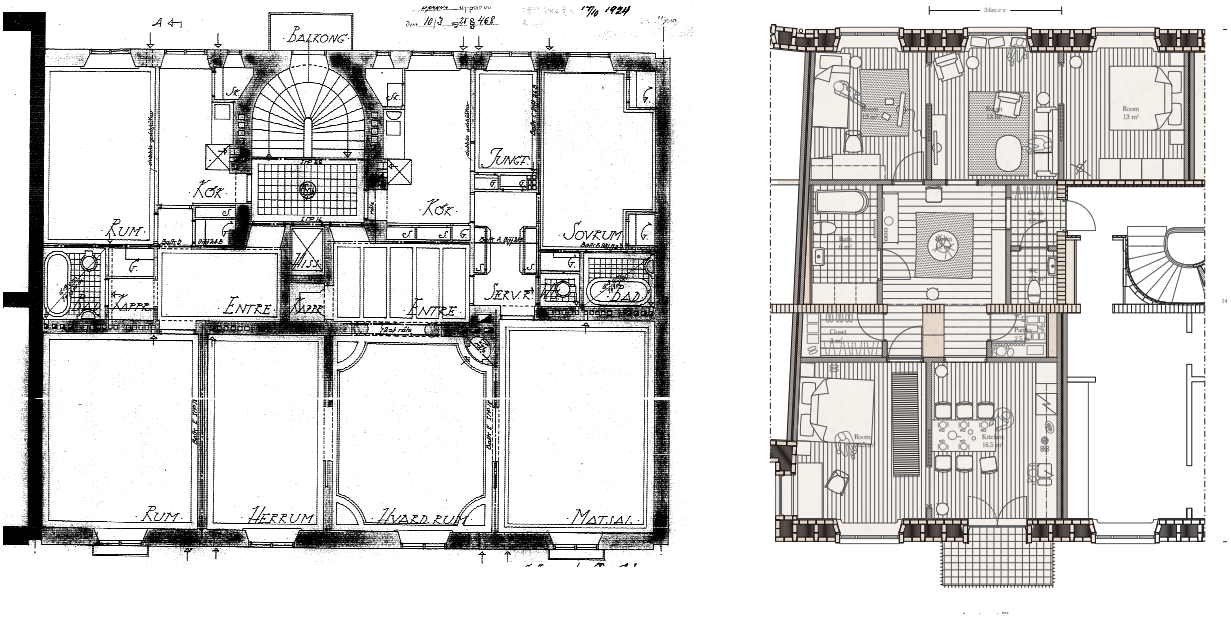
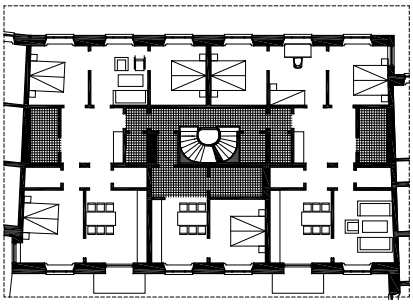
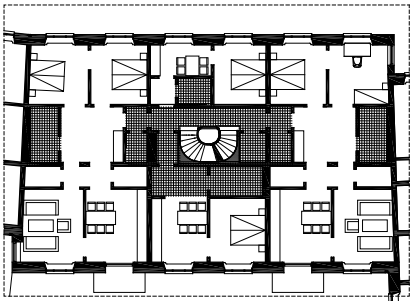


FIGURE 31 *Left: The plan for two apartments in the building across the street. Lorensberg 25:8. Scans from the city archives. Right: apartment plan from the design project.*

