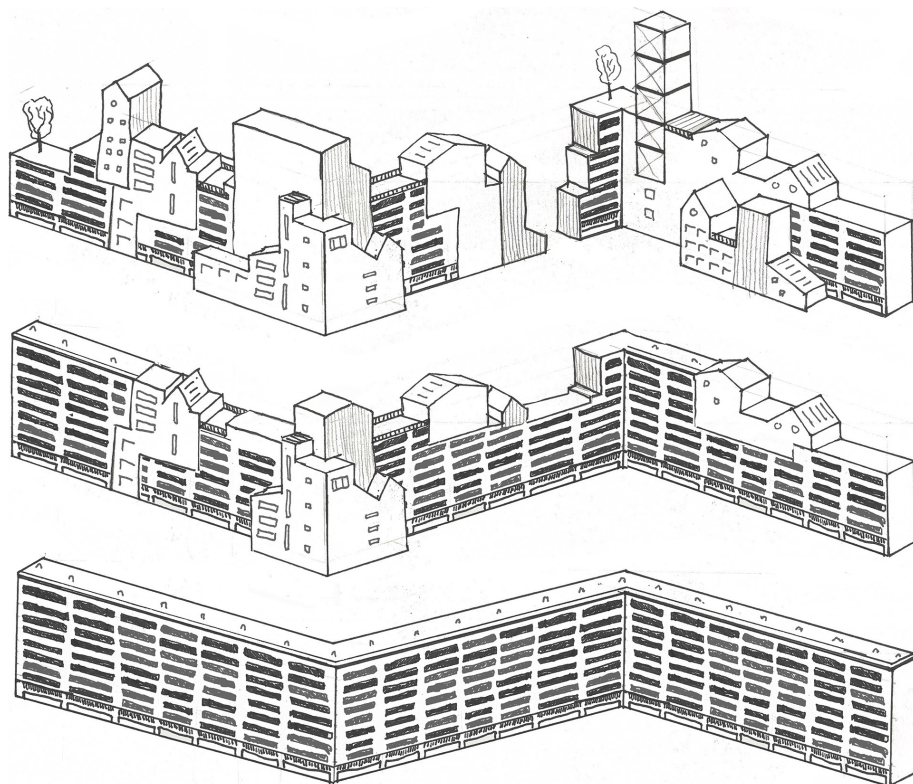# STANDARDISATION & VERSATILITY

SOCIAAL & EIGEN IN MOOI MOKUM

Maarten Verheij

STANDARDISATION & VERSATILITY

SOCIAAL & EIGEN IN MOOI MOKUM

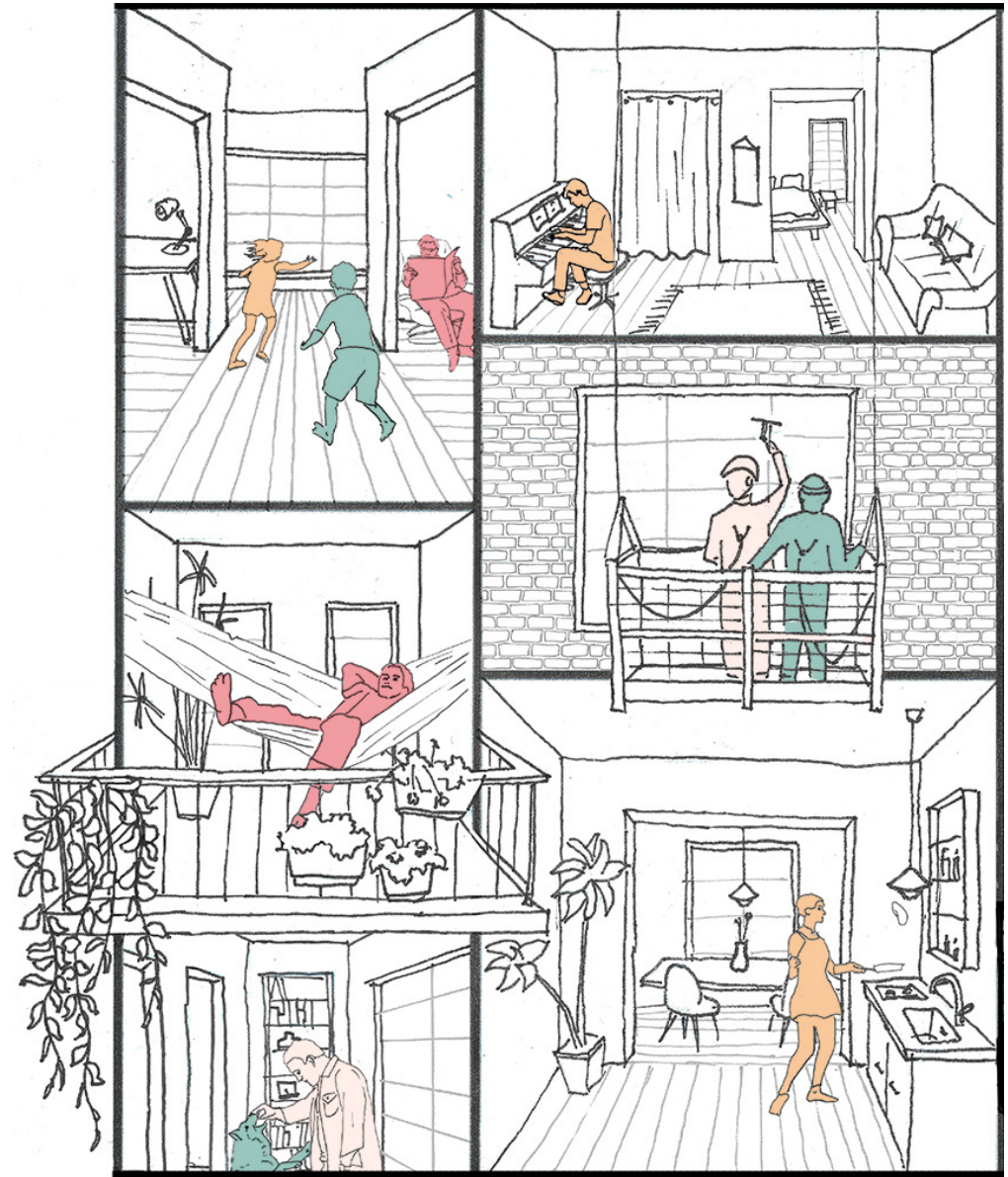Maarten Verheij

STANDARDISATION & VERSATILITY

SOCIAAL & EIGEN IN MOOI MOKUM

Maarten Verheij

Maarten Verheij
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Contents

Introduction

1 Versatilisation of the Bijlmermeer
Drawing inspired by Simone & Lucien Kroll. Own work.

Contemporary social housing development in the Netherlands often prioritises standardisation over progressive and imaginative design, resulting in an undesirable dullness of the urban environment. This is a problem not only because it creates an urban landscape that is boring for the people living in it; standardised housing plans also impose a certain way of living onto residents. Furthermore, conformity hinders progress in the architectural field.

Having stated these problems, it needs to be mentioned that there are also advantages to standardisation in the built environment. According to the Dutch Economic Institute for Construction, industrial housing development offers reduced design costs, quicker construction times, higher technical quality, and potential for circularity/sustainability (Ruiter & Koning, 2023). In a time where - in the Netherlands - there is a housing shortage (VRO, 2024), houses are getting more and more expensive

(NOS Nieuws, 2024), and the climate crisis is globally getting more and more pressing (European Commission, n.d.), these benefits of standardisation become all the more relevant.

This seemingly creates a paradox. To prevent future cities filled with only the same houses, and to prevent future cities having only a small offer of unsustainable, unaffordable houses, housing development should strike a balance between standardisation and versatility.
This paradox has been debated by architects for over a century. In 1918, engineer J. van der Waerden and architect Hendrik Petrus Berlage discussed similar issues, which have been recorded into a small book. The book consists of two parts, a speech by van der Waerden, and a response by Berlage (Berlage, 1918). In his speech, van der Waerden argues for strict measures for standardised housing to tackle the housing crisis of that time. The speech was received with much protest, both by workers and architects. In the second section of the book, Berlage recognises the necessity for standardisation but acknowledges and shares the concerns of the workers and architects. The main argument of the architects is the fear of creating a city lacking aesthetic satisfaction. Regarding the workers, Berlage writes:

"The workers (...) see an attack on their personality, on their freedom, on their humanness in the dreaded monotony of the endless rows of the same houses; through this kind of habitation one becomes a herd animal, the slavish treated, the dependent one. (...) They fear the elimination of participation and initiative, which they had gradually conquered regarding their home" (Berlage, 1918, p. 24)

This problem is still relevant today; even though the traditional working class of the early 20th century has disappeared, disregarding participation and initiative of individuals from lower-income groups can result in increased inequality in urban development.

So why is the problem of mundane housing still relevant today when discussions about standardised housing have been going on for over a century? Among other things, there are two main reasons: a practical need for efficient land use

in the Netherlands combined with rising housing demands, and the neoliberal housing policy implemented since the 1990s. The Netherlands is the second most densely populated country in the EU, with a density of 518 people per square kilometre. For comparison, the average population density in the EU is 109 people per square kilometre (Eurostat, 2022). At the same time, the country is also expecting a growth of more than one million people in 2035 (CBS, 2022). The growth is estimated to be centred mostly in urban areas, hence the need for efficient densification of the housing stock. Standardisation is an essential tool for this densification to run smoothly.

The second reason is a political one. From 1989 onwards, policymakers in the Netherlands started changing the way the Dutch housing market functions. Before, the housing market was regulated by the social democratic government, with many subsidies for social housing. In the 90s the government started to become more neoliberal, and policymakers implemented a free market system to regulate housing. This forced housing associations to take the role of private developers (Kadi, 2012). This led to more standardised buildings because financial restrictions hinder the ability of developers to take risks and create diversity. Bernard Hulsman, editor at NRC Handelsblad with specialisation in architecture, criticizes the housing architecture this produces in an article of a conversation between him and Fenna Haakma Wagenaar, head designer of Space and Sustainability of the municipality of Amsterdam (Hulsman, 2023). The article shows that since the new policy, houses in Amsterdam have become more expensive, smaller and less fit for people to live in. Hulsman also argues that the architecture has become more standardised and monotone, with boring façades and interiors. They conclude their observations by terming the new housing developments as residential barracks.
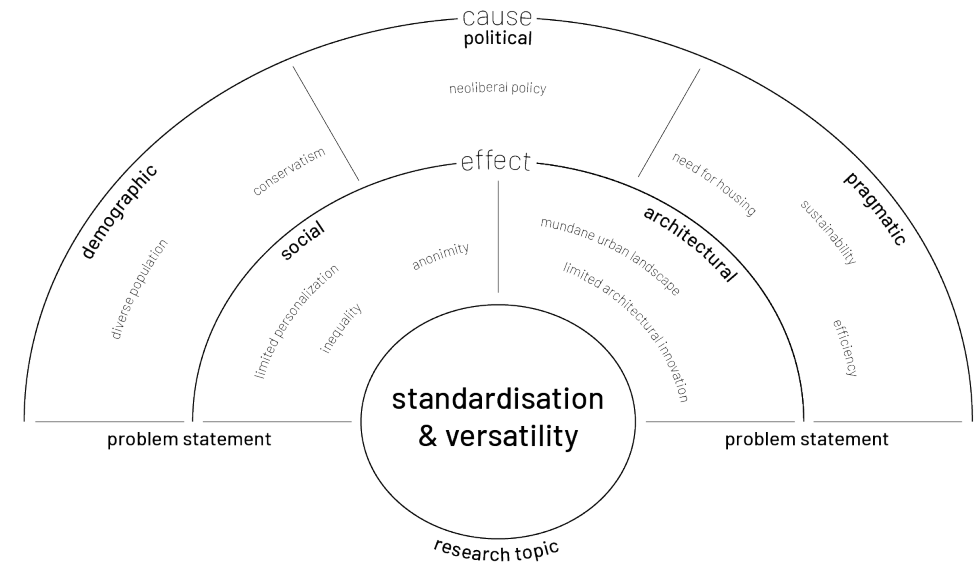
In short, there is an unwanted lack of architectural diversity and individual living style and freedom, caused by a strong focus on standardisation and its benefits. To change this current state, other forms of social housing complexes have to be explored. Buildings that support divers e living conditions for diverse inhabitants, that favour equitable housing over equal housing, with architectural emphasis on the unicity of its users. Housing that invites people to explore their style of living, that evokes a feeling of freedom of style.

2 Cause & Effect of the problem statement, leading to research topic
Own work

This study aims to explore the intersection of standardisation and versatility in social housing. The research question is stated as the following:

"How can a large-scale social housing complex with standardised elements still be versatile?"

From this main question, four sub-questions are stated:

1. *"What are desirable elements of standardisation that support efficiency, functionality and sustainability of a large-scale social housing complex?"*

2. *"To what extent can a large-scale social housing complex create a cohesive, yet visually and spatially diverse environment that reflects the unique identities of its users?"*

3. *"To what extent can a large-scale social housing complex stimulate and accommodate individual styles of living?"*

4. *"To what extent oppose/strengthen aspects of standardisation and versatility each other in a design for a large-scale social housing complex?"*

In the following methodology section, the methods to address the research questions stated in this introduction will be outlined.

MAIN QUESTION

How can a large-scale social housing complex with standardised elements still be versatile?

SUBQUESTIONS

| desirable elements of standardisation? | cohesive, yet visually and spatially diverse? | individual styles of living? | strengthen/oppose? |

METHODS

literature study

case studies

research by design

RESULTS

conclusions

design

research report
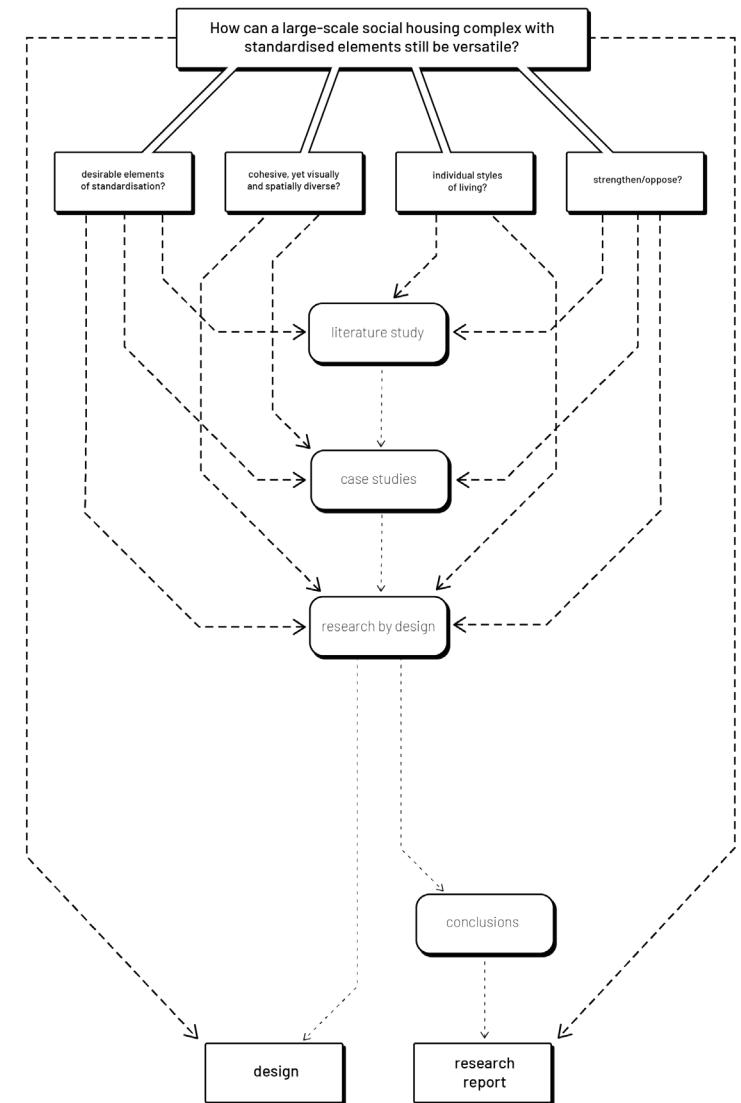
- - - - - ▶ aims to answer question

........▶ input from other methods

Conceptual framework & methodology

To understand the contents of this research, the following terms have to be explained.

Standardisation; the practice of building using repetition and copying, such as using the same type of building components, building materials, construction types, apartment types, but also for overarching designs or building techniques.

Versatility; the aim to design communal housing that enables habitation for a large diversity of individual households and their respective living styles, in a building that reflects the diversity of its inhabitants.

> *Communal housing*; housing that hosts a large number of inhabitants, who interact with each other for social activities (such as parties or barbeques), to be able to support each other (such as elderly taking care of working couple's children during the day) and to share facilities and/or common equipment (such as a shared roof terrace or a garage with shared tools).

> *Diversity of households*; different types of households, for example traditional families (two parents with a small amount of children), but also big families, student groups, single people, elderly couples, adult friend groups, co-parenting families, intergenerational groups, etc.
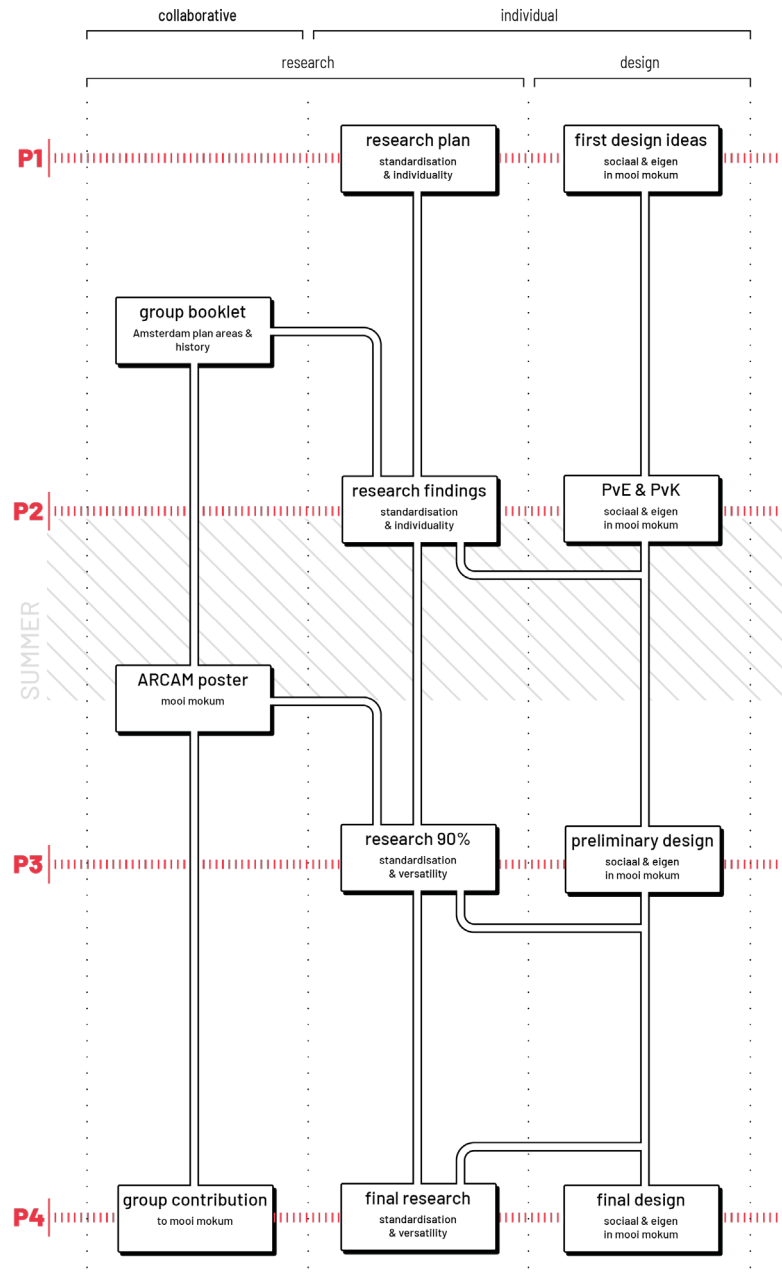
> *Living style*; the way an inhabitant can make use of a house, for example in assigning functions to rooms or creatively furnishing a house (for example: houses with strange shapes require more ingenuity for the infill).

> *Architecturally diverse building*; a building that is spatially – regarding its massing and shape – and visually – regarding its materialisation – varied.

Large-scale housing; housing with a density of at least 200 houses per hectare, and a FSI of at least 2.

This research has been set up using the following methods. The fourth method, research by design, is implemented to translate the findings of the research into a design project.

1. *Literature research*
   - on history, state of the art and future standardisation
   - on architectural design approaches to versatility
   - on architectural design approaches of standardisation that enable versatility

2. *Setting up an analytical framework and case study selection*
   - specifying versatility design categories
   - specifying a list of requirements for standardisation and versatility
   - explaining case study selection

3. *Case study analysis*
   - societal sketch
   - background of architect
   - explanation of architectural style
   - general description of the building
   - evaluation of standardisation and versatility using the analytical framework
   - making analytical drawings

4. *Research by design*
   - evaluation of case studies; what works, what doesn't
   - what lessons learned from analysing the case studies can be applied to personal design project
   - iterative process of testing design ideas through sketching and modelling, and then reflecting on them

collaborative | individual

research | design

P1

research plan	first design ideas
standardisation & individuality	sociaal & eigen in mooi mokum

group booklet
Amsterdam plan areas & history

P2

research findings	PvE & PvK
standardisation & individuality	sociaal & eigen in mooi mokum

SUMMER

ARCAM poster
mooi mokum

P3

research 90%	preliminary design
standardisation & versatility	sociaal & eigen in mooi mokum

P4

| group contribution	final research	final design
to mooi mokum	standardisation & versatility	sociaal & eigen in mooi mokum

4 **(Left page)** Relation between research questions, methods and results.
Own work

General history of standardisation

Throughout history standardisation has been a theme in architecture; a closer look at reasons for this standardisation can give insights for contemporary benefits.

In an overarching literature review by Kostas Anastasiades et al (2021), the authors provide an overview of standardisation practices throughout history and the values supported by those practices. In the following section, these practices are summarized in a historically chronological order. In the discussion of this thesis, a list is made of the _values_ corresponding to these standardisation practices. It adds the contemporary relevance of these values and provides examples of corresponding standardisation practices specific to the Netherlands.
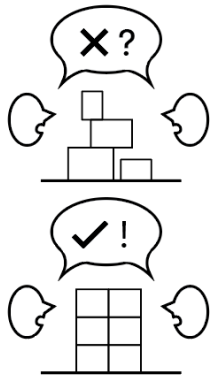
Standardisation in architecture probably started in the 4th millennium BC with the standardisation of measuring units, like the Egyptian cubit (Anastasiades et al, 2021, 5). Making use of a standard measuring unit ensured that builders, contractors and architects had a reference base about what and how to build. Standardisation was therefore used as a means for _communication_. Today, measuring units are standardised almost all over the world, so this is irrelevant to this research. However, communication is still an integral part of the building process. It is easier for different actors like occupants, designers, constructors, contractors, builders and investors to communicate when building elements, processes and materials are standardised. Less variability and deviation from these standards means that everybody is on the same page. During the 70s in Western Europe the building industry got a more varied demand, because governments became less involved in housing. This meant that instead of having radically standardised housing blocks, such as in the Soviet Union, industries focused on creating a large diversity of products with standard dimensions (Goldhoorn, 2020). This way, the building components would be easily interchangeable and installable. The use of this system meant that architects could design freely without compromising on communication between builders and contractors, who would know how to install the components because of the standard measurements and connections.

Standardised measuring units - and additionally weighing systems, for example one developed in the 4th millennium BC by the Indus Valley Civilisation - also served as a monetary reference for base trade goods (Anastasiades et al, 2021, 5). Standardisation was therefore implemented to serve the _economy_ by facilitating trade. Economy remains one of the most, if not _the_ most, prevalent reasons for standardisation throughout history. Standardising for economy can be done for two reasons; to regulate trade goods, but also to keep building costs low. In general, standardisation can't influence the costs of raw building materials. It can however drastically lower the cost of labour. In the Netherlands this was extensively done in the 50s and 60s, to build as many houses as possible after WWII. To make this possible, new standardised building systems that saved on labour costs were introduced (Werkgroep 5x5, 1989). The profits that were made often went to the contractors and developers. This is still true today, especially in cities like Amsterdam, Rotterdam, Utrecht and Den Haag, were renters pay high rent for small, low quality standard apartments, which Fenna Haakma Wagenaar describes as "_form-follows-finance_" towers and blocks (Hulsman, 2023).

Later standardisation was implemented to ensure _safety_. In around 1750 BC the Hammarubi code was composed in Babylon. In this legal text, on of the oldest in the world, various penalties are written down to hold builders and designers accountable for the collapse of their buildings (Anastasiades et al, 2021, 5). This was primarily meant to ensure the safety of the citizens of Babylon, but reducing risk of collapse also strengthened the stability of the economy. In the current time, safety standards for designing and building have been developed to greatly reduce risk of collapse or other hazards. On of these standard prescriptions enforced in the Netherlands - that among other things contains safety regulations - is 'het bouwbesluit' (Rijksoverheid, n.d.), firstly implemented in 1992. Before that, building regulations weren't regulated nationally; instead municipalities set up their
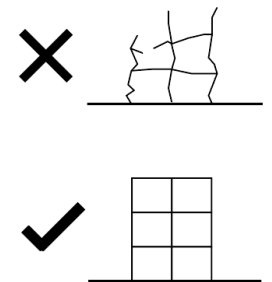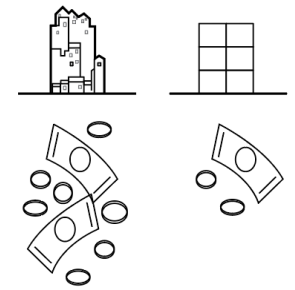
own building regulations. Since the first of August, 2024, the 2012 'bouwbesluit' has been replaced by the more updated 'besluit bouwwerken leefomgeving' (Rijksoverheid, n.d.).

In the Greek and Roman era, new standardisation practices started to emerge. Unified column and beam proportions ensured a consistent _aesthetic_ appearance of Greek architecture, which was later largely adopted in Roman architecture. At around 50 BC, architect Vitruvius documented Roman building technology and architecture of the time in a treatise called 'De Architectura' (Anastasiades et al, 2021, 5). Not only was standardisation used for a consistent aesthetic appearance, is also meant that the _effectiveness_ of the architecture, infrastructure and urban planning was reliable and consistent. Additionally, it enabled _speedy_ expansion by the Roman Empire.

5 Greek order of columns.
Photograph. Classicalgreekart.
wordpress.com. n.d.

Aesthetics have played, and will always play, a crucial role in architectural design. Standardisation for aesthetics doesn't necessarily equal a search for a perfect form of architecture, even though architects in the past have attempted this. Instead, it can also create a sense of visual cohesion for an otherwise chaotic appearance of a building. The inner city of Amsterdam is a good example of this. The old city consists of many individual houses, built directly next to each other. The width of these house allotments is varied, but all houses were relatively thin, and in the 18th century the allotments were more or less standardised to be around four meters (Schoonenberg, 2021). The reasons for these thin houses came mostly from an economic perspective – the smaller the house footprint, the more houses could fit in the city and the less taxes a house owner would have to pay – but is also resulted in an aesthetic coherence. It also led to the creation of prefabricated façade toppings like the classic bell or stair façade. When a façade topping was too thin, additional ornamentation would be fitted. Although all these houses look different, these common features ensure a coherent image, as a form of organised chaos. Today, this visual coherence is enforced in many cities by so called 'welstandscommissies' (welfare committees), who use a set of standard aesthetic 'rules' for new development.

Effectiveness is also still relevant today, the use of standardised building components is a good example of this. In the Netherlands brick dimensions are standardised, like the 'waalformaat', a brick of 210 x 100 x 50 cm. This way the brick is uniform, can be easily mortared, and has a predictable performance. Another example is the evolution of glass types that are increasingly more insulating. Double sided HR++ glazing is now commonly used in new buildings, due to its proven effectiveness.

As mentioned in the introduction, the population of the Netherlands is growing, and this growth is expected to be mostly centred in urban areas (CBS, 2022). In the Netherlands there is already a significant

shortage of housing so it is essential to build _quickly_, which makes this value for standardisation extremely relevant. Hugo de Jonge, who was the Dutch Minister of the Interior and Kingdom Relations from 2023 to 2024, is of the opinion that standardisation should solve this crisis: "Our homes must be built as sustainably as possible, as quickly as possible, as affordably as possible. We do this by raising the bar - the requirements are increasing, and by standardising: no more thousand-flowers-blooming but clear and high requirements" (VRO, 2023).

The next big change for standardisation in architecture came with the industrial revolution in the 19th century. During this period new materials were introduced which created new possibilities for standardisation, like prefabrication and consequently _mass production_. Additionally, the growing urban population led to the introduction of new city planning _safety_ standards. At the time, many of the workers lived in slums which were small, poorly built, and a breeding place for many diseases. These slums needed to be removed, and the people living in them needed replacement housing, which stimulated the creation of mass housing. To facilitate the quick and cheap production of architecture in these growing cities, mass production facilities were built and building materials such as steel beams were given morphological standards (Anastasiades et al, 2021, 7). Mass production is a means for standardisation that is closely related to other values. It allows for speedy, qualitative, safe and cheap construction. Because of this, mass production is an essential enabler not only for the housing crisis in the 19th century centred in Western countries, but also the housing crisis we face today in the Netherlands.

The last major historic change for standardisation in architecture came with the introduction of computers. With the help of computers new mathematical structure calculations were made possible. This led to optimisation of overall structural designs and quality and optimisation of safety

standards of construction components. It also caused the introduction of building codes and national and international standards such as the EuroCode. The values corresponding to this standardisation are _effectiveness_ and _safety_.

To summarise, in the past reasons for standardisation are a result of these seven values: communication, safety, economy, aesthetics, effectiveness, speed and mass production.

6   The Bijlmer.
Photograph. Stadsarchief Amsterdam. n.d.

Dutch history of standardisation and versatility

In this part of the discussion eight major events in Dutch history regarding standardisation and versatility in housing will be discussed.

Industrialisation 1860-1940. The industrial revolution of the Netherlands took place relatively late compared to other Western countries, starting from around the 1860s and onwards. The first steam powered factory was opened in 1834 in Maastricht, to create glass and later also pottery (TU Delft, 2024). In Enschede, a factory for the spinning of cotton was opened in 1834, as a result of a long textile crafting history in Twente (TU Delft, 2024). Other then these first small industries, industrialization in the Netherlands couldn't grow further because of a lack of infrastructure for national trade and access to important raw materials. Starting from the 1850s, new infrastructure to make this trade possible was built. To stimulate the industry in Twente, the Overijssels Channel was built in the 1850s (TU Delft, 2024). In 1860 a National law was passed, the 'Spoorwegwet' (railway law) deciding that the government would help to finance a large expansion of the railway network (Canon van Nederland, n.d.). In Amsterdam, the 'Noordzeekanaal' (north sea channel) was first opened in 1876, which meant a new start for the city. The port industry, now accessible again, could flourish, and the new flow of water through the Amstel washed away all the dirt in the canals (Gemeente Amsterdam, n.d.). The Rotterdam harbour got an upgrade in 1872 with the construction of the Nieuwe Waterweg [new waterway] (Amsing et al, 2019).

All these infrastructure projects stimulated the growth of new industries, and with it came standardisation possibilities for architecture, mainly because of the introduction of steel and concrete. In the Waterdriehoek – the area around 'de Biesbosch', the Drecht cities and Kinderdijk - maritime industry started to emerge. The area was situated in an optimal position in the river delta of the Lek, the Merwede and the Maas, downstream of the Rührgebiet, and now better connected to the world with the Nieuwe Waterweg. The maritime industry was focused on shipbuilding, dredging and steel construction (Amsing et al, 2019, 6). This steel industry created new possibilities for architectural applications, like standardised steel profile beams and prefabricated construction elements. Another new material which would greatly influence standardisation in architecture was concrete, introduced in the Netherlands around 1880 (RCE, 2022). The use of concrete in housing architecture started from the 1900s, when prefabricated concrete elements - like floor systems and roof plates - became available. Amsterdam Betondorp, built in 1925, is an early example which makes use of these new standard concrete elements. However, the new materials and building systems weren't used extensively until 1940, because the prices of labour weren't in proportion to the prices of the products, and transport and assembly options were limited (RCE, 2022).

7 Betondorp
Photograph. Stadsarchief Amsterdam. 1925.

Woningwet (housing law) 1901. Besides the introduction of new materials and construction techniques, the industrial revolution also resulted in another standardisation event. The growing industries attracted people from the rural areas of the Netherlands and cities grew exponentially larger. Because of a lack of suitable housing, many workers lived in slums and basements, often with large families living in a single room (Gemeente Amsterdam, 2019). The houses seldom had a proper sewage connection, were built very close to each other, frequently without any windows which meant the rooms couldn't be ventilated properly. Within these

slums diseases could easily spread. Even for these dire living circumstances, workers had to pay high rent. Dutch policy makers knew that strong regulation and government funding would be needed to solve this housing crisis, which ultimately led to the enactment of the 1901 Woningwet (housing law). The Woningwet consists of a combination of regulations, such as subsidies and expropriation rules, but most notably for this thesis, a list of standards for new housing. These standard requirements for housing led to the creation of many 'woningwetwoningen'; houses that were built according to these new rules. For example, in Amsterdam, façades of new housing were required to visually express where staircases were located, and access stairs should be connected too as few individual apartments as possible (Casciato, 2003, 23).

8   Korte koningsstraat 13 - interieur van een woning; grote en vervuilde bende.
Photograph. Stadsarchief Amsterdam. 1934.

New architectural styles 1900-1940. After the implementation of the Woningwet, architects had to find ways to deal with the new requirements in their designs. A new form of housing started to emerge because of this, called mass housing. While some architects proposed that sober functionalism was the best way to approach this new design assignment, others argued that architects should express their individual capabilities and style as much as possible. As described by the Werkgroep 5x5, proponents and opponents "tried to underline their point with concrete, and on both sides often impressive, designs. For example, in Amsterdam the Spaarndammerbuurt, which sings the praises of traditional building with brickwork and carpentry, and Betondorp, where experiments with steel and concrete are carried out with equal verve, are simultaneously created" (Werkgroep 5x5, 1989). In this period, the early 20th century, architect Hendrik Petrus Berlage and engineer Van der Waerden also argued for strict measures for standardised housing, in order to house as many workers as quickly as possible (Berlage, 1918). This rationalistic approach used the rules of the Woningwet as a basis for the search of the perfect house plan that would suit everybody equally. Jan Gratama argued that "this rationalism had, however necessary it had been for a healthy development of architecture, 'still too little poetry, too little fervent life. (…) We are now in the stage that follows rationalism, a deepened rationalism, a beautiful striving for a combination of business and beauty, reason and feeling, a striving for a simultaneously characteristic and beautiful design of our modern society" (Casciato, 2003). Architects of the Amsterdam School used the guidelines of the Woningwet as a way to find constructive unity and aesthetic coherence (Casciato, 2003).

During and after WWII 1940-1960. During the second world war, about 90.000 homes were destroyed and 50.000 were heavily damaged (Dogger et al, 2011). This created a large housing shortage, which was also caused by the economic crisis in the 1930s and a large population growth after the war. Architects strived to solve the housing crisis quickly by implementing standardised housing (Blom et al, 2004). This was done for multiple reasons, the two most important reasons were that standardisation would speed up the

process of building, and it would be cheaper. Additionally, after the war, there was a shortage of traditional building materials like brick and timber, and a shortage of craftsmen. All these factors made standardisation more fit to solve the housing crisis. The reconstruction period was "a time of optimism and modernisation," (Van der Hoeven, 2016). during which architects developed new visions for urbanism and architecture. Ideas envisioned before and during the world wars by groups like CIAM could now be put into practice. These were explorations of new materials, urban massing, infrastructure, and the introduction of large green spaces. However, many of these promising ideas for new modern neighbourhoods didn't immediately take off the ground because of market instability and technical problems that came with building using new techniques (Blom et al, 2004).