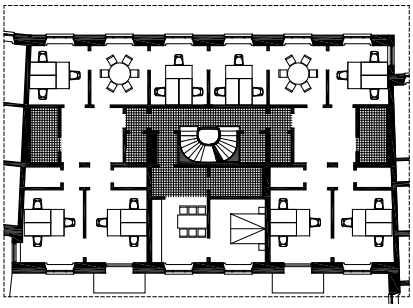
Arranged for three apartments



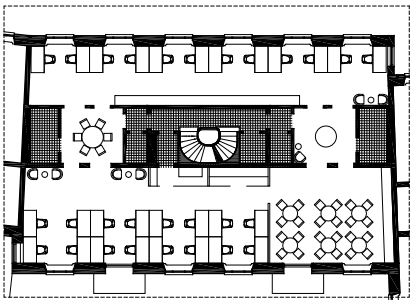
Arranged for four apartments



One apartment and an office remake



Remodeled for office



Dental clinic, offices, apartment

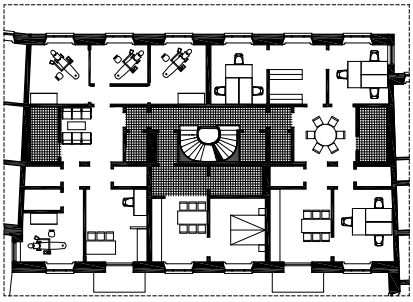


FIGURE 33 ***Programmatic varition allowed in the system***

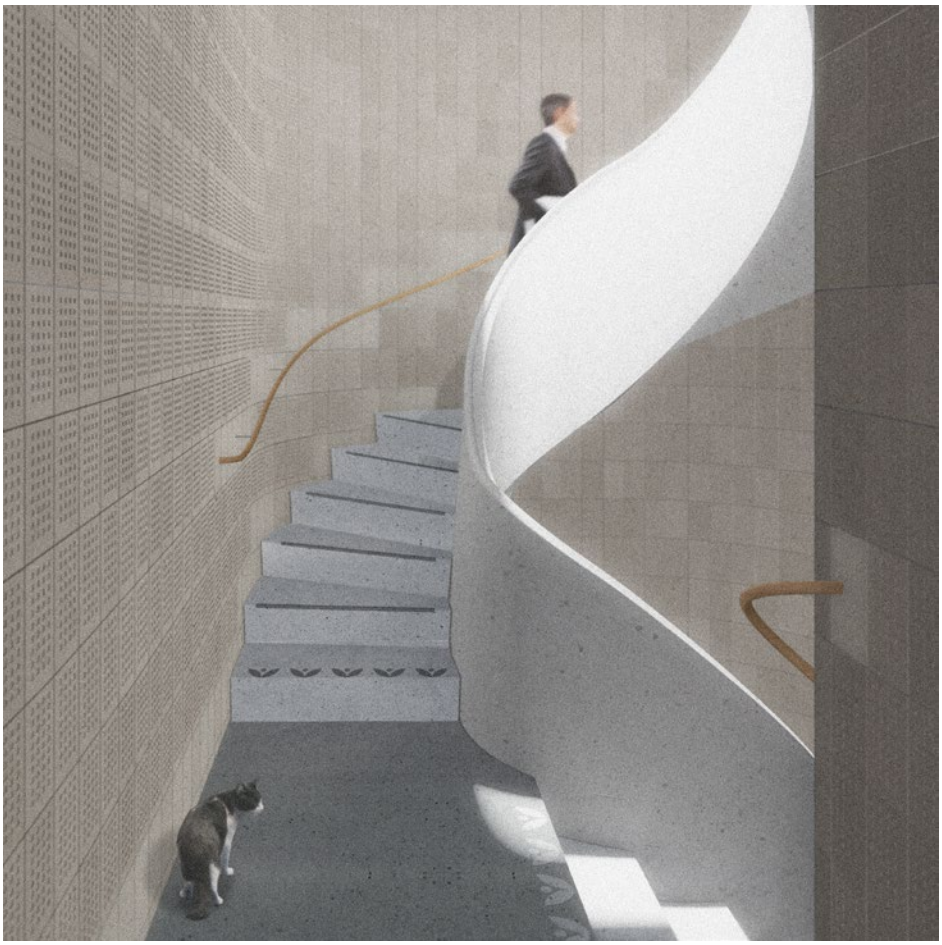


FIGURE 34 ***The floor to floor hight changes for the commercial levels. The stairs repond and stretch another quarter here.***

FIGURE 36 ***South facing windows.***

FIGURE 35 ***Apartment in the central building***

IV: Reflections

Misses

As delimited, the process and economics of building is not really addressed adequately in the thesis. However, if it would be explored, the question of conflicts of interests becomes interesting. It is hard to imagine smooth operation. To be a bit polemic, I would characterize it like the following: The architect designs for personal ego. The builder constructs for profit. The owner wants low costs and high rents. The construction company ensures margins and forces building systems onto the architect. The facilities manager chooses the cheapest material for a 30 year life span. The politicians act populists and care about what seems to be the strongest action. The user cares about their condominium career and the next bigger apartment. Building economics are important. Spending money on building parts that is to stay for hundreds of years rather than the ones that only need to last thirty seems to be a dead simple, almost kindergarten type of logic, yet effort is continuously made to lower the cost of structure in order to put more money on finishes and services. Where money goes in a building is something worth looking at from an architectural point of view.

Projects and books to use as reference that fit to talk about “material maintainability” was difficult to find. Not that they do not exist, there is probably a lot of them out there, but they are rarely published in architectural journals and magazines. I would assume that self-builders pay attention to this type of building. Budgets are often tight, which creates incentives for cheap materials like wood, which together with the fact that you yourself will be the maintainer, creates incentives for a maintenance friendly design. I missed out on exploring one of the outset goals: which buildings have proven to accept maintenance better? More studies of this would definitely have helped, and it saddens me that it was difficult to find in the literature.

The choice of a diaphragm wall to work with would have been more appropriate for a taller, more slender strucure. It does bring a lot of insulation issues with it naturally, due to the binders. Another option for making an insulated wall without any steel would be to weave together a facade wall with a back porotherm wall. There are not many examples of this but it is seems very promising for lower to medium rise residential buildings.

Time, change and sustainability

Buildings can outlast civilizations. With the risk of vagueness, I want to speculate on another reason for constructing buildings with longevity in mind. The reason I propose is to have our cities act as societal buffers in rapidly, geopolitically changing times. The idea struck me when

I visited Budapest a couple of years ago. I was amazed over how well the city was doing after being on the losing end of two world wars, and being under the reign of the Soviet Union for many years. Hungary had piecemeal lost most of its territory, including all of its coast line (the joke was that admiral Horthy was the only admiral without a fleet). My conjecture was the reason Hungary and Budapest was doing relatively well was that their buildings could help institutions recover and restart, again and again. But if this is one of the utilities of the built environment, as economical and societal buffers, that means buildings should not be designed based on how society works at its current peak. Instead, they should be made with a much more conservative and careful brief in mind. A brief that asks for long term stability, generality and technological independency. The way Stewart Brand puts it is that:

"*The quick processes provide originality and challenge, the slow provide continuity and constraint. Buildings steady us, which we can probably use*." (Brand 1995)

This perspective on change and material turnover reappears throughout the scales. During the final seminar, an animated discussion occurred on the topic of kitchen refurbishments. Recent research from the department had shown that occupants remodelled their apartments way more often than expected, mostly because of fashion and the highly speculative condominion market. This is not really a sustainable practice and a lot of material is wasted. Maybe the apartments should also resist change somewhat?

Water and weathering

A friend during the bachelor at architecture had a nifty suggestion for the school building. Over the entrance of many graveyards around Sweden it is written "tänk på döden" (Think about death). It's to remind one of the fragility of life. He suggested that the school's teachers would hang a sign saying "tänk på fukten" (think about the moist) on top of our entrance. I think it is a great idea. An architecture of maitnenance is also about finding beauty or poetry in the munande details in order to have them done in a good way.

Aesthetics and designing architecture

What should the aesthetic of sustainability be? I tried to formulate my own approach through this thesis. But it could be done in many different ways by different designers. Are there any objective features? It seems to me clear that the answer does not lie in the abstract environments of the modernist and post-modernist projects. It is not in the flat industrial platforms rolled out along our highways and harbours. These abstract aesthetics of planes and slabs are in some ways monumental and even beautiful – but they are not the aesthetics of a sustainable society. Instead, i believe that the aesthetics of sustainability is characterized by contextualism, directness of material and construction, and of harmony in form.

Design of a building is always a holistic process. Parts interact in ways that they cannot be isolated. This is since they do not only interact in a complementary way, they are often in competition with each other. Christopher Alexander explores these relationships fully in “Notes on the synthesis of form” from 1964. To me, this means that a purely conceptually conceived building can never be a good building. It needs a directness and emotional content, which leaves the drawings and appears physically in the real world. And it needs the right amount of compromises, to balance the destructive interferences of parts with the positive, to create a fully designed whole. But compromises might bring the edge from a project, leave it either or. Adam Caruso suggests that good architecture comes from intense periods of time where a collective worked on similar questions. Where an architectural movement, like the Chicago school, could piecemeal refine and develop a language. Architecture is cultural organisation of a technical reality. The architect needs to be comfortable with each domain, which is not an easy task indeed.

FIGURE 37 *Image of my workspace during the thesis.*

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Original quotes

“Projekteringen ledde även till en diskussion om vår tids sätt att bygga i rent teknisk mening. Jag sökte ett konsekvent ställningstagande. Massiva tegelmurar, ibland 6-sten tjocka, bidrog till en arkitektonisk verkan i en skulptural och mönsteraktig mening, men också till teknisk kvalitet: an klimattrög och underhållsvänlig vägg likt gånga tiders byggnadssätt. Bly och zink ersatte vår tids plastbehandlade plåtsorter, vars framtida underhåll ingen kan garantera. Dörrar och fönster tillverkades i ek som får gråna i väder och vind. Även ögat kräver en logik av kontruktiv art för att kunna se och uppskatta material i sina sinnliga former. Om god byggnadsteknisk moral har gamla hus mycket att berätta.” (Nyborg 1991, p. 31).