High housing production 1960-1980. In 1963, the new Minister of Public Housing, Pieter Bogaers, raised housing production to 100.000 per year (PDC, n.d.). Over a time period of about 20 years, many standardised housing complexes were built around city centres (Lörzinget al, 2008). The social housing that was built was highly standardised, and bound to "strict standards, down to the level of the kitchen cabinets. A new house is on average 55 square meters and in Groningen exactly the same inside as in Maastricht" (Appelman et al, 2016). Building components were produced in newly established factories and assembled on site (Blom et al, 2004, 25). Development was dominated by new housing typologies, mainly 'portiekflats' [portico flats], 'galerijflats' [gallery flats] and 'doorzonwoningen' [literally: sun-through-houses]. This higher production meant that contractors determined what system housing looked like, whereas before, architects were the ones who experimented with system housing concepts (Platform 31, 2013). The contractors focused more on technical quality and financial aspects of the housing, and experimentation, identity and appearance fell into the background. This suggests that standardisation in and of itself isn't necessarily a cause for monotone or boring housing; rather, standardisation in housing in this period becomes relatively repetitive as a seemingly unavoidable consequence of the housing crisis.

Counter reaction 1970 – 2005. The next Minister of Housing after Bogears, urbanist Wim Schut, had radically different ideas regarding standardisation, and wanted a bigger focus on quality. More and more, uniformity and high-rise were regarded as a bad environment for living, by both architects and citizens. The first closing of a factory for large building components happened in 1972 (Blom et al, 28). Wim Schut increased rents integrally and implemented individual rent subsidies. This way housing could be built "according to need and that meant more quality. Fewer high-rise buildings. A better living environment and more variety" (Pflug, 2020). From 1968 to 1980, he allocated government funding to improve housing quality (in the subsidy scheme Experimental Housing). Architects came together and formed groups to discuss the future of housing. In 1964, John Habraken was appointed as the chairman of the group SAR (foundation for architectural research). As Dorine van Hoogstraten writes, "the architects agreed that the period of post-war reconstruction had produced a one-sided focus on quantity, while efforts to promote quality had foundered. Although architects had contributed to this one-sided focus, they had not been in a position to alter it. They now wished to rectify the situation" (van Hoogstraten, 2018). At the end of the 1980s, the working group 5x5 are inspired by the high-quality social housing from before the world wars (Appelman et al, 2016, 45). The group consisted of not only architects, but also aldermen (in Dutch: wethouders), architects, artists, representatives of housing associations, and clients, and initially from five municipalities (Werkgroep 5x5, 1989, 7).They were of the opinion that after the war, standard prescriptions created an atmosphere in which nobody felt personally responsible for the quality of housing. Standardisation had become so common that the position of architects in housing design had considerably weakened (Werkgroep 5x5, 1989, 48).By combining efforts from the five different disciplines in the group, they strived to equally value both quality of housing and quantity. In 1991, the ministries for Welfare, Health and Culture (in Dutch: WVC) and Housing and Spatial planning (in Dutch: VROM), published a new policy 'Space for Architecture' (in Dutch: nota Ruimte voor Architectuur) (Schipper & Enning,

2021). This policy was implemented to stimulate the quality of Dutch housing and to bring attention and interest to the field. This policy was successful: "in the period 1990-2005, social housing projects again make it into (international) architectural journals and architectural yearbooks. To name a few examples: Piraeus KNSM-eiland by Kollhoff and Rapp in Amsterdam, Hoornse Meer subplan Oost I by Mecanoo Architects in Groningen, Rietkampen by Kristinsson in Ede, Schippershoek by Inbo in Zaandam and De Muzen by Atelier Pro in Almere" (Appelman et al, 2016, 46).

Economic crisis of 2008. During the 1990s, the Dutch government implemented a free market system to regulate housing. Whereas housing developers previously relied on governmental subsidies, they now had to take on the role of private developers (Kadi, 2012). This shift was influenced by optimistic views of free market policies, rooted in neoliberal ideologies and the need to reduce government spending after the budget deficits of the 1970s. However, the global financial crisis of 2008 - the largest economic crisis in nearly a century - had widespread consequences, significantly affecting housing developments in the Netherlands. Financial resources were scarce, so housing corporations were forced to build as cost efficiently as possible. This meant that social housing was reduced to be purely sober and efficient (Appelman et al, 2016, 46). New housing developments were increasingly often built using prefabricated components produced in factories, making standardisation once again the norm.

Contemporary housing crisis. In 2010, the Dutch Ministry of Housing was dismantled, because the Netherlands seamed 'finished'. "The Delta Works had been completed, highways and railways had been built and there were enough homes. Spatial planning by the government was no longer a great necessity" (König, 2022). The ministry was also a cause for irritations because of the excess of regulations and complex procedures. However, over the last decade, the Netherlands has gone into a new housing crisis. There is a shortage of 401.000 houses (VRO, 2024), and the housing sector needs to deal with the nitrogen crisis and the climate transition. As mentioned in the previous part in this thesis,

Hugo de Jonge wanted to solve this crisis using standardisation as a means (VRO, 2023). And indeed, standardised construction methods can effectively meet the demand for quantity, even whilst resulting in good and aesthetically pleasing buildings in some cases. However, they also tend to limit opportunities for personal creativity. And to repeat the problem statement in the introduction of this thesis: there is an unwanted lack of architectural diversity and individual living style and freedom, caused by a strong focus on standardisation and its benefits.

9 Timeline showing standardisation periods as established in this research, in addition to housing production and the case studies analysed later in this research.
Own work. Data from CBS.
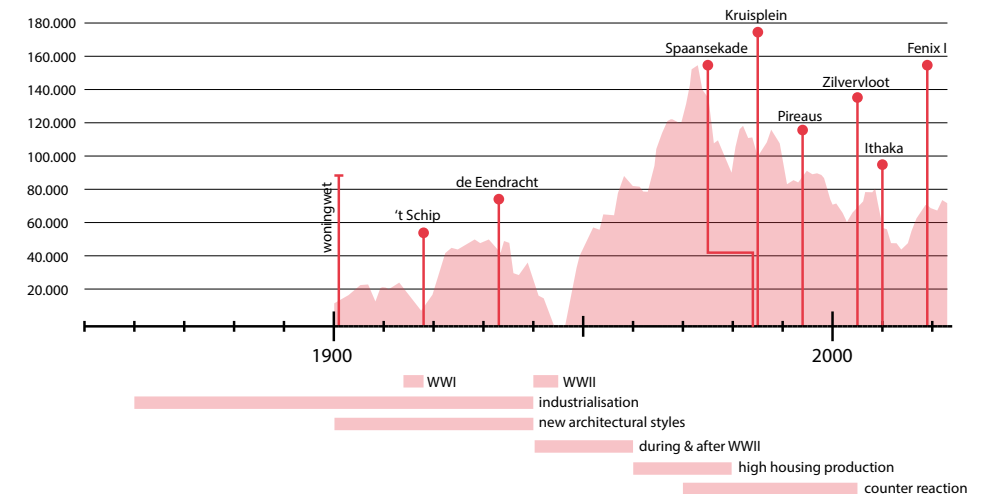
Future standardisation developments

After discussing the history of standardisation, it is important to note that future developments will also rely on standardisation. This is especially true for sustainable developments, and to use standardisation to enable a circular building economy.

Sustainability and circularity. The final standardisation phase in history described by Anastasiades et al. is termed "awareness of the sustainable world" (Anastasiades et al, 2021, 12), spanning from the 1990s to the present day. This period highlights the ongoing efforts to set up standardised regulations for sustainable construction. Standardisation regulations can help establish an objective baseline to test a building's sustainability. One example in the Netherlands is the BENG-norm (literally translated 'Almost Energy Neutral Buildings'), which contains a set of regulations regarding the energy consumption of architecture. Anastasiades et al. observe that these standardisation attempts often remain minimal when looking at a wider range of sustainability issues. Critical sustainability issues like material use, construction emissions and circular design principles are not yet sufficiently addressed by existing regulations.

To adopt a more holistic sustainability approach, it is essential to transition to a circular building economy. The built environment plays a big role in global sustainability issues; the Circularity Gap Report of 2024 (Fraser et al, 2024), lists three main problems of this sector.

1. "The extraction of minerals used to produce construction materials is responsible for a quarter of global land use change."
2. "Approximately 40% of global GHG [greenhouse gas] emissions can be attributed to buildings' construction, use and demolition."
3. "Construction and demolition processes drive nearly one-third of all material consumption."

Standardisation is a key tool in the transition to a circular building economy. Standardisation could both be implemented in *policy*, for example by mandating a material passport for new buildings, and in *building practice*, for

example by standardising building components or connections to facilitate disassembly. An important concept to introduce about this topic, is the list of R-strategies (see figure 10). This list ranks circularity methods by their potential, ranging from short-loop processes like reduce to long-loop processes like recycle (TU Delft, n.d.). R-strategies related to processes in the short and long loops could benefit from standardised *policy*, while R-strategies related to design in the medium loops could benefit from standardised *building practice*. Two specific design approaches regarding circularity that can benefit from standardisation, are *Design for Disassembly* (DfD) and *Design for Adaptability* (DfA).

10   The different stages that R-Strategies can be implemented.
Diagram. Larae Malooly and Tian Daphne. Circularise. 2023.
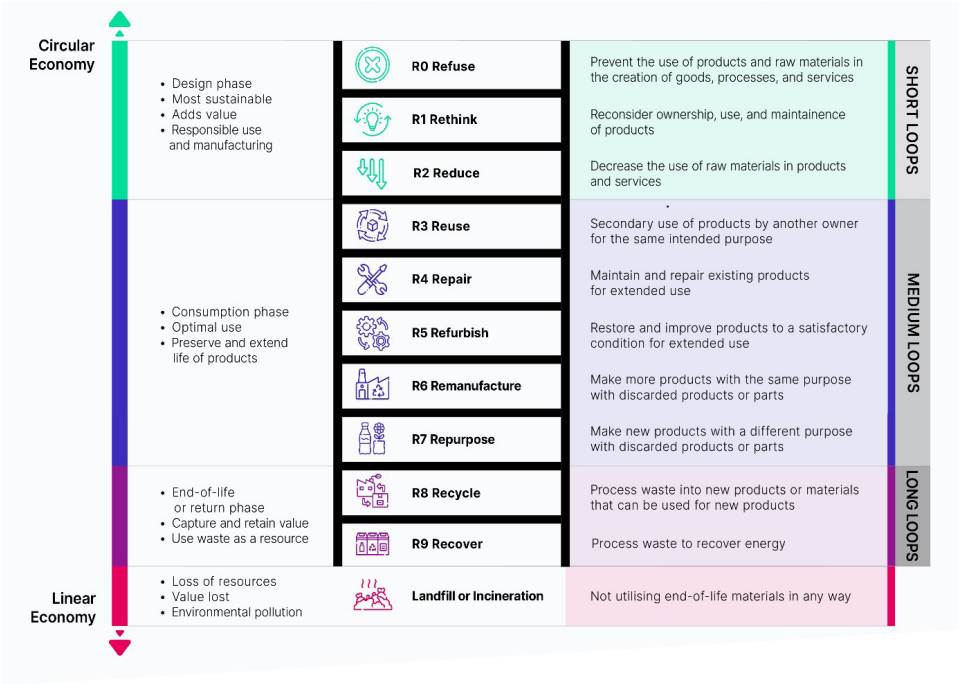
Design for disassembly. Most buildings today are constructed with permanent connections, making them difficult to deconstruct and leading to waste and downcycling after their demolition. The DfD approach, however, uses reversible connections to allow building components – or even entire buildings – to be disassembled. This benefits not only the end of life stage of a building, when it is dismantled and its components can be reused, but also facilitates easier repair an replacement of building components. A key concept to consider for this approach is the "Shearing Layers" concept, first conceived by architect Frank Duffy (see figure 11). This concept categorises a building into layers, based on their lifespan and impact (TU Delft, n.d.). For instance, the services layer of a building typically has a shorter lifespan than the structure layer, making replaceability and repairability of the service layer particularly important. Nonetheless, allowing for disassembly of all the building layers has the highest impact on sustainability.
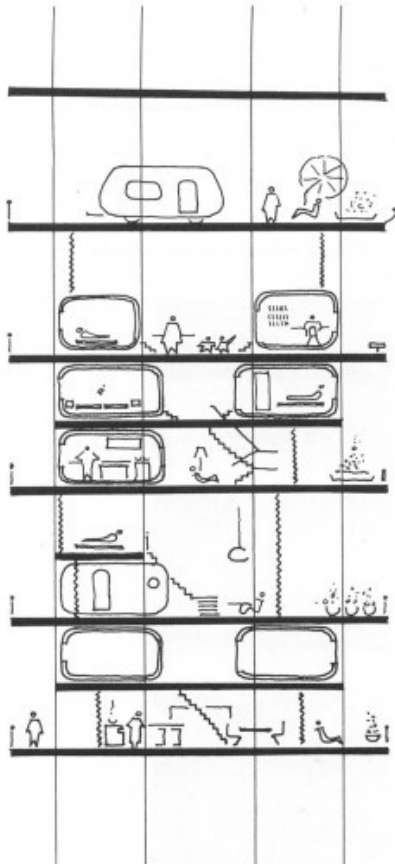
11   Shearing Layers of Change –
     Seeking Higher Ground.
     Diagram. IFMA. n.d.

A Building's Shearing Layers
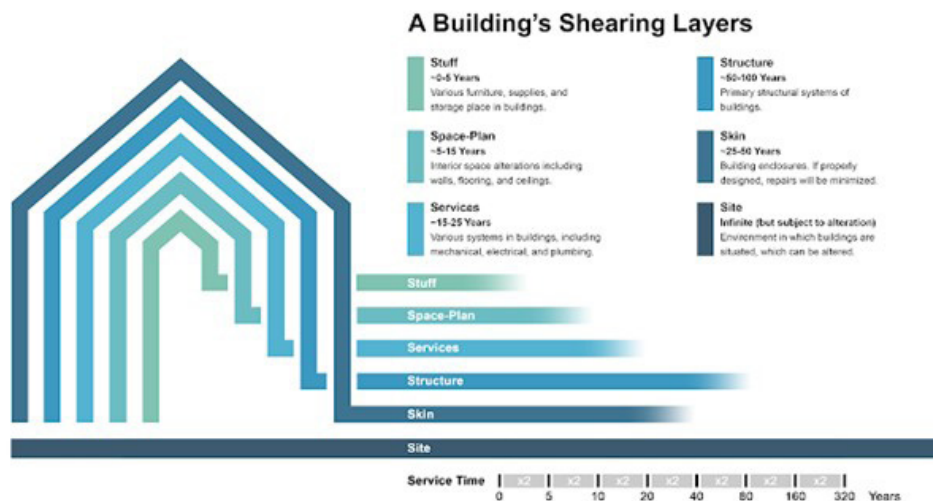
Design for adaptability. Another approach to extending a building's lifespan is Design for Adaptability (DfA). This design method ensures that a building is adaptable, meaning that it can accommodate different types of use over time. By allowing future generations to repurpose a building rather than demolishing it, DfA significantly increases sustainability. Interestingly, DfA contrasts with DfD in their fundamental goals. While DfD emphasises impermanence of building elements for repairability and replaceability, DfA prioritises permanent building elements that are multi-functional. Bernard Leupen, Associate Professor at TU Delft, argues that this focus on permanence over changeability offers a new perspective: a durable structural frame provides the foundation for spaces where change can take place (Leupen, 2004). This close relation between versatility and circularity will be discussed later in this thesis. Standardisation is essential for DfA, both practically and theoretically. Practically, a building's structural frame can be standardised to create a permanent structure that facilitates flexible space. Theoretically, designers could aim to develop an optimised structural system that enables this goal – a universal, polyvalent standard. However, a single, perfect standard may be unattainable due to the diverse requirements of buildings, the evolving needs and perspectives of architecture over time, and the equal importance of diversity in fostering beauty, creativity and equity.

Standardisation that enables versatility

This part of the discussion features a few architectural theories regarding standardisation approaches that enable versatility.

Habraken and the SAR. An early example of an architectural theory regarding standardisation and versatility was developed by John Habraken. In 1961, he published a book called 'De Dragers en de Mensen' (in English: the bearers and the people) (Habraken, 1961). The book describes the essential need for housing and the deeply personal connection people have to their homes. Habraken mentions that mass housing is not suited to the individual needs of inhabitants, because it forces people to live in certain styles and certain household compositions. He "defined housing as an act rather than an object, and he believed that those who housed themselves deserved a greater role in housing development" (van Hoogstraten, 2018). Throughout Habraken's life, he developed a drastic alternative to the mass housing of the time. He established a working group called the 'Stichting Architecten Research' (SAR, in English: Foundation Architects Research), to improve the theory which would later be termed 'Open Building'. Open building is a method of construction that consists of a standardised structural grid that supports individual infill. The infill of different apartments and façade elements would be decided through participation of the inhabitants.

12   Grondslagen voor de bouw van dragers en de fabricage van dragerwoningen.
Drawing. John Habraken. 1963.

Flexible floor plan. The flexible floor plan is described by Friederike Schneider (Schneider, 2011, 33) as a floor plan that can be modified to fit different forms of living within the same apartment. This can be achieved by the use of modifiable external walls, movable room dividers or wall elements, movable rooms, etc. Making use of this concept should enable different inhabitants of a building to express their individual living styles. However, Schneider states that most people find that repositioning walls requires too much effort, people often settle within the apartment layout they are given. Additionally, flexible floor plan elements often come with downsides such as poor noise protection and higher costs. All these points seemingly show that flexible floor plans aren't a successful concept to strive for. The implementation and nature of flexible elements is varied though, so taking into account the downsides and using flexible elements for specific purposes can provide desired outcomes. For example, the use of flexible elements in common spaces in a housing complex can stimulate inhabitants to make use of the space in different ways. This way, the flexible elements aren't implemented in the basic housing units, where they could interrupt basic living needs.
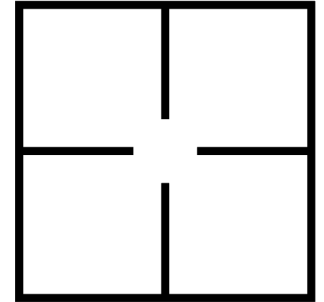
Ambiguous floor plan. Next, Schneider discusses a different type of floor plan that enables varying living styles: the ambiguous floor plan (Schneider, 2011, 34). This type of floor plan is characterised by a collection of spaces without clear distinctions between specific living functions, allowing occupants to interpret and use the rooms in varied ways. To maximise the potential of the ambiguous floor plan, "the rooms need to be of a certain size and proportion and, ideally, with independent access," (Schneider, 2011, 34) making the spaces more versatile. Schneider identifies two variants of the ambiguous floor plan. The first features rooms of uniform size accommodating a variety of functions and encouraging users to personalize the layout. The second variant features rooms with differences in size, lighting, form, orientation, etc. In
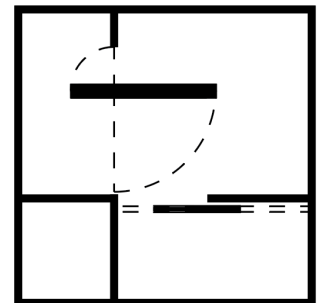
this case, the unique characteristics of each room enable highly specific and personal uses.

Design for Disassembly, Design for Adaptability. The previous section explored the standardisation benefits for circularity. This section examines how these circularity strategies can also benefit versatility.

In a DASH article, architect Bart Goldhoorn compares standardisation practices in Western Europe and the Soviet Union after the second World War (Goldhoorn, 2020). Soviet standardisation was characterised by the strict building standards, only differentiating housing blocks according to the countries 5 climate zones. Western Europe on the other hand established a capitalist system, which allowed the building industry to create a market with varying building products. To ensure efficient post-war reconstruction, standard sizes were introduced. This way, a balance could be created to enable fast and cheap construction, whilst preserving a degree of design freedom for architects. Today, this kind of standardisation could be reimagined to support circularity, to create products that are easily interchangeable, repairable or replaceable – in line with the principles of DfD. Additionally, the post-war examples in Western Europe highlight that creating standard sizes and connections does not necessarily limit diversity. Standardisation strategies following the DfD approach can benefit circularity without obstructing the possibilities for a wide range of building products. Designing systems that allow for disassembly can even create new design possibilities. For instance, when a façade reaches the end of its life, it could be replaced with a different material. Taking the idea of individual freedom further, a housing complex could offer a range of prefabricated façade units with varying designs, which individual residents could choose from.

The circular design approach DfA is similarly intertwined with both standardisation and versatility. Adaptable floor plans can not only accommodate varying functions throughout a buildings lifespan –

they can also accommodate varying residents with individual living needs and styles. By increasing access doors, available installation shaft connection points and similarly sized rooms, apartment floor plans can become more adaptable and versatile.

Versatility in common spaces. Besides designing versatile housing floor plans, the versatility of housing complexes can also be enhanced through the inclusion of common spaces. The Communal House of the Textile Institute, designed by Ivan Nikolaev is a good example of this design tactic. The student housing complex consists primarily of small, standardised sleeping units. In addition to these minimal housing units Nikolaev dedicated a large part of the building to shared communal spaces. The two parts of the building, separated by function, also differ visually. The housing units are repetitive and square, while the common spaces on the ground floor are designed more freely and poetically with differing materials and integration with the surrounding landscape.

13 Student Commune.
Plan. Ivan Nikolaev.
Constructivism Kharkiv.
Drawing. 1963.
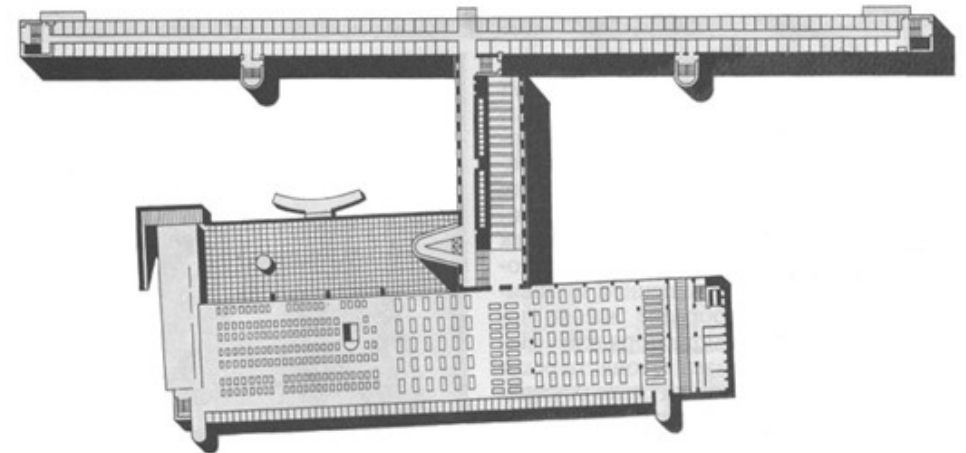
The building is the topic of an article written by Michael Trencher, in which he describes that the building set an example for new social conditions for housing, where "individuals could only find their identity within the totality of the community" (Trencher, 2000). This design choice reinforced communal living, which was in high demand at the time, but also imposed certain living constraints for individuals. However, the abundance of communal spaces also allowed the residents to use the building in their own way. Different people could use the communal areas according to their personal needs. It should be noted that Nikolaev's contrast between the compact private units and the large communal areas was a specific design ideology. Housing complexes with larger, more versatile private floor plans can still benefit from well integrated common spaces.

Analytical framework

To understand more about the practical implications of standardisation and versatility in architecture, the next part of this research will consist of analytical case studies. As mentioned in the methodology section of this thesis, the case studies will be discussed using the following sections.

Societal sketch. Views of standardisation and versatility have changed throughout history, often as a result of the needs of society at the time. Sometimes that is a need for cheap and fast housing production that fits everyone, sometimes it is a need for diverse housing for a diversifying population. Therefore, it is relevant to discuss the societal context of the design and construction of the case study.

Background of the architect. As well as changing societal views, architects also have varying views and reasons for designing the way they do. A short background about the architect can give insight into different design choices.

Explanation of architectural style. We learned that different architectural styles deal differently with the interface of standardisation and versality. Therefore it is relevant to point out the architectural style of the case study, as well as the corresponding values or philosophies.

General description of the building. To introduce the case study itself, a short description of the building is given, supported with photos.

Standardisation and versatility goals. In the literature study, eight values for standardisation were distinguished. For my graduation design project, a selection of these values are relevant and have been refined into the following four standardisation goals:

1. Circularity (design for disassembly/adaptability)
2. Affordability
3. Mass production (scalability)
4. Aesthetic coherence

Regarding versatility, in the literature study examples of architectural theories on standardisation that enable versatility were mentioned. These theories have been used to formulate the following three versatility goals:

A. Visual/spatial diversity
B. Individual styles of living
C. Diversity of households

Case studies are analysed in terms of these goals. Only the goals relevant to the specific case study are discussed.
Making analytical drawings. The evaluation in terms of the four standardisation and three versatility goals will be illustrated using analytical drawings of the buildings. The process of making these drawings helps to understand and get to know the building. Additionally, drawing is a process of abstraction, which helps to conceptually understand the design. The drawings are mostly done in Rhino. In this program it is possible to copy and mirror parts of the drawing. This way symmetry and repetition, and disruptions of symmetry and repetition are easy to find.
Case Study Selection. To make a selection of case studies, the following guidelines have been set:

- The eight case studies that have been selected are all housing complexes in an urban context.
- The case studies are situated in the Netherlands. The design assignment for my graduation is set in Amsterdam, so the case studies will be set in a similar architectural, historical, social and political context.
- Four of the case studies were built in the 20th century, the other four were built in the last 30 years. Large scale housing in the Netherlands took off from the 20th century, and architects started to question how to design such housing complexes. Furthermore, the 1901 housing law drastically increased the quality of housing, and therefore relevant to compare with contemporary housing. The more recently built case studies are selected because they deal with more relevant contemporary issues and questions in architecture.

- The case studies are selected with a variation of approaches to standardisation and versatility. Some cases will be more standardised, and others will be more versatile. The architectural qualities and design philosophies and choices for these buildings will be looked at.

These selection criteria led to the following list of case studies:

I. Michel de Klerk (design: 1971 – 1919). *'t Schip*. Amsterdam.
II. Jo van den Broek (1934). *De Eendracht*. Rotterdam.
III. Piet Blom (1984). *Stadsvernieuwing Rotterdam Spaansekade*. Rotterdam.
IV. Mecanoo (1985). *Kruisplein*. Rotterdam.
V. Hans Kollhoff & Christian Rapp (1994). *Piraeus*. Amsterdam.
VI. AAUI (2005). *De Zilvervloot*. Dordrecht.
VII. VMX Architects (2010). *Ithaka*. Almere.
VIII. MEI architects and planners (2019). *Fenix I*. Rotterdam.

Michel de Klerk (1919). 't Schip. Amsterdam

This project is chosen because it touches on standardisation goals 2, 3 and 4, and versatility goals A, B and C.

14 't Schip
Photograph, Museum Het Schip, 2018

Societal sketch. From the 1870s and onwards, the Netherlands went through an industrialisation period; industries grew, and many workers moved to the big cities, where they lived in slums. At the turn of the century, even liberal Dutch policymakers realised that the free housing market and privatised charity would not solve this housing crisis (Hulsman, 2023). This led to the enactment of the 1901 'Woningwet' or housing law. This law gave rise to new, high quality social housing for the working class. The government gave financial aid to help realise this new housing, and municipalities wrote down strict quality standards. These new social housing complexes were realised by housing associations. During the first world war (1914-1918) building became so expensive that many developers and individuals couldn't afford new construction projects. This meant that housing associations – heavily supported by governmental subsidies - could buy land originally labelled for private development and build social housing complexes there (Bock et al, 1997, 224-241). This also took place in the Spaarndammerbuurt, where Michel de Klerk was commissioned to build three 'arbeiderspaleizen' (workers palaces). The most famous complex of the three is 't Schip.

Architect. Michel de Klerk (1884-1923) was an influential architect, furniture maker, designer and illustrator. He was an iconic and leading pioneer for the Amsterdam School. De Klerk only occasionally talked about is views on architecture, even less so for larger crowds. He was of the opinion that his designs and buildings should speak for themselves (Bock et al, 1997, 1 8-29). What is known however is his vision on social housing, specifically meant for industrial workers at the time. He wanted to give the workers beauty: "Nothing is beautiful enough for the worker who has had to live so long without beauty" (Museum Het Schip, n.d.).

Architectural style. 't Schip is built in an architectural style called the Amsterdam School. The Amsterdam School is characterised by its rich ornamentation, use of brick, inclusion of traditional craft and its picturesque, romantic style. Architects of the Amsterdam school were inspired by Hendrik Berlage, from whom they learned about rational composition, spatial organization and materiality. Where Berlage focussed on purity of form, architects of the Amsterdam school strived for more freedom of expression, specific to the architects own abilities and character (Casciato, 2003, 9).The architects were described as a young group that had renounced "the doctrinaire application of rationalism as leading to aridity and dryness, and aims to restore fantasy, richness, and picturesqueness" (Ellenbroek, 1997). They searched for "beauty and individuality in a world that was becoming increasingly massive and functional" (Gómez & Roegholt, 2018). Arguably the architects favoured versatility (specifically architectural diversity and individual expression of architects) over functional standardisation. The Amsterdam School could flourish in Amsterdam, because there was a need for more aesthetic control of the urban landscape after the 1875

15 Michel de Klerk
Photograph, Nieuwe Instituut, 1915.

plan of Jan Kalff (Casciato, 2003, 13-14). This plan led to uniform, pragmatic, drab houses that contrasted greatly with the beautiful city centre. Because of this, there was a large focus on beauty of development, in which financing played a smaller role.

Building description. 't Schip is a triangular building block, consisting of 102 apartments, a post office and a school. The school had already been built on site before development started, so Michel de Klerk had to incorporate it in the design. The building stands out for its beautiful brickwork, the use of many masonry bonds, waving lines of brick, intricately shaped windows, incorporated stone artworks, and most striking, a large decorative tower at the short side of the triangle block. At first glance, the building is an example of supreme versatility, but with a closer look, standardisation can be recognised as well. There are multiple different apartment types, but one type is predominant, and copied and mirrored throughout the building. The parts of the building which house the apartments, would look a lot more standard if the post office, school, and tower wouldn't be there. Just as with the triangular lot shape, the application of

16 Woningbouw Spaarndammer-plantsoen.
Michel de Klerk. Drawing. 1917. Collectie Nai.

the design to a specific site, with existing buildings, and the addition of common spaces, give additional spatial diversity to the building.

2 - Affordability. The costs of building housing complex 't Schip were extraordinarily high, because of the amount of detail in the design and the corresponding need for attention and skill of the builders. During a municipal meeting on the 8th of October 1920 the building costs were discussed, and different councilors debated their views on the matter. One such councillor, Wibaut, argued: "Although Mr. De Klerk builds expensively, he does not build TOO expensively, because the work of an extraordinary artist can never be so" (Wendingen, n.d.). Wibaut called De Klerk the "Rembrandt of the architects." Councillor and architect Zeeger Gulden gave another argument: "future generations will be grateful to us for this method of urban expansion" (Wendingen, n.d.). This raises the question of whether affordability should be defined as generally keeping costs as low as possible, or to create value as cost-efficiently as possible.

3 - Mass production. After the enactment of the 1901 housing law, a new form of housing arose in the Netherlands which we now know as mass housing. In order to give homes to the large group of former slum inhabitants, it was necessary to create collective housing complexes as opposed to individual homes. The design of these complexes was an important theme for architects of the Amsterdam School. Even though the definition of mass produced housing has changed with contemporary views, in the early 20th century this form of housing was the first exploration of mass production in housing. Specifically for the case of 't Schip, it can be seen that the housing parts of the complex are copied throughout the design. The copied unit consists of five floors of single level apartments, connected with a portico staircase, with balconies facing the inner courtyard. The main deviations from this basic unit are where the common facilities connect to the design (post office and school), and at the ornamental tower and its connection to the rest of the building.
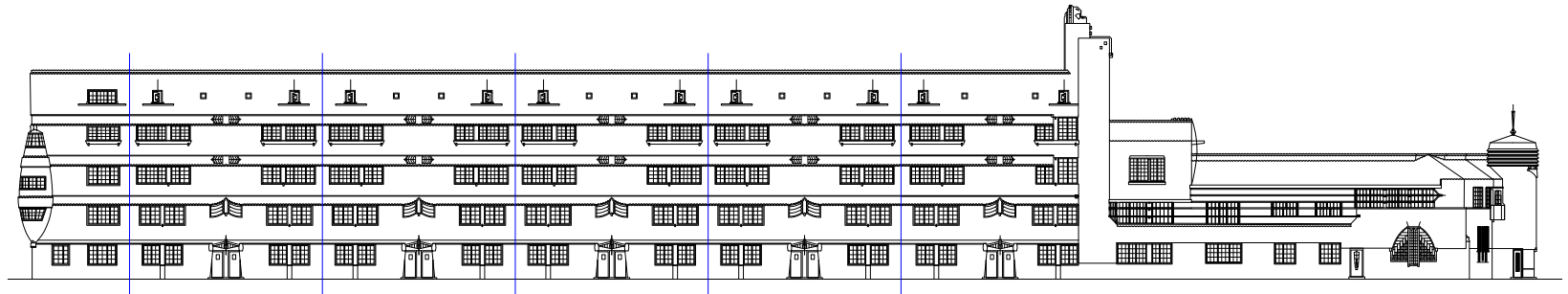
17 Repetition in the Southern
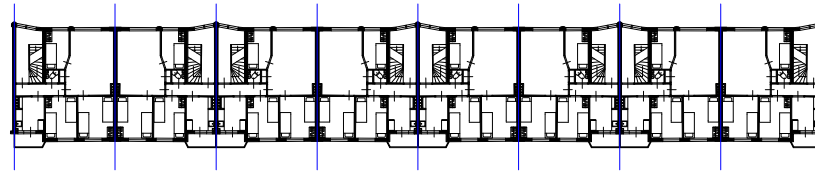façade of 't Schip.
Drawing. Own work.

The southern façade has easily
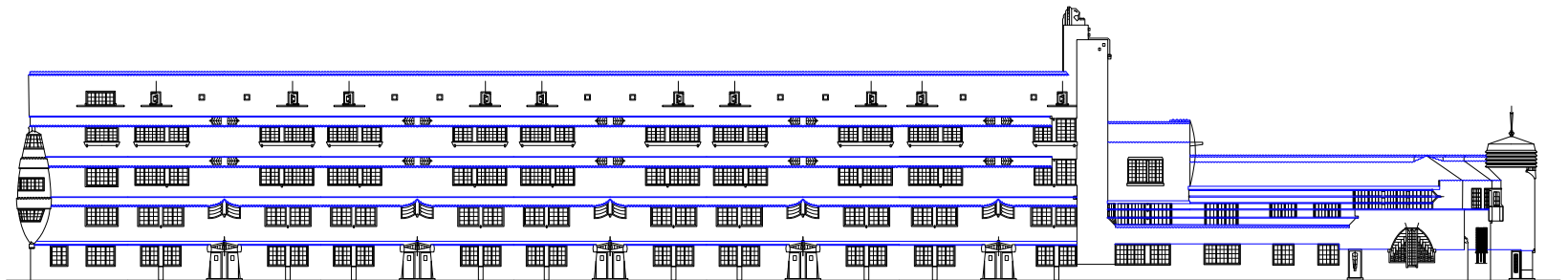identifiable copied units.