”Vi lever i en tid där ingenjören och humanisten ställs mot varandra. Ingenjören vill, med viss överdrift, stanna tiden med sin konst, göra materien stark och oövervinnlig, medan humanisten i stället söker hålla kvar tidsupplevelsen, förstärka känslorelationen till tidens oundgängliga flykt. Det är av två helt väsensskilda perspektiv med klart olika utfall, sett till det slutgiltiga resultatet” - Ove Hidemark (Edman 1999, s. 185)

“Sätter man byggnadens livslängd till trettio år som man gjorde på 50- talet händer inte så mycket mer än byte av kranpackningar och omtapetseringar, men talar man om sextio år, då blir reparerbarheten en viktig egenskap. Reparerbarhet kan återföras till hopfogningstekniken. I det gamla byggandet var fogen svagare än materialet, i det moderna byggandet är det tvärtom. Det handlar då i stället om att göra fogarna svagare än delarna, att göra murbruket svagare än teglet. [...] Lång livslängd kräver underhåll. Underhåll kräver reparerbarhet. Reparerbarhet kräver att material går att ta isär. “Som man fogar får man avfall”!” Hans Isaksson (Lööf, Isaksson, Södergren, 1994)

Appendix A.

DRAWINGS

Erik Hedborg 2017

In Praise of Maintenance

Chalmers School of Architecture