18 Repetition of apartments of
't Schip.
Drawing. Own work

19 Horizontal lines on the
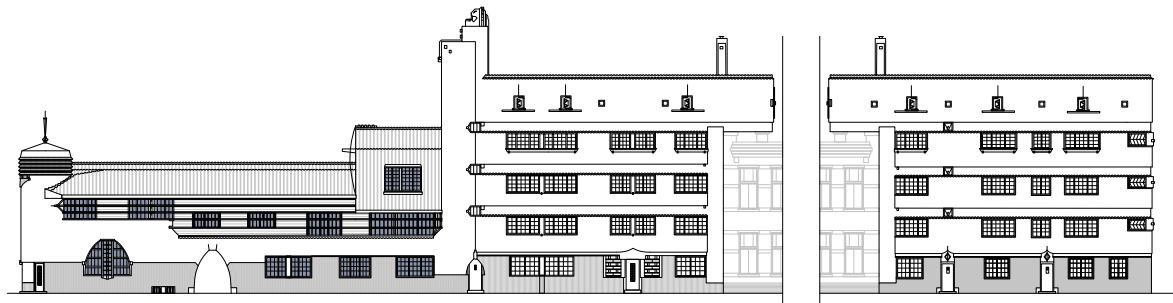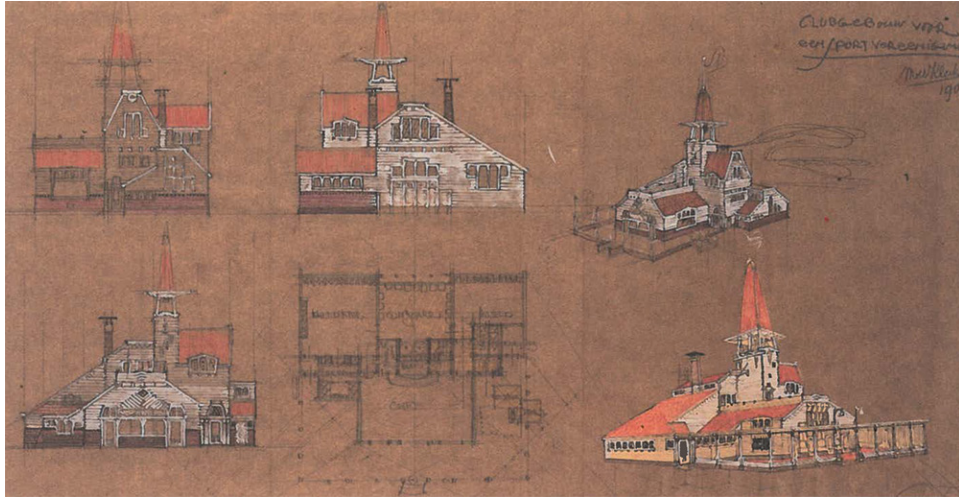Southern façade of 't Schip.
Drawing. Own work

20 Northern façade of 't Schip.
Drawing, Own work.

The northern façade is much
less standardised because
it connects to the existing
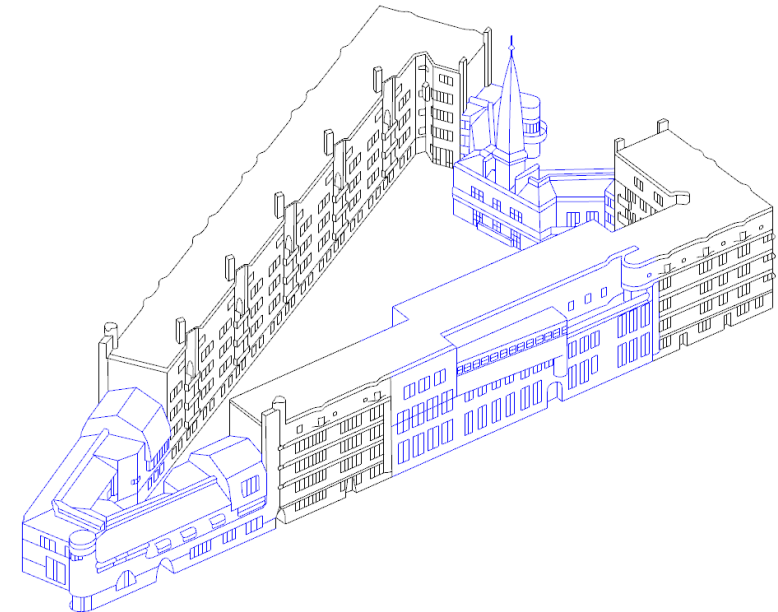school building, as well as the
post office.

21 **Ontwerp voor clubgebouw op een sportterein.**

Michel de Klerk. Architectural drawings. 1907. Collectie NAi.

4 - Aesthetic coherence. Michel de Klerk struggled to find compositional balance in the early years of his career (Bock et al, 1997, 40-43). As an example, a design of a clubhouse for a competition in 1907 came in second place, mainly because of a lack of compositional coherence. De Klerk developed his style overtime to still be very diverse and with great detail, while maintaining compositional coherence. In his design for 't Schip this is done by limiting the materialisation (most of the façade exists of brick and tilework), by using repeating elements mirrored around the porticos, and be making use of continuous horizontal lines visually connect the different parts of the building.

A - Visual/Spatial diversity. Visually the design of 't Schip is very diverse. The building is adorned with ornamentation, and it is altogether beautifully crafted. All the façades have relief in their design, casting interesting shadows and creating visual accents. Besides the visual diversity of the building, the composition of the housing block is spatially also intriguing. The composition is a result of the existing site, with its triangular shape and the existing school, and the incorporation of the ornamental tower and post office.

Interestingly, the main housing parts of the block are spatially much simpler. The building as a whole is a beautiful example of the societal views on social housing at the time. As Keppler, director of the Amsterdam housing agency from 1915 to 1937, answered to a journalist who had sarcastically asked about luxuries of some workers housing: "nothing is fine enough for the working man whose deprivation and suffering have been so great" (Casciato, 2003, 26).

22 **Axonometric drawing showing difference between standard housing parts and other functions of 't Schip.**
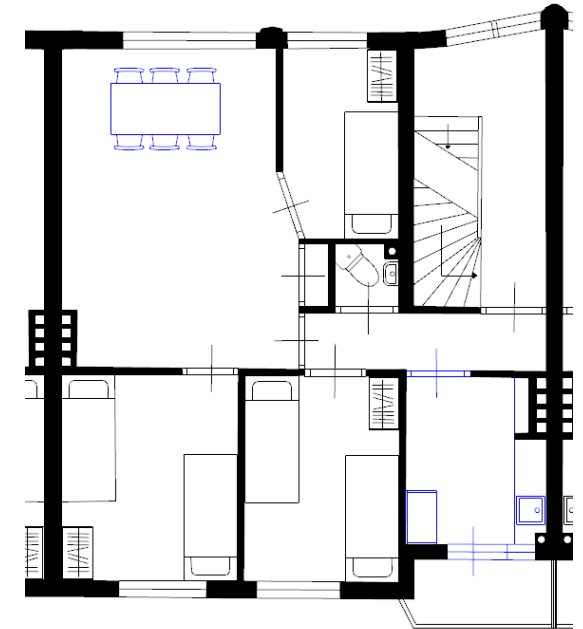
Drawing. Own work.

B - Individual styles of living. Octavia Hill (1838-1912) was an English social reformer, who started socially managing workers' homes in the 1860s. She was of the opinion that good social housing could stimulate public development. She aimed "to raise the working class to a higher level of civilization" (Appelman et al, 2016, 25). In the Netherlands this view of social housing took off after the 1901 housing law. Michel de Klerk had similar ideas for his design of the floor plans of 't Schip. Instead of designing the floor plans to stimulate individual uses of the house, he designed it so inhabitants would follow his predetermined idea of 'correct' living. In a newspaper article published in

NRC, Bernard Hulsman writes that architects of the Amsterdam School like De Klerk "had paternalistic tendencies" (Hulsman, 2023), which the floor plans reflect. The kitchen was deliberately designed to be relatively small, so workers wouldn't eat their dinner in the kitchen. Similarly, in the living room connection points for ceiling lights were placed near the walls, so the dining table wouldn't sit in the middle of the room.

C – Diversity of households. 't Schip has no less than 18 different apartment types, as a result of the unconventional spatial composition of the building. This seemingly creates accommodation for many different types of households, but this is not the case. The floor plans are more standardised than one might expect: "most types are variations on the basic solution based on the sizes of the plots, with a slightly different layout" (Bock et al, 1997, 243). The floor plans are specifically designed for a large family unit. For the time this made sense, because this exactly fit the average worker's household.

23 Floor plan drawing showing enforced living ideas of Michel de Klerk.
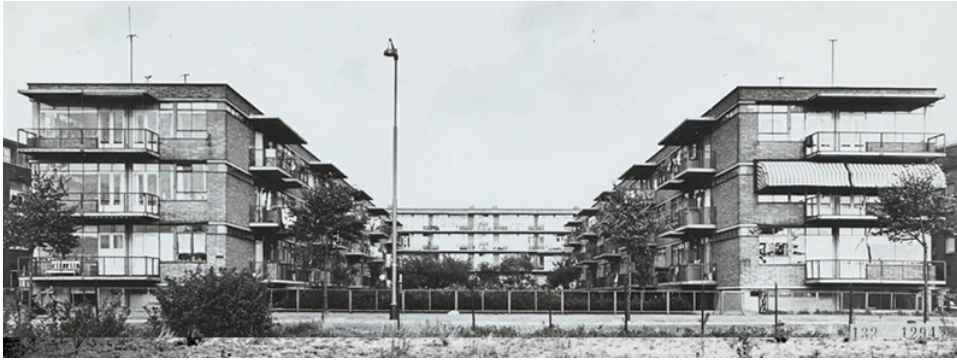Drawing. Own work.

24 Different apartment types in 't Schip.
Drawing. Own work.
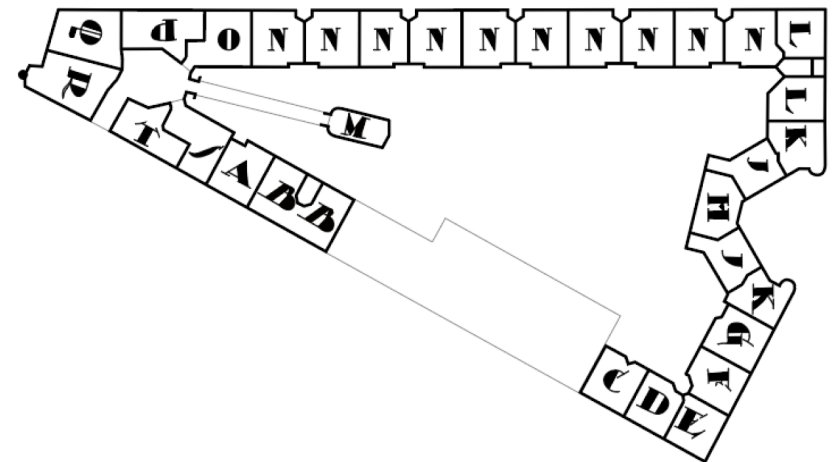
Jo van den Broek (1934). De Eendracht. Rotterdam

This project is chosen because it touches on standardisation goals 1, 2, 3, and 4, and versatility goal B.

25 de Eendracht
Photograph, Flickr, 1973.

Societal sketch. Designed over a decade later than 't Schip, housing complex de Eendracht was still a search for new housing architecture that was more hygienic, but also more functional, than the slum housing of the early 20th century. Jo van den Broek was a member of 'de Opbouw' (Smit, 2013), a group formed in 1920. The group was in disagreement with the municipality planning of Rotterdam about their 'conservative' urban approach (Stroink, 1981). The group wanted to experiment with massing of housing blocks; they argued for open building blocks, in stead of enclosed blocks. They focused on sun exposure of the housing, experimentation of floor planning and adding public facilities to neighbourhoods. In 1931, van den Broek published a variation plan to the existing urban plan of the Bergpolder (Vanstipthout, 2005). This plan proposed to build mostly half-open building blocks and a few places for row housing. The plan was never realised, but housing block 'de Eendracht', built in Blijdorp, is a built experiment of these new ideas for half-open block.

Architect. Jo van den Broek was an influential architect in the Netherlands, especially because of his interests in housing design and research. He was an early proponent of a modernist approach to architecture, which to him meant that he embraced modern construction methods pragmatically (van Es et al, 2018). His ideas were based on pre-war functionalism, but besides pure efficiency he also felt a responsibility for the social significance of architecture. As a professor at TU Delft, he was viewed as an inspiring teacher. On the 'inspiring Alumni' webpage of the TU Delft, it is mentioned that "van den Broek positioned Architecture and the Built Environment as an important player in the development of Dutch housing production and as a leading factor in the professionalisation of the architectural profession" (TU Delft, n.d.). As van Es et al. write: "He excelled in designing efficient and organizing floor plans; during the late 1920s and early 1930s he acquired an excellent reputation in the field of inexpensive and good quality housing" (van Es et al, 2018, 14).

Architectural style. Van den Broek designed in a functional style, and was one the founders of the 'Nieuwe Bouwen' (New Building). His designs are characterised by the use of experimental new construction techniques, with modern materials like concrete and glass, and a sense of humanness in large-scale housing (Smit, 2013). He designed, together with Jaap Bakema, a lot of housing for the reconstruction of Rotterdam, making use of industrialised building techniques whilst keeping a humanist approach (van Es et al, 2018, 13). Whereas architects of the Amsterdam School focused on giving visual beauty to the worker, architects of het Nieuwe Bouwen focussed instead on creating beautifully designed, functional floor plans. They criticised the Amsterdam School for their focus on beauty of the outside, which according to them led to small windows and strange, impractical floor layouts (Hulsman, 2023).

Building description. At first glance, the Eendracht – one of van den Broek's earliest projects – seems like a standard portico flat. The one-story apartments are accessed through portico stairwells, the apartments are stacked and flipped and together they form a larger building block, each apartment has a balcony, the bottom floor is half-buried underground and contains storage units - all elements of a standard portico flat. The Eendracht was however one of the earliest


26 Portret van J. H. van den Broek.
Photograph. A. Groeneveld. Stadsarchief Rotterdam. 1968.
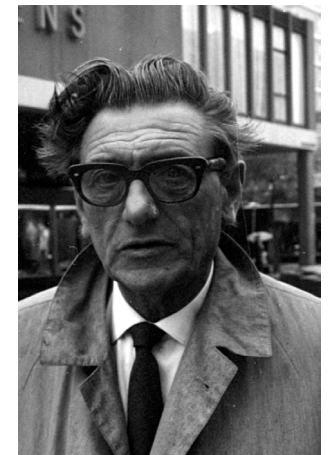
examples of this style of housing, (and designed by an influential architect specialised in housing) and therefore also has some notable deviations from the standard. The design of the floor plans plays a large role in what makes the design interesting, because it designed with flexibility in mind. Throughout the social housing complex one apartment type is used. Besides housing, the complex also has common facilities; a garden, a washing and playing room, a kindergarten and a small shop.

1 - Circularity. De Eendracht was built using a concrete skeleton structure (see figure 28). This ensured the infill of the floor plan – where facilities and dividing walls are located – was not bound to the dimensions of the construction. This principle can be used in a circular design, using the DfD approach. The structure is flexible, and interior walls could be dismantled to change the layout or function of a

27 De Vroesenlaan met wooncomplex de Eendracht.
Photograph. 1951.
Stadsarchief Rotterdam.
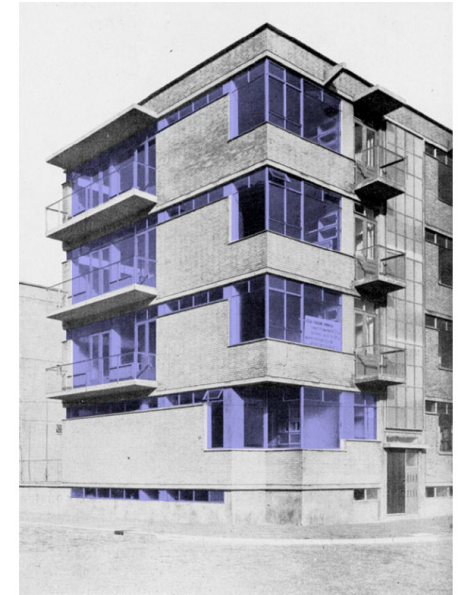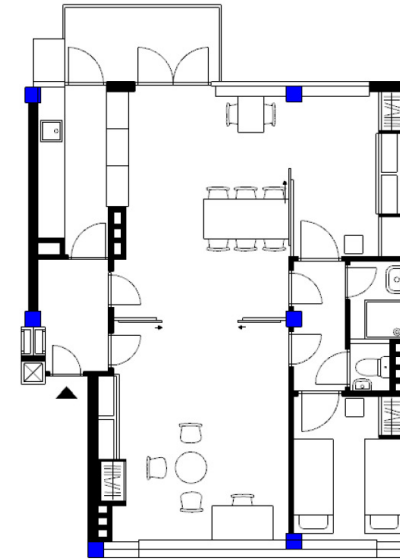
space. However, in the 1930s circularity was not yet a design goal architects strived for. Van den Broek used this type of structure not for circularity, but to be able to have non load bearing, movable interior walls. Additionally, it allowed the addition of a open façade design, with rows of glass along the whole façade (see figure 28).

2 - Affordability. As mentioned before, van Es et al. write that one of the qualities of van den Broek's housing design is that he managed to build affordable housing that didn't comprise on quality (van Es et al, 2018, 14). In the case of social housing complex de Eendracht, he achieved this affordability by building apartments with a relatively small floor area. To make the floor plan still functional, he introduced flexible elements with a designated day and night arrangement. This allowed the same rooms to have different uses throughout the day.

3 - Mass production. De Eendracht has a relatively simple construction that allows it to be scalable. Initially, the design was also meant as a stamp unit

28 Floor plan showing concrete skeleton structure of De Eendracht and the uninterrupted windows
Drawing. Own work.

to be built six more times in the neighbourhood (Rotterdam Woont, n.d.). The building blocks would be placed along the Vroesenpark, facing the green space. However, during the 1930s there was an economic crisis, and the only De Eendracht was built. Instead the other blocks were built more traditionally for middle income rent.

4 - Aesthetic coherence. As a member of architectural movement 'Nieuwe Bouwen,' van den Broek didn't make use of ornamentation, and let construction and materials aesthetically speak for themselves. Because of this, the construction grid is leading to the appearance of the building. Therefore, there is a lot of repetition and symmetry, and the overall picture is coherent.