Examiner Björn Gross
Tutor Mikael Ekegren

City figure ground

1:7500 / A3

1 km or 12 minute walk

Site Plan

1:1000 / A3

0 100m

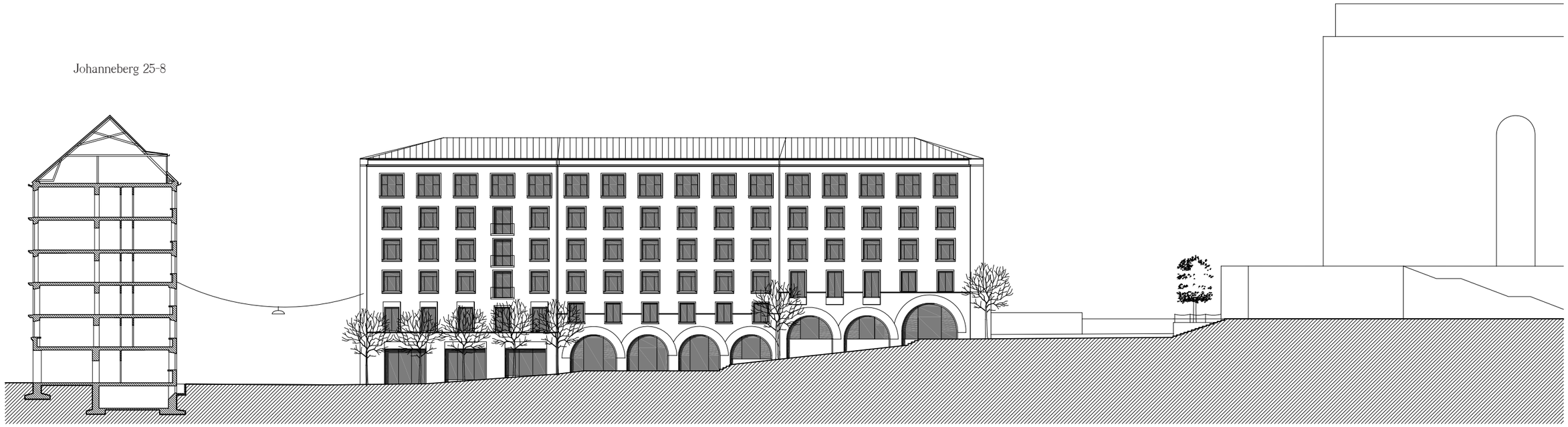
Artisten

Stadsteatern

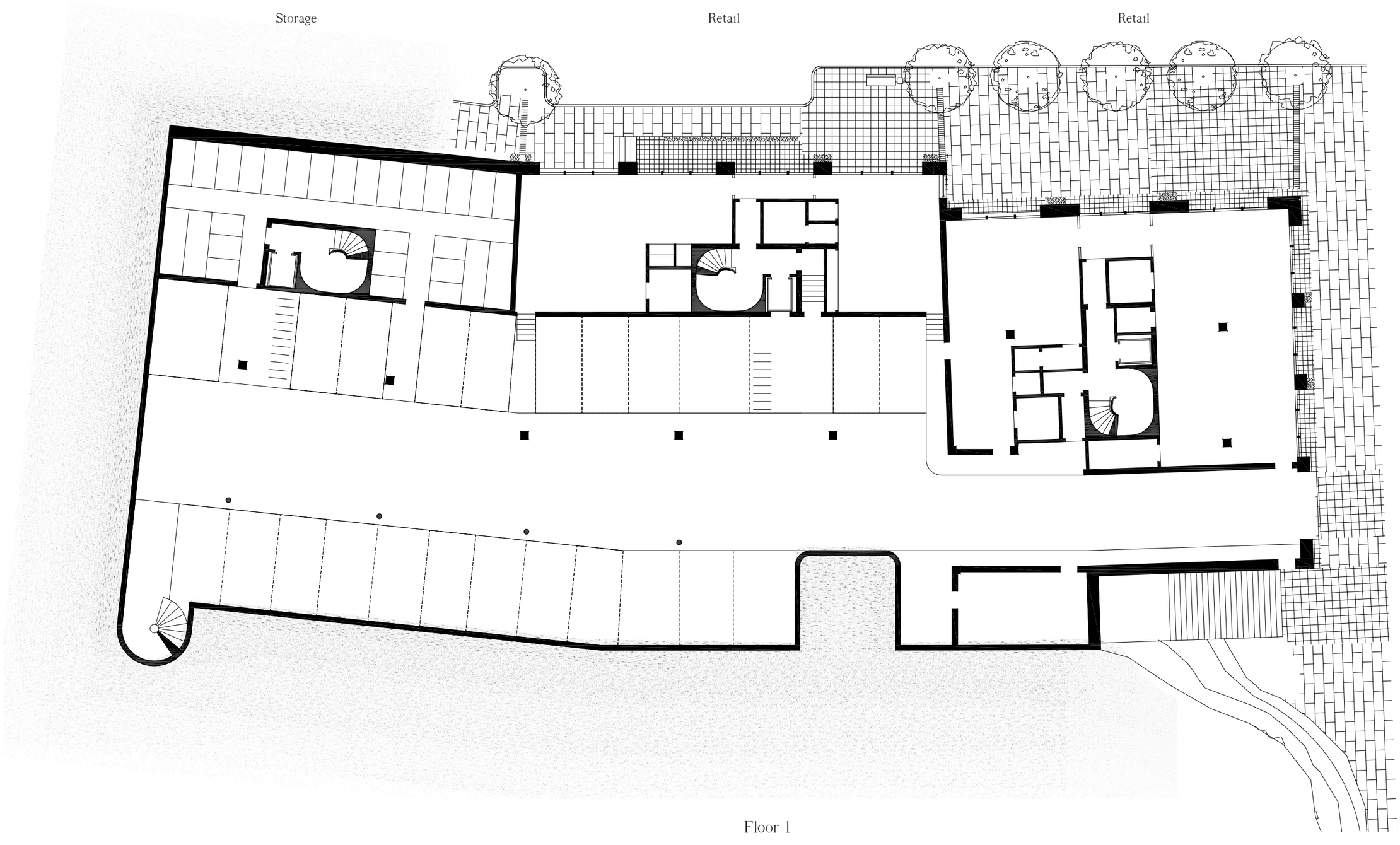
City Section - Johannebergsvagen

Konstmuseum

Johanneberg 25-8



City Section - Gosta Rahms Gata



Floor 1

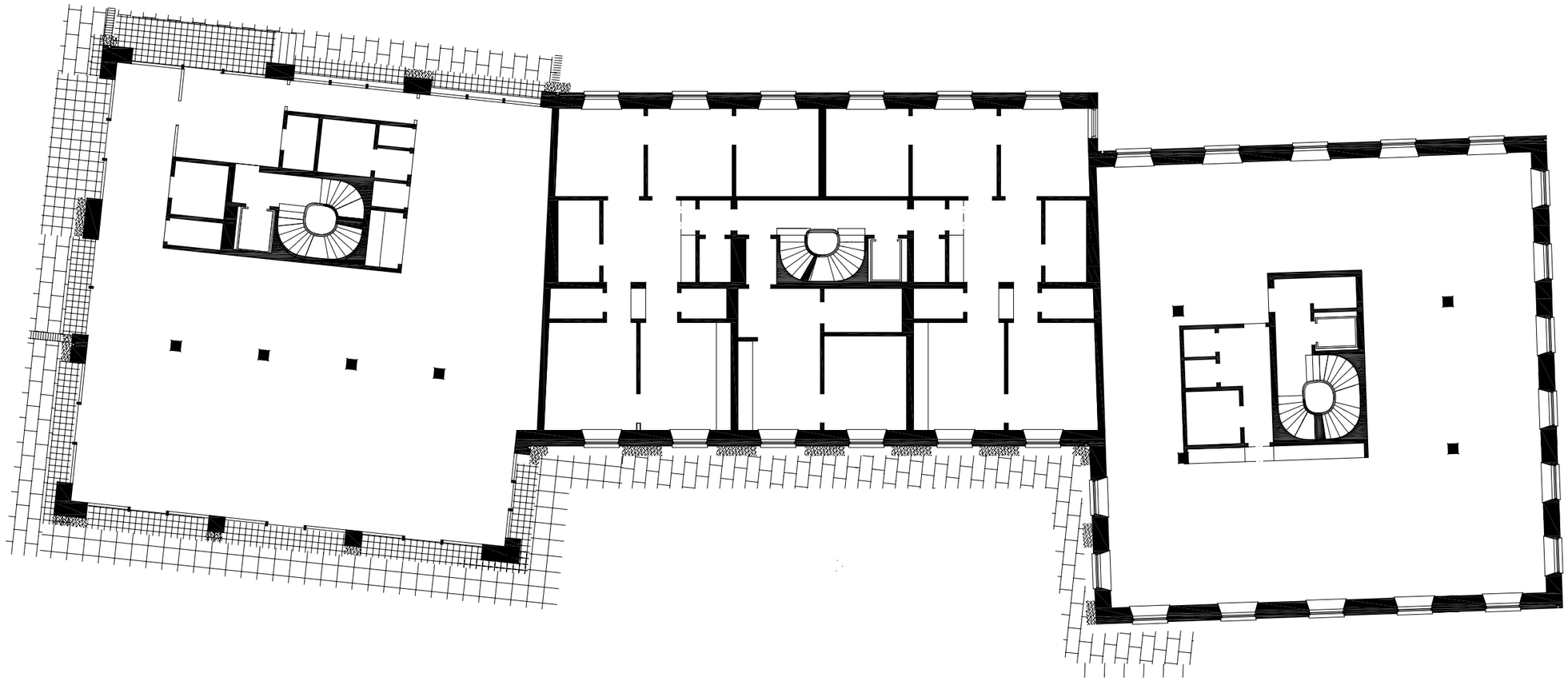
1-200

0 20m

Retail

Flexible residential

Offices

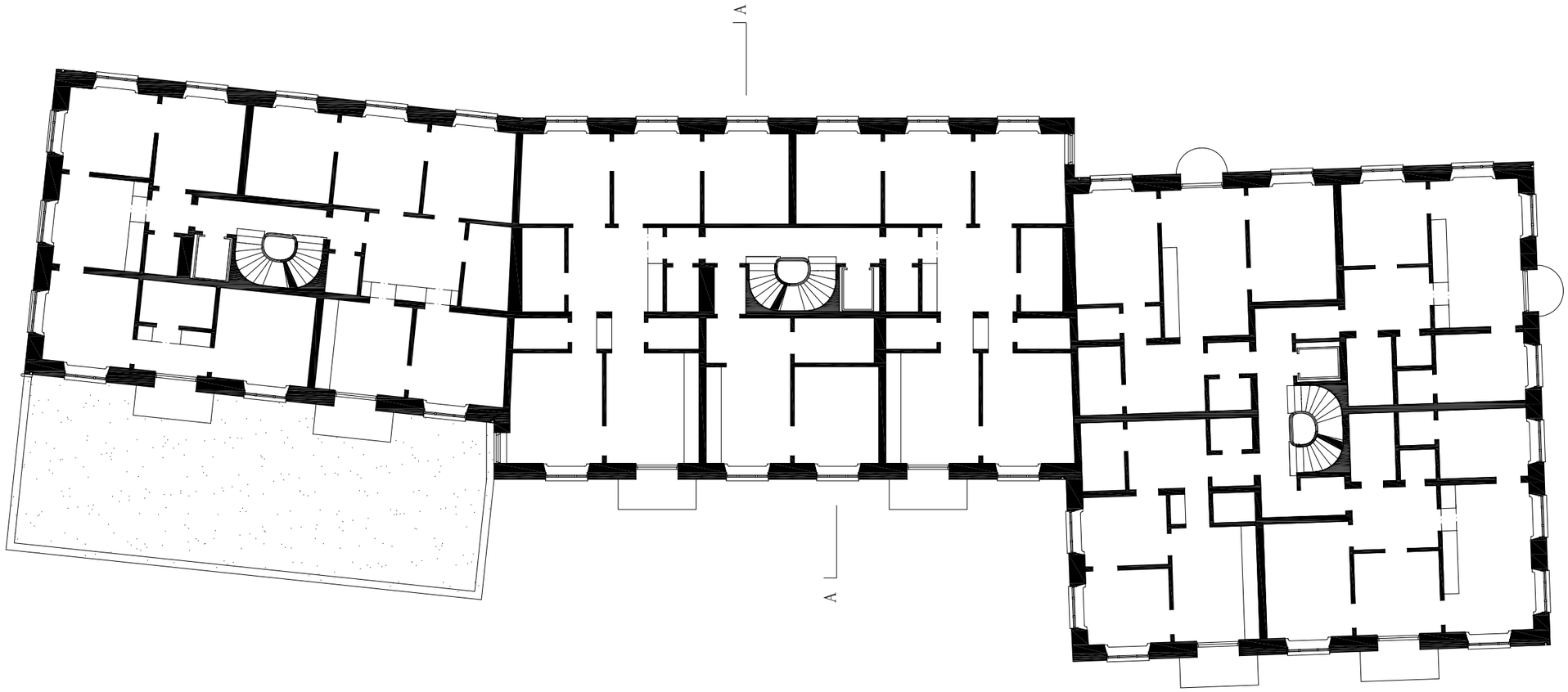


Floor 2

1-200

0 20m

Flexible residential

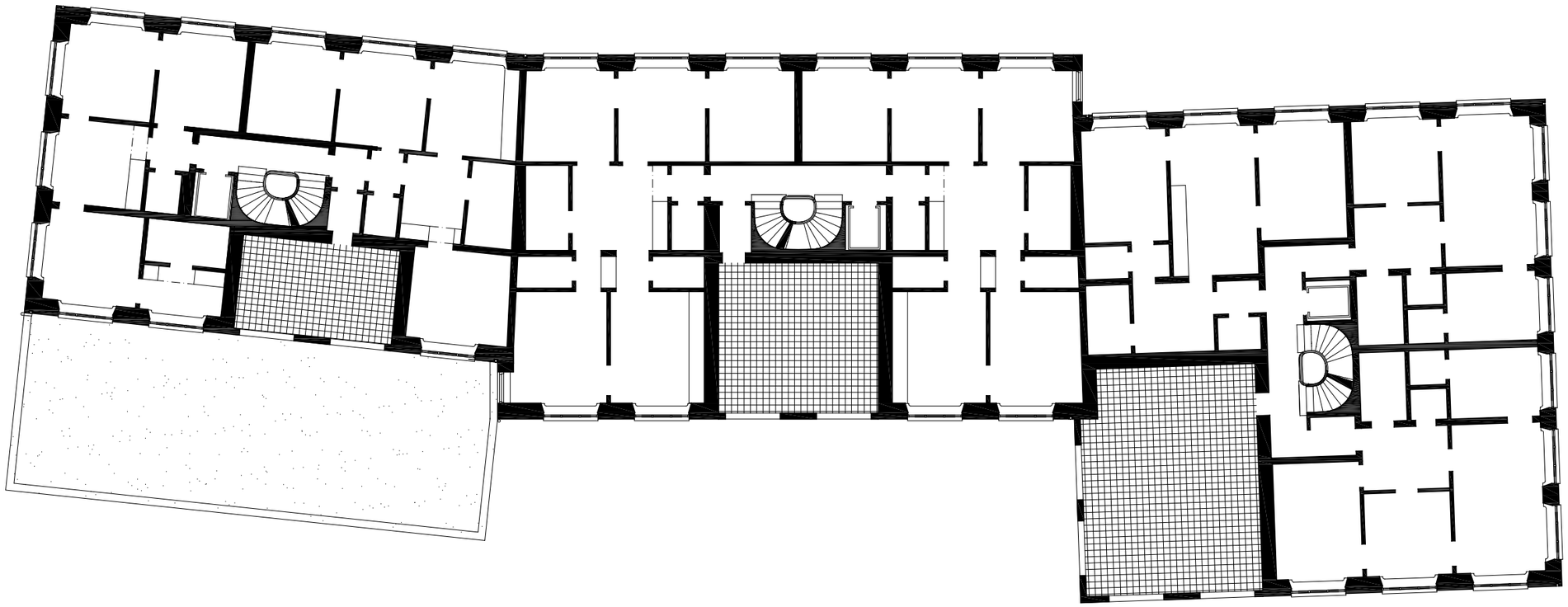


Floor 3-5

1-200

0 20m

Flexible residential
Roof terraces

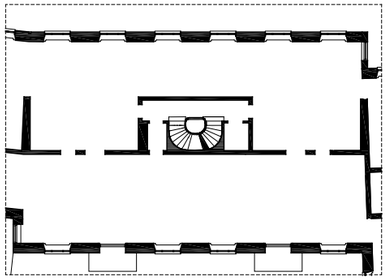


Floor 6

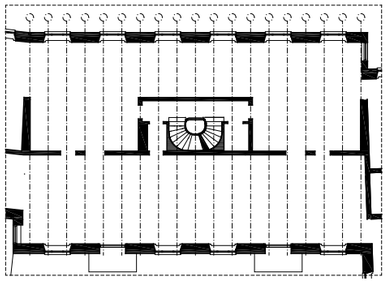
1-200

0 20m

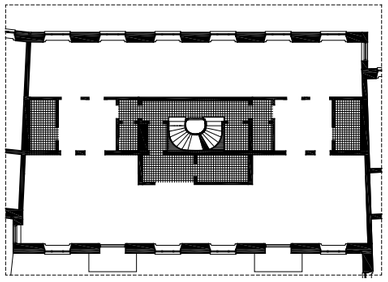
Loadbearing system and vertical shafts



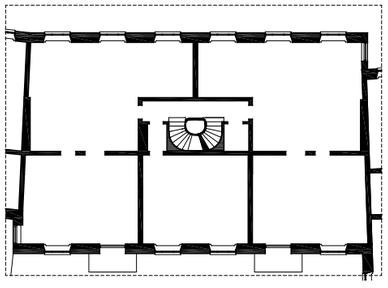
1.2 m slab module



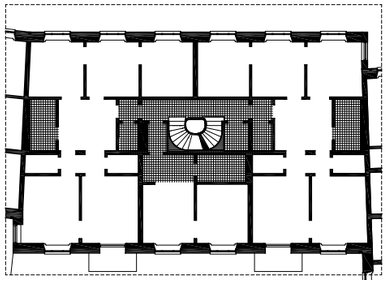
Cores



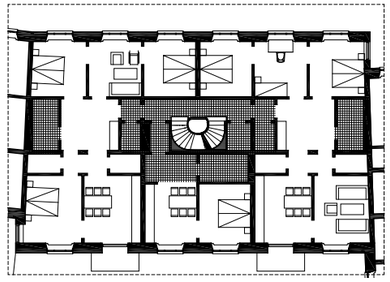
Apartments



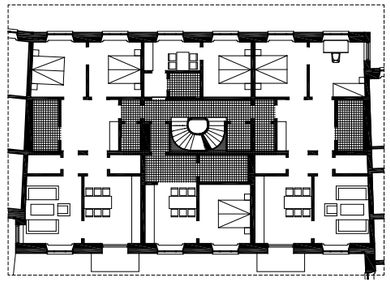
Cores-apartments-partitioning walls



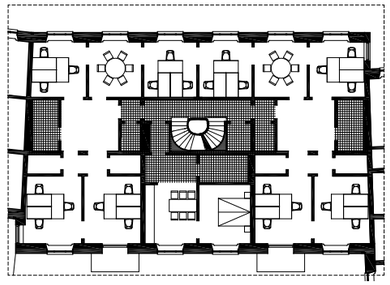
Arranged for three apartments



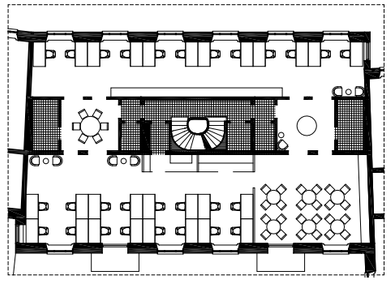