B - Individual styles of living. The floor plans of de Eendracht feature flexible elements like extra access doors for different layouts, glass sliding room dividers, and foldable beds. The apartment was specifically designed for families, and the flexible elements were implemented to be able to efficiently use the small floor area of the house. During the day, the sliding doors would be opened to create a large L-shaped living room. During the night, the sliding doors would be closed to divide the living room into three smaller rooms, two bedrooms with foldout beds and one dining room. A problem with this implementation of the flexible elements is that to be able to functionally use the space, changing the layout is necessary. The flexibility doesn't encourage users to have their own ideas for living styles, the architect has set the uses for the rooms and flexible elements. The elements have to be moved to their predetermined positions twice a day to be able to make use of the floor plan as it was intended. The inhabitants of the building were given a leaflet with instructions for proper use (Rotterdam Woont, n.d.). To stimulate individual living styles, it would be better if a room with flexible elements didn't have a predetermined function, so that different users can change/adapt the room according to their own needs and style.
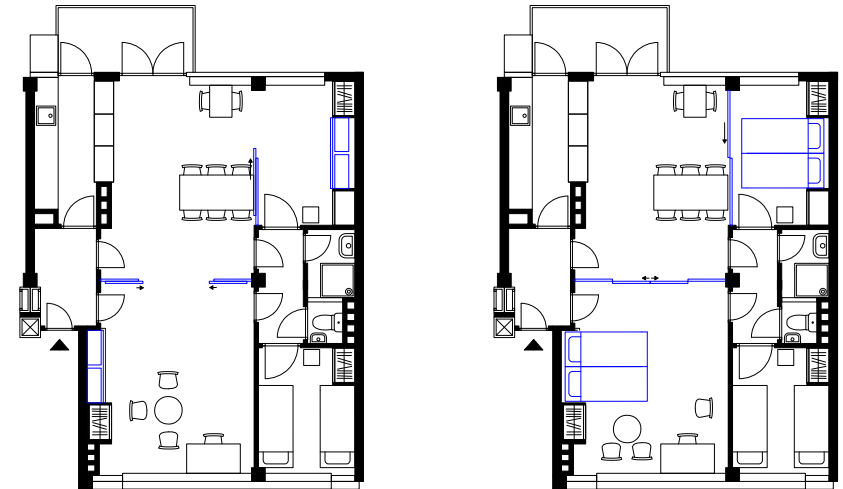
Piet Blom (1984). Spaansekade. Rotterdam.

This project is chosen because it touches on standardisation goals 3 and 4, and versatility goal A and C.

31 Spaanse Kade, Rotterdam
Photograph. D. Verwoerd. n.d.

Societal sketch. During the second world war, the inner city of Rotterdam was destroyed. The area of the old harbour (Oude Haven) hadn't been redeveloped for almost 40 years, and what had remained was only "war rubble, a few old tram rails, 5 trees, a piece of balustrade and the White House [Witte Huis]" (Blom, 1978). In the mid 1970s, the decision was made to turn the old harbour into a new, vibrant city centre for Rotterdam. The plan was to create an area that "would earn the city, and the architect in question, instead worldwide fame" (Hengeveld, 2008, 117). As we learned in the history section of this thesis, starting from the 1970s there was a general consensus that the reconstruction period after the war had lead to a one-sided focus on quantity of housing over quality. This led not only to more differentiation in architectural and urban typologies, but also created a wish to make housing plans more adapted to diversifying household types (de Vreeze, 1989). During the 1970s these changing societal views were also reflected in the election of the city council of Rotterdam, were the Dutch labour party [PvdA], gained the majority. Among

other things, the new government put their focus on the regeneration of the inner city, and the creation of high quality housing (Hengeveld, 2008, 117).

Architect. The architect that was chosen to design this huge redevelopment was Piet Blom (1934 † 1999), whose earlier designs highly impressed the municipality (Hengeveld, 2008, 117). Blom spent his youth in the Jordaan, a working class neighbourhood with vivid street life. A lot of his views on social housing and working are based on the period he grew up there (Piet Blom Museum, n.d.). During his early architectural career, he envisioned a concept called 'Wonen als stedelijk dak' (living as an urban roof), with opposing ideas to the separation of functions that CIAM argued for. The concept was a human focussed, large-scale structure of housing units, which function as a roof fur public urban life below, stimulating social interaction (van den Heuvel, 2018, 60). Blom would apply this theory to most of his architectural designs. It can be argued that making use of a preconceived conceptual scheme in architecture can be classified as a form of standardisation, helping Blom efficiently conceptualise his buildings. Aesthetically, Blom used an accessible and simple form language, and his
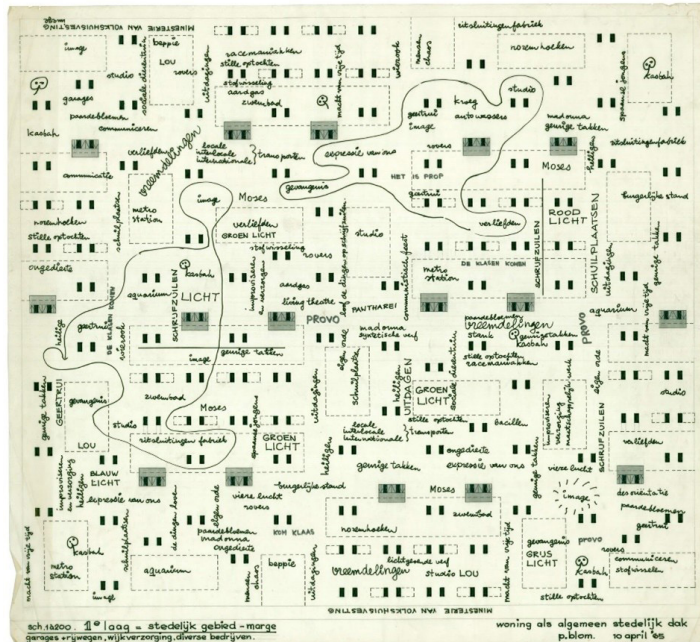

32 Portret van Piet Blom.
Photograph. n.d.
Bewonersvereniging Kasbah.

33 Oude Haven in 1940 vanaf het Witte Huis.
Lex de Herder. Photograph.
1940. Stadsarchief Rotterdam.

34 Woning als algemeen stedelijk dak.
Piet Blom. 1965. Collectie Het Nieuwe Instituut.

buildings often had a strange, but playful character. These designs reflected his fundamentally "anti-elitist and anti-establishment stance" (van den Heuvel, 2018, 60). All of these ideas would continue to play a large role in his architectural career.

Architectural style. Whilst Piet Blom was designing his redevelopment for the old harbour, Jaap Bakema (architectural co-partner with van den Broek) was designing a public library next to the old harbour (van den Heuvel, 2018, 60). Bakema designed in the style of functionalism, completely opposing what Blom was taught during his years at the Amsterdam Academy of Architecture (Hengeveld, 2008, 9). There, Blom was encouraged to develop original, innovative concepts which led him to a more structuralist style. He designed structures that could be extended infinitely, yet simultaneously "cut off and curbed at any moment of choice" (van den Heuvel, 2018, 63).

Building description. The redevelopment of the old harbour is a complex that exists of three main parts; the Blaaktoren, the cube housing, and the Spaanse Kade (Spanish Quay). Blom was of the opinion that housing communities should feel like villages, and while developing his ideas of the Urban Roof, became sceptical of stacked housing (Pascucci n.d.). The cube housing are a practical application of the Urban Roof concept. To still be able to achieve busy street life and housing availability, the Blaaktoren and the Spaanse Kade used stacked housing to achieve a density of 205 dwellings per hectare. The Spaanse Kade is a brick housing complex with a 'climbing' form; the building block has a wide footprint that recedes each level. This creates a diverse form that gives a sense of human scale and invites exploration. For the appearance of the Spaanse Kade, Piet Blom was inspired by the pre-war architecture that used to be there (Hengeveld, 2008, 118).

3 - Mass production. Piet Blom approached his designs in a structuralist way. Architectural structuralism is recognizable for the use of geometric structures, often consisting of an arrangement of smaller units designed for human scale. This is easily apparent in the cube houses of the masterplan, but Spaanse Kade also makes use of a strict grid of 127,5 x 127,5 cm squares (Blom, 1978) (see figure 36). According to Jan-Willem Vader – an urbanist who collaborated with Piet Blom at the old harbour – Piet Blom "devised of a system within which all the desired variations in dwellings were possible without the need for all kinds of major changes to the basic structure. Despite its fanciful style, the Spaanse Kade is structured in a very obvious way. Blom thought on the basis of the construction itself, he was always exceptionally meticulous with his

35 The Spaansekade housing by Piet Blom, modest brick highrise from the 1980's.
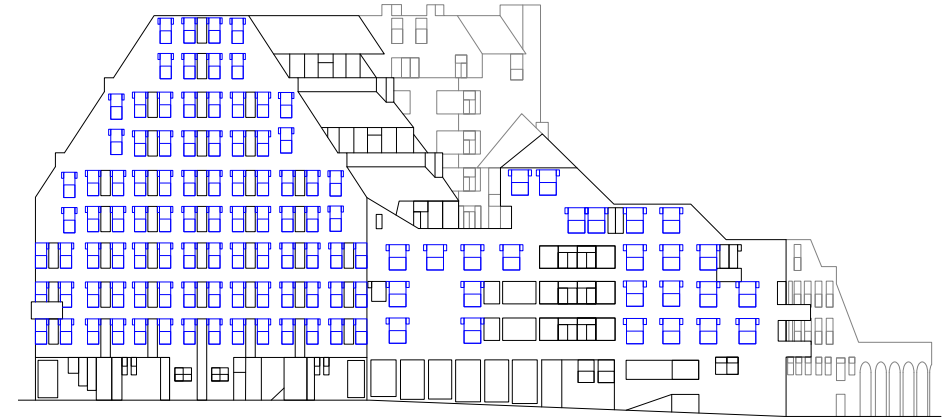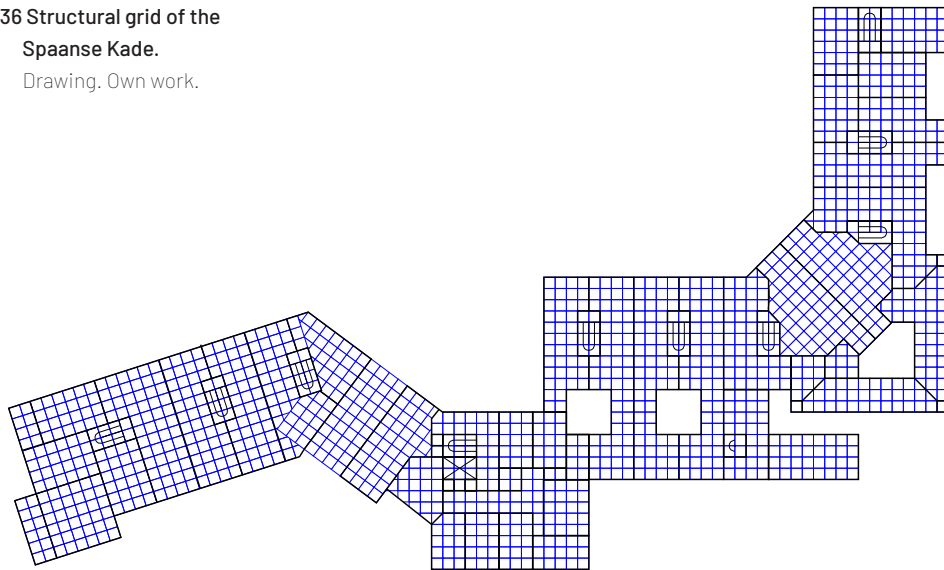Frans Blok. Photograph. 2018. Alamy.

working details" (Hengeveld, 2008, 118). Not only does this allow Blom to create a large variety of apartment types, it allows for spatial variation. As Dirk van den Heuvel writes: "It is only proof of the versatility of Blom's talent that he turned the various, structuralist typologies around to create a most specific place of local identity" (van den Heuvel, 2018, 69).

4 - Aesthetic coherence. The Spaanse Kade is spatially very diverse, but visually relatively simple. This is in contrast to the neighbouring cube housing, which is spatially more repetitive (of course still very unique), but its materialisation is more complex. This creates an interesting contrast. At the Spaanse Kade, only one façade material is used, brick. Additionally, the number of different building components is limited. As seen in figure 37, one type of window is predominant. It can be argued that this is done to lower building costs, but it simultaneously adds to the visual coherence, in an otherwise chaotic spatial composition.

A - Visual/spatial diversity. Piet Blom designed the whole area of the old harbour to be an ensemble

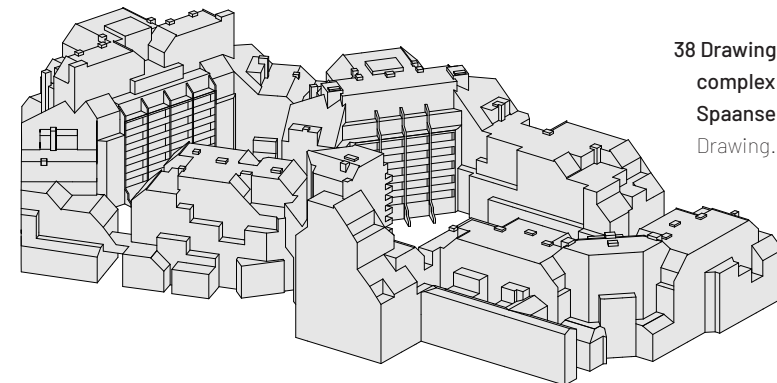**37 Repeating windows on the façade of the Spaanse Kade.**
Drawing. Own work.

of different clusters. He wanted it to seem as if not one, but multiple architects had designed the different clusters (Hengeveld, 2008, 117). All of the clusters shared a common vision, to design architecture that effectively combined housing, working and social life of the city. The Spaansekade achieves this by creating a high density of dwellings, combined with a parking garage, cafés, restaurants, a theatre and art studios. This not only creates a compact city, but also a diverse spatial environment that is taken even further with its 'climbing' form. The arrangement of the different parts of the building form a large diversity of public spaces, from the busy quay with its cafés, to the plazas inside of the block, and the spaces that connect the building to the surroundings.

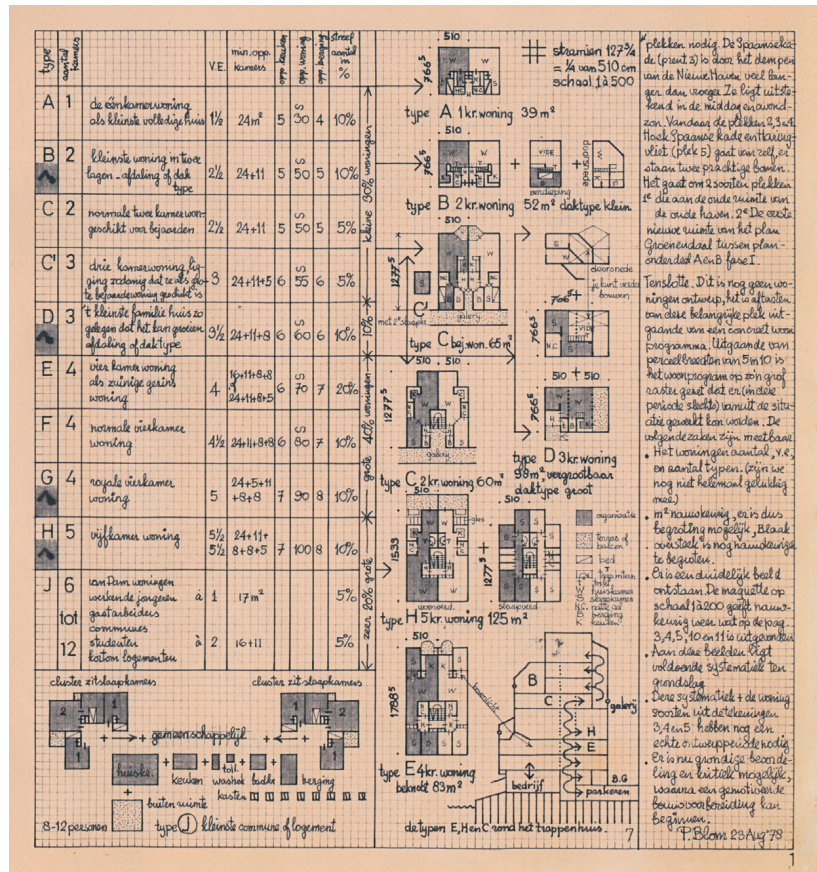**36 Structural grid of the Spaanse Kade.**
Drawing. Own work.

38 Drawing showing the complex massing of the Spaanse Kade.
Drawing. Own work.

C - Diversity of households. The Spaanse Kade has a large diversity of apartment types, which today is seldom replicated (van den Heuvel, 2018, 68). The Town Planning Department and the housing association Patrimonium formulated a housing program that had 10 basis types (Blom, 1978). Those different types could still have varying layouts and floor plans. This want for diversity was based on the progressive views of the municipality and Blom himself, and was implemented to offer housing for all income groups and household sizes. The apartment types range from 1-bedroom houses to 12-room houses (see figure 39).

39 Pamphlet in a presentation folder of the first phase of the Oude Haven housing and urban renewal in Rotterdam. Program. 1978-1984. DASH | Delft Architectural Studies on Housing.

Mecanoo (1985). Kruisplein. Rotterdam.

This project is chosen because it touches on standardisation goals 1, 2, 3, and 4, and versatility goal A, B & C.

40 Kruisplein
Photograph. Leon van der Velden. n.d.

Societal sketch. Until the 1970s, housing development was predominantly catered to traditional family apartment types. These types fit the societal needs at the time, but family homes became more and more outdated and unfit for a large part of society. During this time, there was a large housing crisis and consequently a big squatting movement. To combat this, the government introduced a new housing law, the first of its kind since the 1901 housing law Martínez-Millana 2023). The law, named Nota Huisvesting Alleenstaanden en Tweepersoonshuishoudens (commonly referred to as the van Dam Nota), provided subsidies to new housing developments built for smaller one- or two-person households. While it aimed to address the housing demands, the new law was also met with criticism, notably by the Delft architectural study association Stylos, of which a group of students formed the van Dam offensief (Drijver & Aarts, 1982). This group discussed their progressive ideas about youth housing, and aimed to incorporate it into the study curriculum. Among these students were Francine Houben, Henk Döll and Roelf Steenhuis;

whose graduation projects reflected their engagement with the van Dam Offensief. The Kruisplein project, an architectural competition for youth housing, was an extension of their graduation projects, which allowed them to put their ideas in practice and propose alternatives to the common family home.