Arranged for four apartments



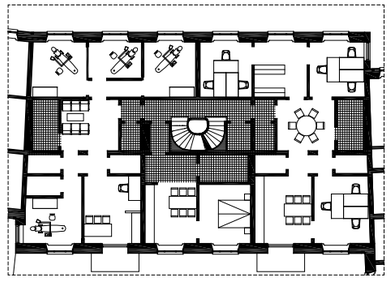
One apartment and an office remake



Remodeled for office



Dental clinic, offices, apartment



Layers and variations

1-400

0 20m

facade excerpt this

Facade N-W

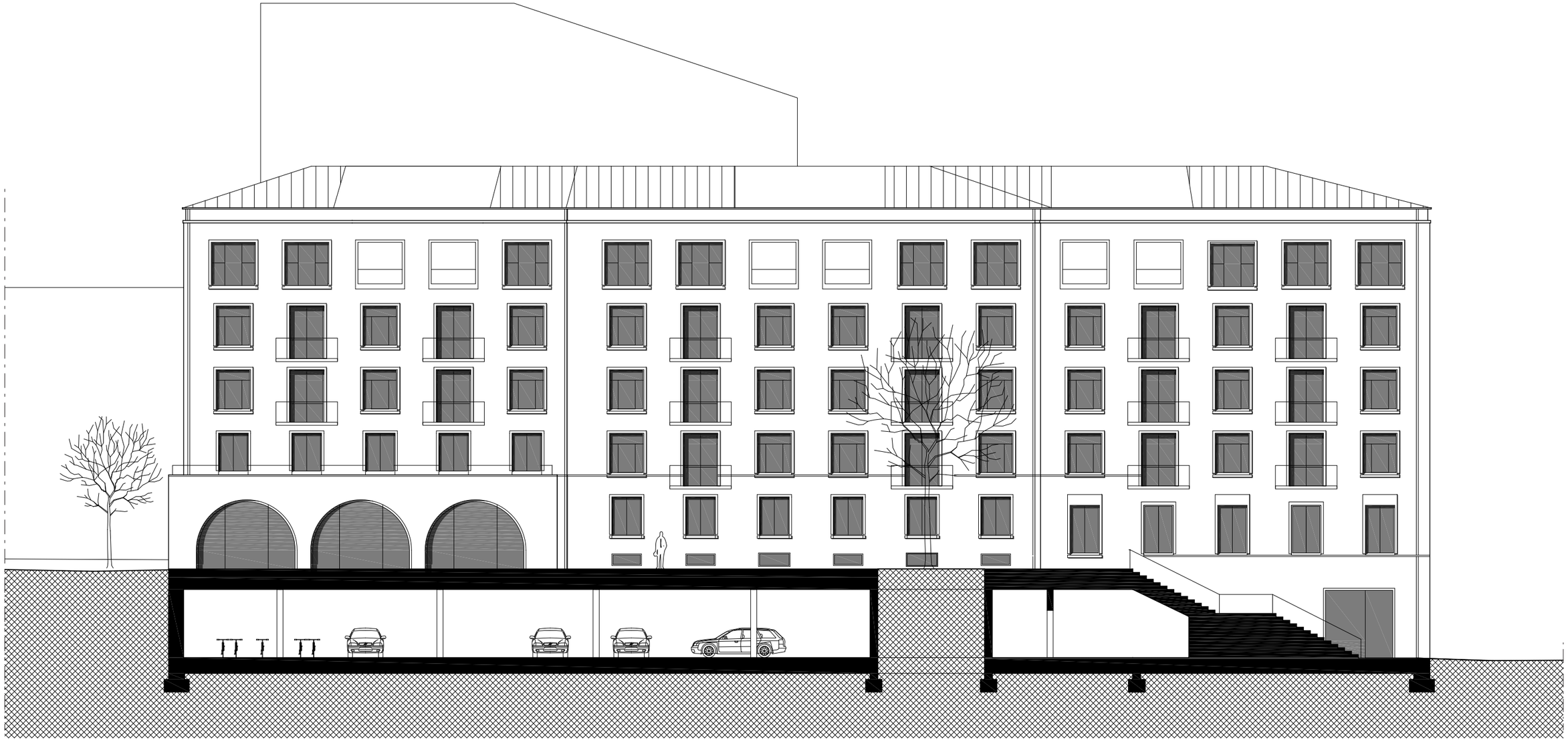
1-200

0 20m

Facade N-E

1-200

0 20m



Facade S-E

1-200

0 20m

Facade S-W

1-200

0 20m

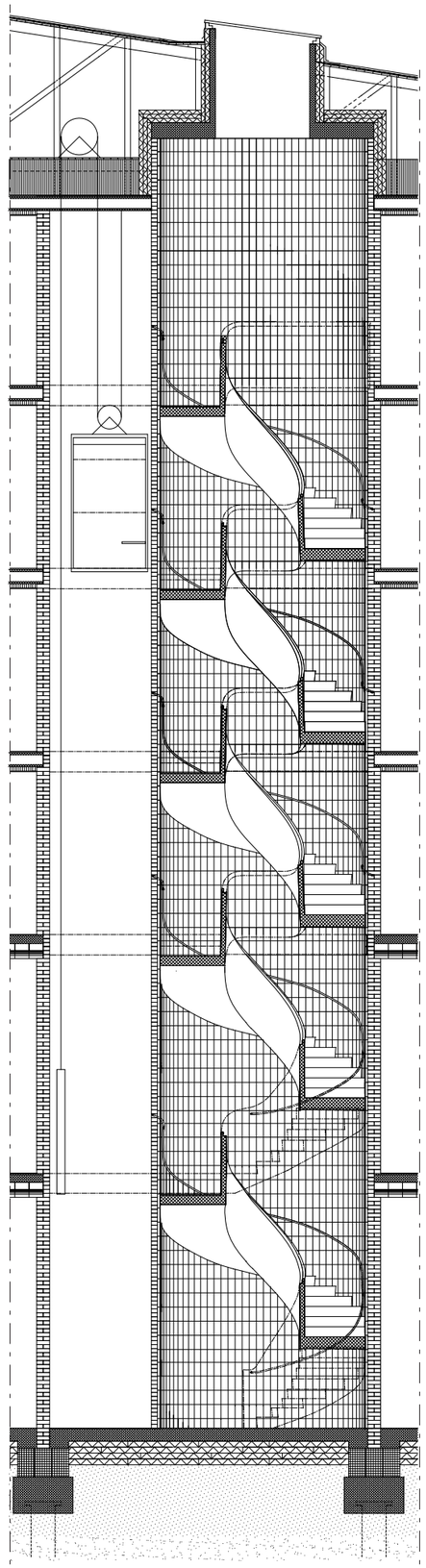
Section A-A

1-200

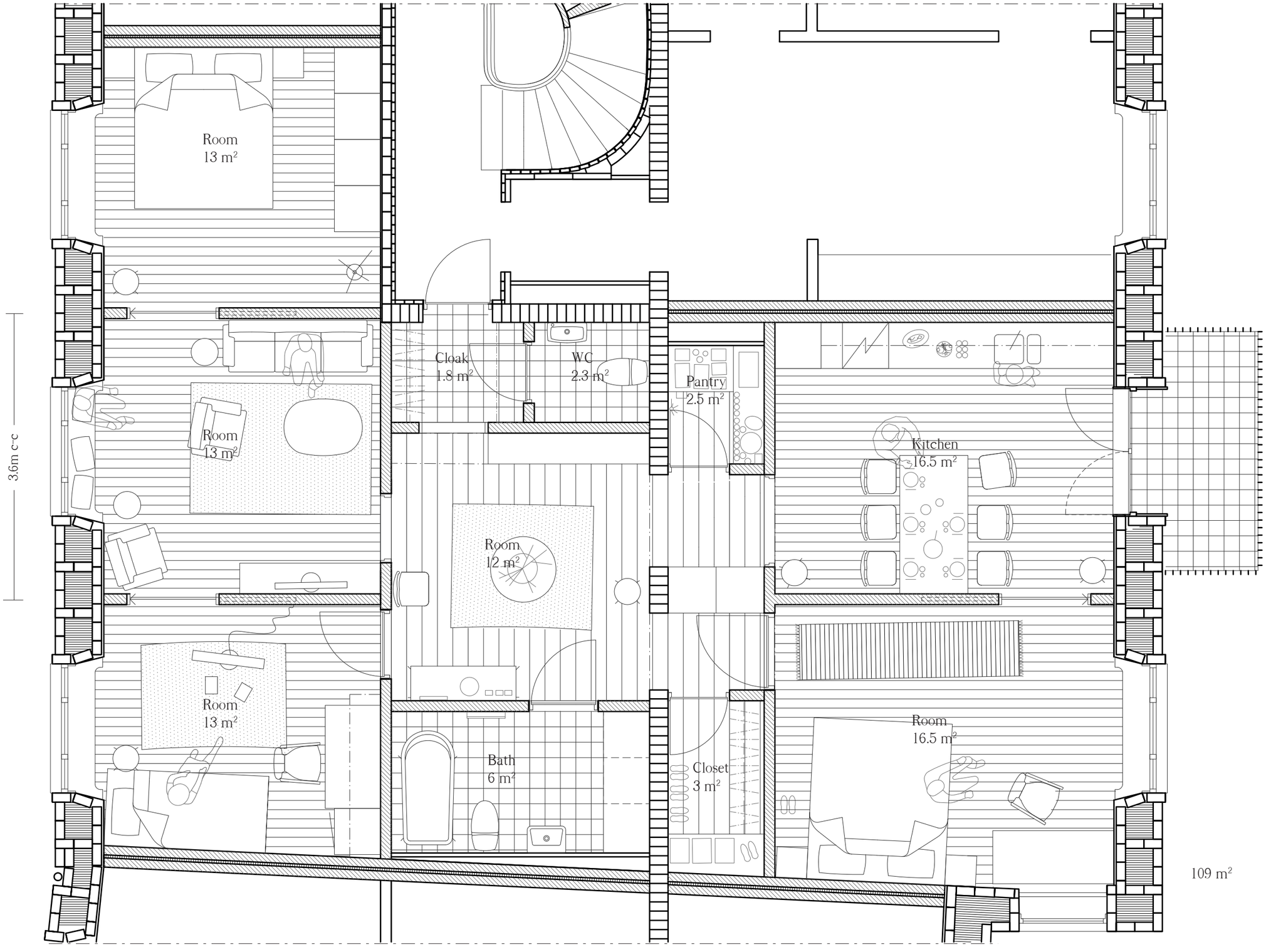
0 20m

Facade assembly 1-100

0 10m

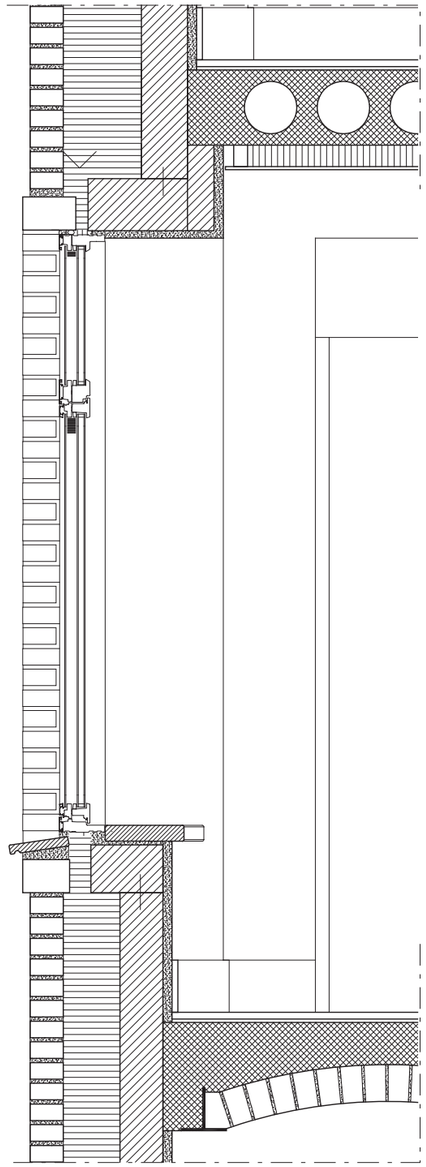


Stairwell 1-100
(N-E building)



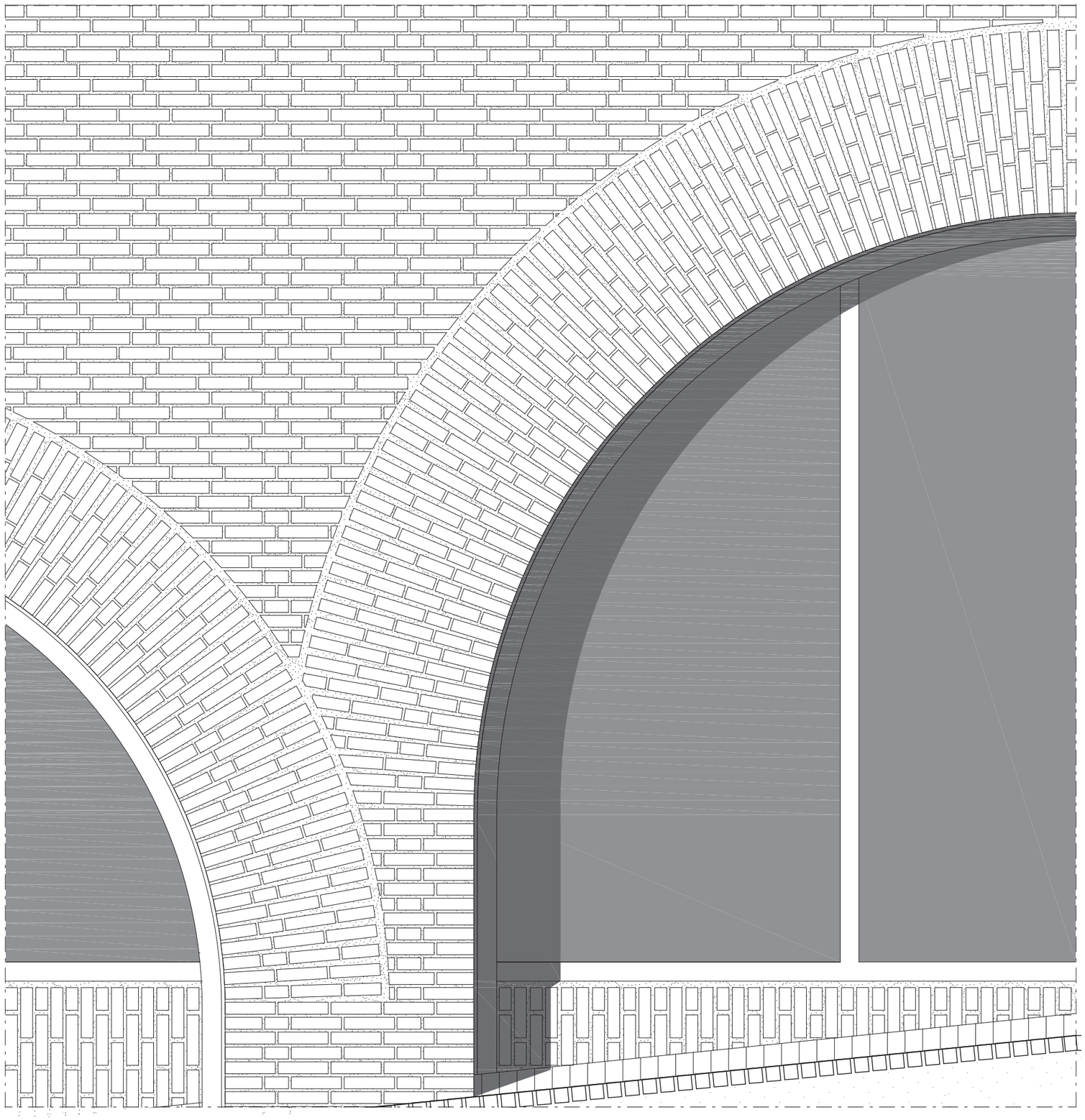
Apartment plan 1-50

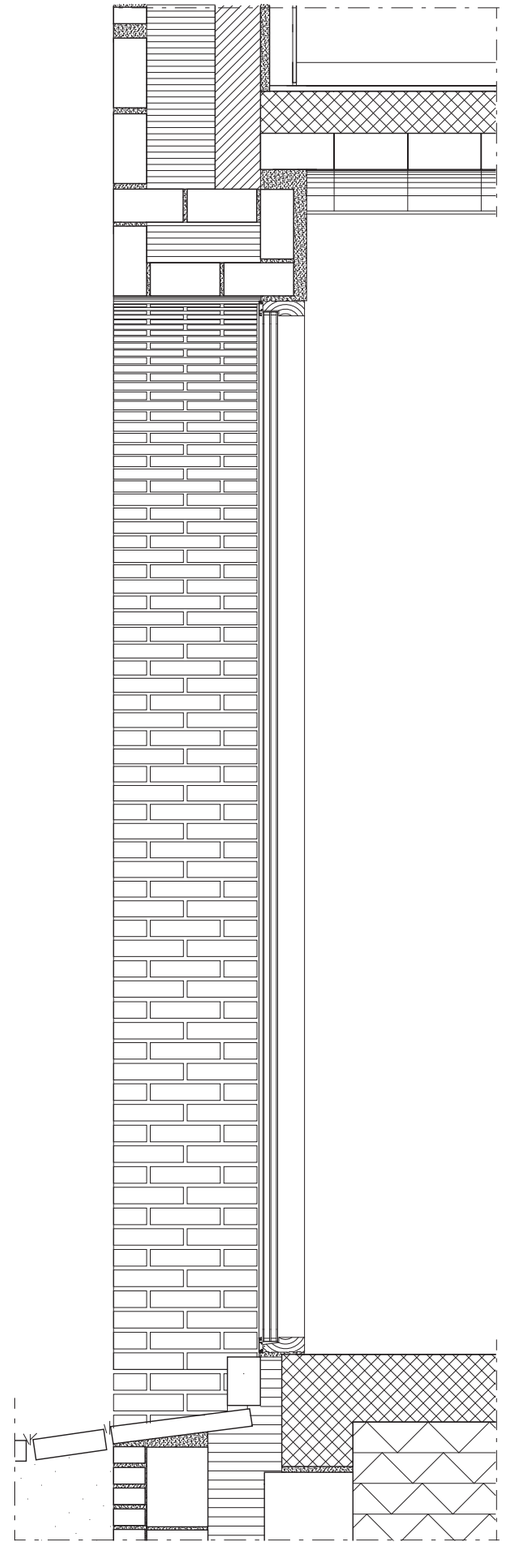
0 5m



Window assembly
1:20 / A3

0 1m





Vault assembly

1:20 / A3

0 2m