Architect. Mecanoo, an architectural firm founded in 1984, emerged from the collective ideas of Francine Houben, Henk Döll and Roelf Steenhuis (who designed the Kruisplein competition), along with Erick van Egeraat and Chris de Weijer. Only Houben remains part of the firm today, the other founders have started their own practices. Over the years the firm has evolved to global, multidisciplinary team from 25 different countries (Mecanoo, n.d.). Regarding versatility, the firm's website mentions two things. First, the diversity of its staff creates a "versatile multidisciplinary team [that] creates the opportunity to develop new ideas and integral concepts" (Mecanoo, n.d.). Second, Mecanoo mentions the importance of adaptability for a buildings longevity: "Over the years we have learned that functions inevitably change. Therefore, we must create buildings that are prepared for (un)predictable change" (Mecanoo, n.d.).

Architectural style. Dick van Gameren, dean of the Faculty of Architecture and partner of Mecanoo, describes the firm in a DASH article as having "rapidly evolved into the most significant representative of 'neomodernism'" (van

41 Erick van Egeraat, Chris de Weijer, Francine Houben, Roelf Steenhuis, Henk Döll.
Photograph. Mecanoo. 1984.

Gameren, 2018). This architectural approach revisits modern architectural concepts about form and typology, adapting them to address the challenges of housing architecture in a time of standardisation after the reconstruction period. During the 1970s and 1980s, the social aspect of housing design was again emphasised, as it had been during the modern architectural movement (van Gameren, 2018). Traditional modern architecture, while innovative, often resulted in relatively standardised architecture, partly because of the limited use of façade materials, and a focus on simplicity. Contrastingly, neomodernism is more versatile in its materials and colours; materials like brick and wood are often used, and materials like stucco can be rendered in a wide arrange of colours, beyond the stark whites associated with modernism (Architectuur.org, n.d.).

Building description. Kruisplein began as an architectural competition aimed at designing a social housing complex for various youth groups. The competition brief asked for a single scheme which could be used to create both the larger and smaller housing types (Döll et al, 1982), each featuring different forms of collective living. This aligns perfectly to the topic of this thesis, exploring standardisation as a means to create versatility. The resulting complex consists of two urban forms; a lower, rounded form facing the busier public street, and a taller housing strip, running perpendicular to the main street. The space between these two forms and the adjacent housing creates a small public green area,

42 **Kruisplein.**
Photograph. Mecanoo. n.d.

offering a shared outdoor space for the residents. The design incorporates different housing types, which is reflected in the massing and expression of the façade. The façade consists of a combination of concrete, glass, steel and panelling, with a selection of elements painted to create visual interest. A common sun terrace on the roof, inspired by Le Corbusier's Unité d'Habitation, reflects the designs focus on varying collective spaces.

1 - Circularity. The housing units of the Kruisplein project are designed around the concept of the ambiguous floor plan. Each individual room is of the same size, to create equal living conditions for groups of youths living together, such as students, and to enable different interpretations of the floor plan. The design intentionally leaves the placement of bedrooms, living rooms, and dining areas undefined, making the floor plan more adaptable. This adaptability aligns with the principles of circular design by expanding the lifespan of the building through reconfigurability. This *design for adaptability* approach is further supported by Mecanoo in the floor plan drawings. In the drawings, non-loadbearing walls are suggested to be constructed or removed, to change room layouts according to different needs (see figure 43). Beyond this *design for adaptability* approach, the design doesn't incorporate other circularity concepts, focusing mainly on spatial flexibility to achieve a certain degree of sustainability.

2 - Affordability. The program of the Kruisplein was specifically written for youth social housing, so the complex had to be affordable. Cost efficiency was achieved through the use of economical building materials, such as concrete and steel, paired with a smart stacking strategy for the various housing types. By fitting all housing types within a single supporting structure, the design maintains standardisation without sacrificing versatility. Despite the focus on diversity of housing options, the design is limited to seven distinct apartment types. This restraint allows for a more efficient construction process, creating a balance between cost effectiveness and variety. Additionally, the façade consists of simple, standardised materials in line with the modernist design approach, further reducing costs.

3 - Mass production. The Kruisplein projects utilises a standardised, cast concrete construction and a façade

consisting of prefabricated components, making it well suited for mass production. In an early version of the design, the building was less adapted to the surrounding urban environment. Even though this made the design more mass producable and cheaper to construct, this lack of integration with the surroundings was a concern for the jury (van der Gaag 1982). Besides the criticism on the urban design, the plan moved on to the second round of the competition. In the second round, the higher bock was connected to a neighbouring building, and the lower block was rounded to create a smooth transition between the different urban forms surrounding the site (see figure 44). These changes made the building less standardised, but were an improvement for the design overall. This change highlights an issue with mass produced architecture. On the one hand, standardised architecture for mass production can aid in making the building process cheaper, quicker and more sustainable. However, it can generally be said that an important quality of good architecture is a good integration or reaction to a buildings surroundings. Modular, or mass produced, architecture has the risk of seeming out of place in an environment because of a lack of integration.

43 Floor plan of a Kruisplein apartment with identical room sizes, and possible wall dividers.
Drawing. Own work.
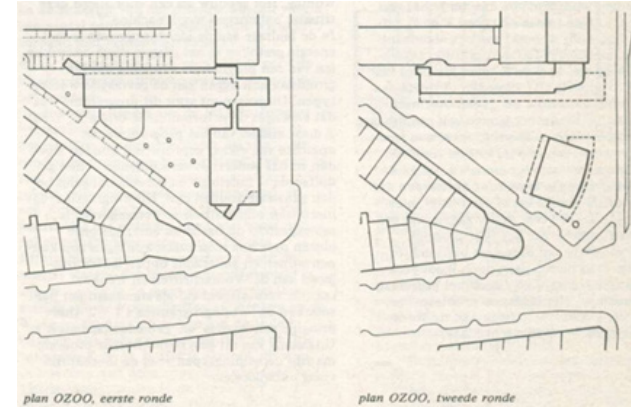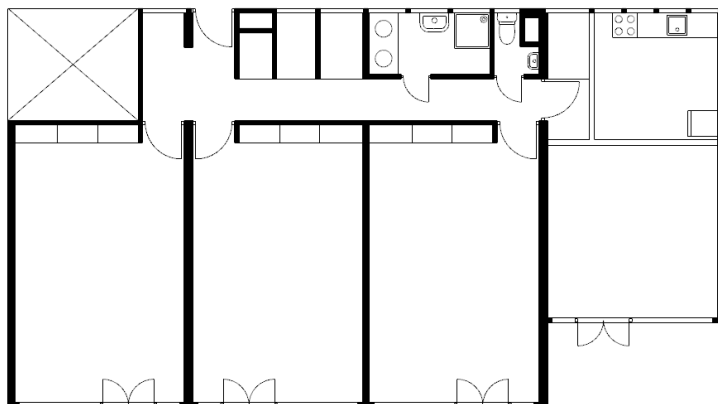
44 Plan OZOO.
Henk Döll, Francine Houben, Roelf Steenhuis. Urban Plan. 1982. OASE Journal.

4 - *Aesthetic coherence.* Mecanoo mentions on its website: "Social housing can – no, must – also be beautiful. The city and its inhabitants should be proud of it" (Mecanoo, n.d.). As said before, the neomodernist style of the Kruisplein housing complex is more versatile in its material and colour use compared to a modernist style. However, neomodernism still borrows from modernism in its use of symmetry and rhythm in the façade, creating a balance between visual interest and readability.

　　A - Visual/spatial diversity. The massing of the Kruisplein complex was changed in the second round of the competition to be more adapted to the urban context. This made the urban ensemble more well designed and visually attractive, but the massing itself is still reasonably simple. The housing complex consists of two massing strips, with the front and back ends of the blocks left as a blank wall. However, today these façades have been decorated with street art (see figure 45). This adds visual interest to the neighbourhood and reinforces its collective identity, especially because the art is made by local artist.

　　B - Individual styles of living. The adaptability of the floor plans of Kruisplein was the main theme of the design project. As mentioned, the floor plans are designed in line with the circularity concept DfA. This spatial flexibility of the floor plan gives people

45 Artworks on the façades of Kruisplein.
From left to right: Astro, JDL street art, Onesto, Maarten Wendrich. Street art. No date. Mooi Rotterdam.

opportunity for their own style of living. An article published on Archined describes a man living in an apartment of the Kruisplein complex throughout different stages in his life (Zeinstra et al, 2024). The different life stages are accompanied by alternative household compositions and living needs. The man, who's a divorced father, moved into the complex in the mid nineties with an acquaintance. They moved into the Z4 apartment type, consisting of three floors, with the main entrance and kitchen on the middle floor (see figure 48). The separation of the apartment into three floors allowed the two housemates some privacy, whilst sharing a large portion of the house. Later, two housemates moved into the two rooms of the upper floor, and the extra room of the lower floor was used for guests, like the children of the man. When the children got older, they went to university and moved to live with their dad on the upper floor. Today the children have moved out again, and two young single starters moved into the upper floor while the man uses the bottom floor as a senior apartment. The adaptability of the apartment is achieved not only by the neutral floor plans with slightly oversized rooms, but also by the combination of privacy and communal living, the availability of two bathrooms, and the large usable staircase landings.

C - Diversity of households. The Kruisplein complex has seven apartment types that vary greatly due to the inclusion of both single floor and multiple floor apartments. The large variety of apartments is made possible by the gallery access type, which is present every three floors. The different floors are then accessed internally in the apartment. The designers of the Kruisplein complex had radical ideas about the housing market at the time, which is reflected in the
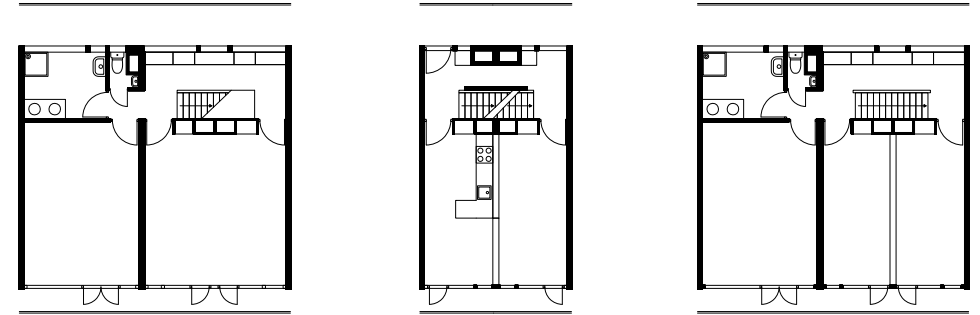

alternative apartment offer of the housing complex. They were of opinion that apartments weren't built to adequately house fluctuating and varying young households. Instead, so-called 'modern patronizing patriarchs' termed young people's households as 'starters' and 'transferring households', implying that these people are only temporarily 'young' and are in actuality yearning for intimate family housing (van der Gaag, 1982, 31).

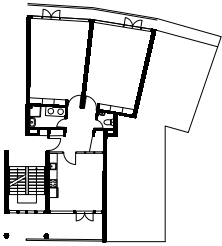**46 Z4 apartment type of Kruisplein, spanning three floors**
Drawing. Own work.

47 Different apartment types of Kruisplein.
Drawing. Own work. based on image from Common Practice.

Y2

Y6

Y2

Y2

Z3
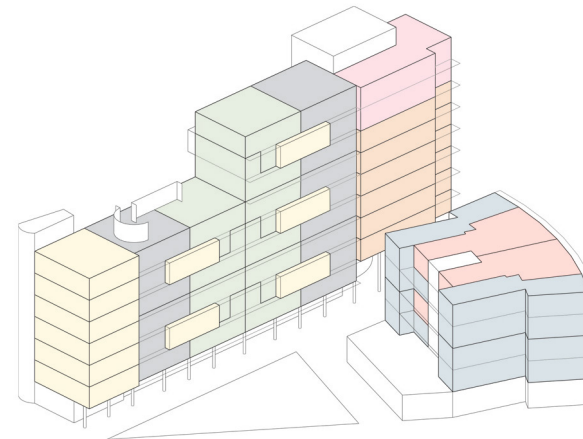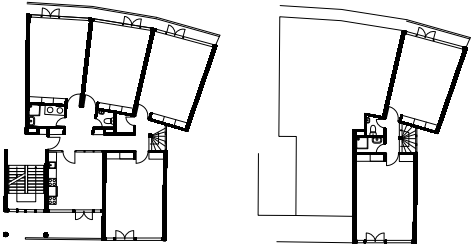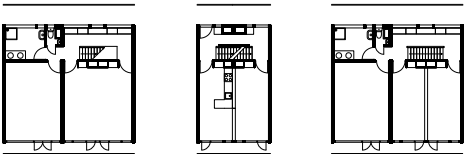
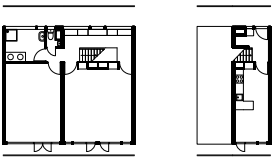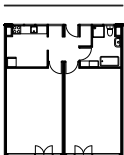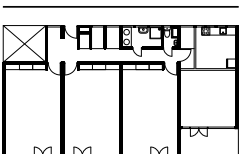48 Different apartment types of
   Kruisplein.
   Drawing. Own work.

Kollhoff & Rapp (1994). Piraeus. Amsterdam.

This project is chosen because it touches on standardisation goals 2, 3, and 4, and versatility goal A, B & C.

49 Het Piraeus gebouw op KNSM eiland.

Photograph. Academie voor Theater en Dans. n.d.

Societal sketch. In 1978 the decision was made to redevelop the former harbour area "KNSM-Eiland" and turn it into a residential neighbourhood. At the time, the area was inhabited by squatters, who influenced the developers to keep certain characteristic buildings in the area, such as the KNSM office (Wikipedia, n.d.). An urban plan was made for the area which proposed to build robust, heavy housing blocks with closed courtyards. The area around the KNSM office would be designed by German architect Hans Kollhoff, and his young assistant Christian Rapp. During the design process of Piraeus, a new spatial policy was implemented to enhance the quality of new housing developments (nota Ruimte voor Architectuur)(Schipper & Enning, 2021). Piraeus is named as one of the projects that gained international appeal for its architectural quality, stimulated by this new policy (Appelman et al, 2016, 46). However, the political influence during the design process was also influenced by the ongoing liberalisation of the social housing sector, which meant that the design goals had to be constantly adjusted (Klaren, 1994, 3).

Architect. Piraeus was design by architects Hans Kollhoff and his assistant Christian Rapp. Christian Rapp came from a brick masonry background, and was a young project architect during his time working on Piraeus. Kollhoff was a more experienced architect, and even though he had a good knowledge of Dutch housing architecture, his German background made him a sort of outsider (Klaren, 1994, 3). As a result, the architecture of Piraeus was more creative and idiosyncratic than standard new development. Today, the website of Rapp+Rapp mentions that their architecture can be typified by its solid appearance with a strong connection to the ground (Rapp+Rapp, n.d.), which holds true for the design of Piraeus.

Architectural style. The design of Piraeus was inspired by a variety of Dutch architectural examples. Firstly, the design uses a combination of portico and gallery access, typical of Dutch social housing design. According to the architects, the sculpted form of the building is a reaction the style of the Amsterdam School (Architectuurgids NL, n.d.), as well as the intricate, crafted detailing of the main entrances to the building. Apart from the main entrances however, the detailing of the building is relatively sober, and the dark brick façades make the building complex appear heavy. These characteristics are in great contrast to the Amsterdam School, which is usually more light-footed, detailed, and meticulously composed. Those more standardised and large-scale features are better categorised as functionalism or "Nieuwe Zakelijkheid". In short, Piraeus cannot be described as having one single architectural style, instead the combination of different styles and inspirations are what give the building its character.

Building description. Piraeus appears to be a very standardised complex when viewed from afar, with repeating rows of the same windows and a limited number of façade materials. The choice of the dark purple brick and the large size of the complex make the presence of Piraeus very strong. It has the heavy, industrial character that is comparable to the harbour

50 Christian Rapp.

Photograph. Rapp + Rapp. n.d.
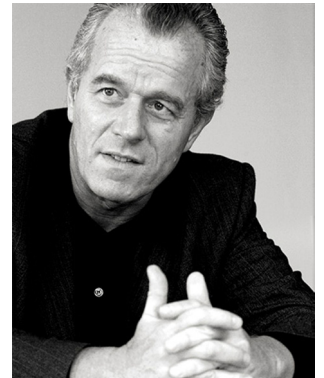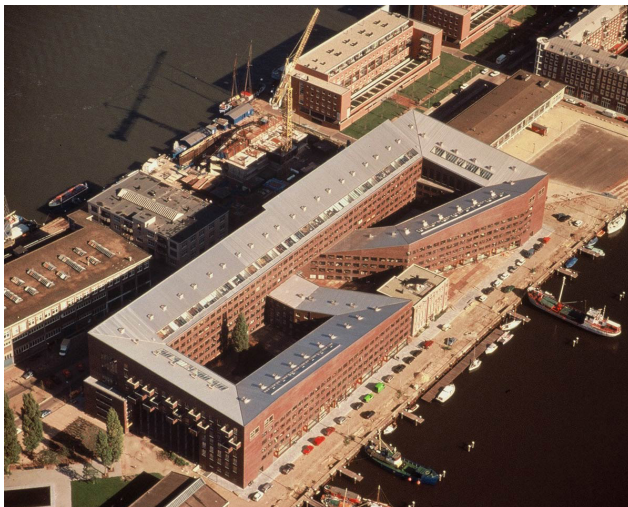

51 Hans Kollhoff.

Photograph. Architectuul. n.d.

buildings that stood before it (Architectuurgids NL, n.d.). However, on closer inspection, it can be noticed that the design has many carefully designed qualities. The building is formed by folding the waterfront façade around the existing KNSM office, which creates an interesting sculptural form. The form is hard to make out from street level, but it does create a variety of interesting outdoor spaces as well as alternatively shaped apartments. Certain details, like the wood façades of the shops placed on the ground floor and the design of the building entrances are designed with craftsmanship. The combination of portico and gallery access allow for a variety of apartment types and a sense of exploration in the complex.

2 - Affordability. The smart cooperation of the architects, the municipality of Amsterdam and the housing association made it possible to financially support the realisation of Piraeus, without too much compromise in its interesting designs qualities (Klaren, 1994, 3). The original program of the building was conventional and unoriginal, but Kollhoff and Rapp managed to change the program in their favour and create a more interesting design. The constant rearranging of the building program required creativity

and flexibility of the municipality and the housing association, which they managed to provide. To collect sufficient funding, the municipality gave extra subsidies, and the client asked for implementation of more expensive apartments in the form of 28 housing units connected to an atelier or workspace. The extra measurements to be able to financially realise the building were given because the municipality believed the project should be an architectural staple and inspiration for the whole KNSM-eiland (Klaren, 1994, 22).

3 - Mass production. To fit a larger variety of apartments and to make use of the available space under the sloping roof more efficiently, Kollhoff and Rapp proposed to add a split level construction (Klaren, 1994, 22). This would be too expensive however, so instead a simple, repetitive concrete construction was chosen for the project. This resulted in a more affordable and efficient construction process. This standardisation made the apartments more comparable, even though the differing ceiling heights and the distortion of the standard due to the sculptural building form still make the apartments considerably different.

4 - Aesthetic coherence. The façade design is repetitive and symmetrical. For example, the waterfront façade features four long rows of windows,

52 Piraeus.
    Photograph. No date. Rapp + Rapp.
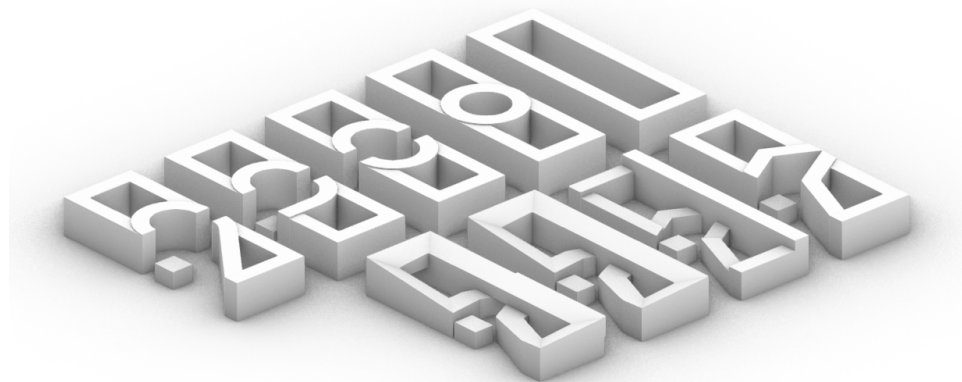
54 Evolution of the massing of
   Piraeus.
   3D model, own work.

all of the same type. For this particular façade, it can be argued that the repetitiveness makes the design less visually appealing. However, in the middle of the building behind the KNSM office, the massing of the building is at its most sculptural and unconventional . In this area, the repetitive façade design helps to make the design more simple and readable (see figure 53).

A - Visual/spatial diversity. Even though the four outer façades of the building are individually relatively standard, they have been designed separately to create more variety (see figure 58). Additionally, during the design process the shape of the building has transformed drastically, from a standard rectangular closed building block, to a complex shape that is formed around the existing KNSM office and an existing garden designed by Mien Ruys (see figure 54). The attention to detail for the design of the entrances and shop façades also make the building stand out (see figure 55). Together these three design choices are what gives the building most of its character and versatility.

B - Individual styles of living. The unusual shape of some of the apartments brings forward another way to design floor plans that stimulate individual styles of living. Because of the variety of room shapes, lighting and ceilings heights, the floor plan requires a certain amount of creativity to furnish. However,

the versatility that is created this way is sometimes also overshadowed by a reduction of living quality of the floor plan. For example, figure 56 shows an apartment that features a larger living room with a bend, which different inhabitants might furnish in completely different ways. This comes at the expense of good lighting of the house, because the amount of windows is not enough for the size of the floor plan – one of the windows also looks directly into the loggia of another apartment. This design flaw does not negate the idea that an unusually shaped floor plan can increase versatility of living styles without compromising on other floor plan qualities.

C - Diversity of households. Piraeus features a total of 150 different floor plans. This is partly due to the program, asking for different varieties of small apartments, as well as a small number of luxurious, more expensive apartments. The variety of basic types can be fit into the building by using both portico staircases and galleries connected to elevators. The different

55 One of the entrances of
   Piraeus.
   Photograph. No date.
   Kollhoff Architekten.
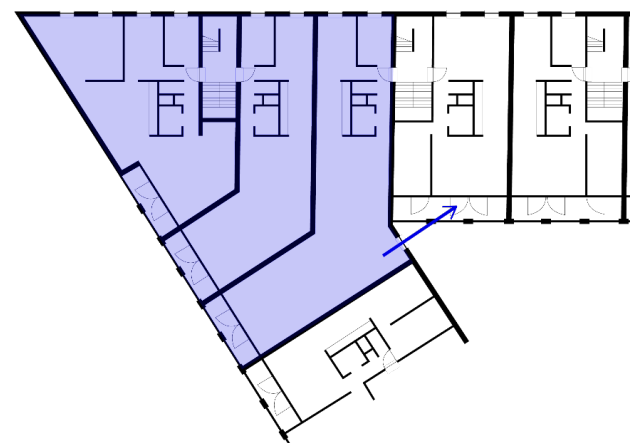
56 Unusually shaped apartments
   require creativity to furnish,
   arrow shows privacy
   issue of this apartment
   composition.
   Drawing. Own work.

access types greatly influence the nature of the apartment, due to where the entrance is located, and due to differences in privacy (gallery access being less private). Interestingly, there are less basic type appartements in the building than there are variations of the basic types. As mentioned before, this is due to the outer shape of the building, which is why there are a total of 150 different types. This is a very large amount, but a lot of the apartments don't differ that greatly from one another.
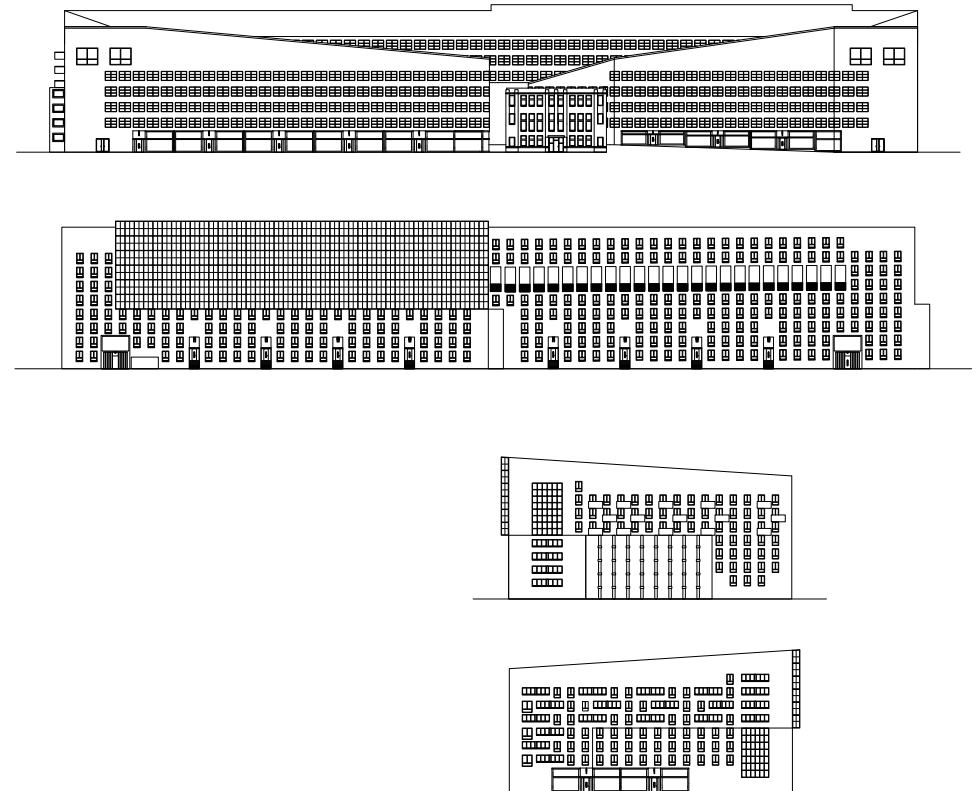
57 Owners of a Piraeus apartment built wardrobes specifically to fit the space.
Dennis Brandsma. Photograph. 2020. VT wonen.

58 Various façades of Piraeus.
Drawing. Own work.

AAUI (2005). De Zilvervloot. Dordrecht

This project is chosen because it touches on standardisation goals 2, 3 and 4, and versatility goal A, B & C.

59 De Zilvervloot.
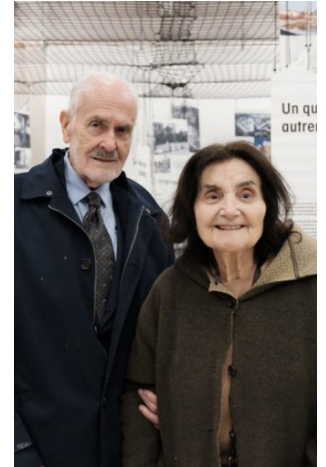Dag Boutsen. Photograph. 2005.

Societal sketch. In 2005, de Zilvervloot was built in Utrecht, designed by Belgian architectural firm AAUI. The housing complex was commissioned to revitalize the neighbourhood it was built in, Wielwijk. Wielwijk is a residential neighbourhood built in the 1960s following the CIAM principles of high rise flats in large open spaces. The neighbourhood had been in decline for a while; some of the flats were uninhabited, many were poorly maintained, the area had to deal with drug nuisance, and the population was homogeneous, consisting mostly of low income people. The people were "involved people, socially concerned with each other, but with little want for integration" (Huisman, 2006). De Zilvervloot would serve as a new centre for the neighbourhood, adding a public square along with multiple facilities to stimulate social interaction. Additionally, the developers hoped to attract households from other income groups to create a more diverse and integrated population.

Architect. AAUI (Atelier d'Architecture, d'Urbanisme et d'Informatique), consisting of Lucien Kroll, Simone Kroll and Dag Boutsen among others, is a firm that emphasizes the importance of participation in the design process. Lucien Kroll is known since 1970s as a "multifaceted, idiosyncratic and anarchistic designer who mobilizes residents with great commitment" (Architectuur NL, 2007). This strong focus on user participation ensures that the architecture of the firm is catered specifically to individual needs of the inhabitants.

Architectural style. The architecture of AAUI cannot be defined by any existing architectural styles. This is also partly the philosophy of the firm. The buildings of AAUI show an essence of chaotic, incremental development, which is achieved by allowing user participation and individual expression of the future inhabitants to lead the design process. This participation combined with the architect's personal ideas about vernacular building materials and complex forms result in architecture that is complex, versatile and profoundly non-homogenous (Boutsen, 2022). To an extent, the architecture of AAUI can be seen as a political statement, which is discussed in an article published in the Journal of Architectural and Planning Research. The article argues that AAUI's architecture deliberately clashes with the environment to challenge existing political, social and economical inequalities that are experiences by people living in social housing (Schuman, 1987). By allowing a great amount of participation, the architect also empowers lower income households to have more influence on the housing market.

Building description. De Zilvervloot is a large housing complex, consisting of 50% social housing, 25% middle-income housing and 25% luxury housing (Robinson, 2015). The complex contains two courtyards, one that is private and one that is public lined with commercial spaces. De Zilvervloot looks architecturally excessive; its form seems almost random, and a large amount of differing façade components, materials and colours have been used. The building uses multiple access options, like portico stairwells, galleries and corridors, which allows for a large variety of apartments.

60 Simone et Lucien Kroll.
Photograph. Alban Van Wassenhove. 2020.

61 Dag Boutsen
Photograph. VRT. n.d.

2 - Affordability. The project was a financial gamble, because there was insecurity about whether the luxury and middle-income apartments would be sold. The concern was that the existing negative image of the Wielwijk would deter these income groups, which later turned out to be the reason for a delay of the apartment sales. However, because the Zilvervloot was seen as the catalyser for the redevelopment of the neighbourhood, the housing association and municipality took higher risks and aimed for smaller profit margins. Woondrecht, the housing association of the Zilvervloot gave large discounts for the first buyers of the apartments, upwards to 25% of the market price (Huisman, 2006, 34). Luckily, the project eventually turned out to be a success for both the inhabitants and the city.

3 - Mass production. The Zilvervloot makes use of the open building concept developed by John Habraken. The building uses a concrete construction with a very wide grid of 8,10 meters (see figure 63) (Architectuur NL, 2007). This large size allows for many variations of the infill, as well as multiple façade elements. This image shows that the façade contains a limited number of prefabricated windows. The windows are distributed randomly, which creates the illusion that each window is completely different.

63 Grid of De Zilvervloot.
Drawing. Own work.

62 Zilvervloot.
Photograph. Hans Jan Dürr.
2018. Flickr.
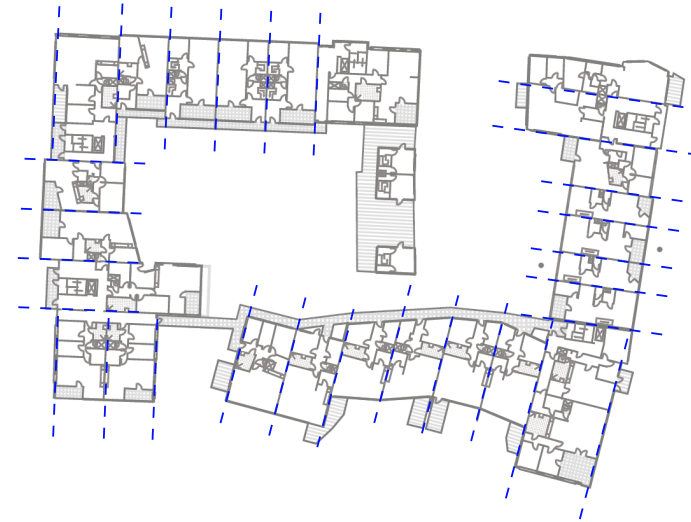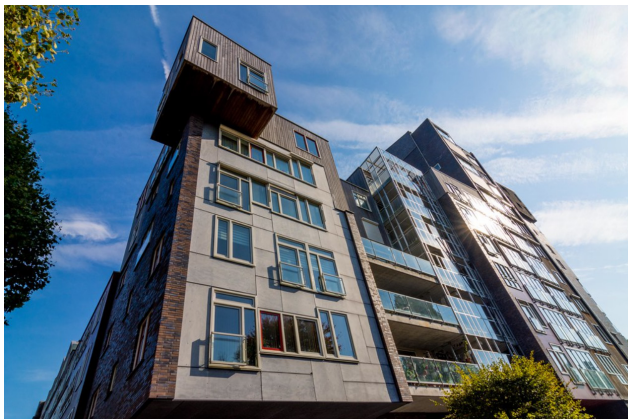
4 - Aesthetic coherence. The design of de Zilvervloot does not form an aesthetically coherent total image. It can be argued that the theme of non-homogeneity and chaos is consistently applied, which creates a certain thematic coherence. However, that is not the point of the architecture. Instead, the Zilvervloot is a direct visual representation of its inhabitants, which makes the architecture feel more human compared to post-war social housing. As mentioned before, the direct contrast of this appearance compared to the surrounding post-war architecture is very deliberate, and is meant to invoke questions about what social housing should be. The people inhabiting the complex are diverse, so why should they live in buildings that hide or even supress that individuality?

A - Visual/spatial diversity. De Zilvervloot is very diverse in bot hits visual appearance and spatial composition. The façades are designed with a large amount of different materials and façade elements, including windows, loggia's and balconies. The roofline is rarely straight, and the façades have varying depths. The massing of the building is made more diverse by using a wooden construction on top of the

more standard concrete construction. The wooden construction allows for greater flexibility of form, which is expressed on the upper levels of the complex.

B - Individual styles of living. Throughout the design process, multiple participatory workshops were held with the future inhabitants. This resulted in apartments that are specifically catered to individual people, allowing them optimal freedom in their own style of living. The floor plans aren't designed for adaptability though. The specificity of the apartments has the indirect consequence that future inhabitants might not find the housing perfectly suitable for their needs. Still, the large variety can also turn this question of style the other way around. Instead of being able to have a complete freedom of individual style, inhabitants can also barrow their identity from their apartment and position in the building.

C - Diversity of households. De Zilvervloot offers apartments for all income groups; 50% of the apartments are for lower-income, 25% are for middle-income, and 25% are for higher-income. The apartments differ greatly from one another, depending on their position within the complex.

64 Aerial view of De Zilvervloot.
Photograph. No date.
BuurtAED.nl.

65 Western façade of De Zilvervloot.
Drawing. Own work.

66 Western Façade of De Zilvervloot.
Drawing. Own work.

The different colours show windows of the same type.

VMX Architects (2010). Ithaka. Almere.

This project is chosen because it touches on standardisation goals 2, 3, and 4, and versatility goal A & C.

67 Aerial view of Ithaka.
Photograph. VMX Architects.
n.d.

Societal sketch. Housing complex Ithaka is located in Almere. Today, Almere is about 45 years old, and during that time the city's population grew to a total of 220.000, making it the fastest growing city in the Netherlands (Gemeente Almere n.d.). This quick growth required a lot of planning to make it successful. One interesting aspect of the development of Almere is that the city strongly encourages co-development between project developers and future inhabitants (VMX Architects, n.d.). This results in new housing that is more flexible, and customised to the individual needs of the inhabitants. For the case of Ithaka, this participatory development helped shape the building's design.

Architect. VMX Architects describe themselves as "socially committed architects" (VMX Architects, n.d.). Their strong focus on designing buildings not only for, but also with their clients, helps make the architecture more suited to their locations and contexts. Instead of creating completely standardised architecture, the architecture becomes versatile due to its adjustment to social and geographic contexts. The project developer of Ithaka, Edwin Oostmeijer,

confirms this in an interview in a DASH article (Frijters & Klijn, 2018, 50). In the interview, Oostmeijer mentions he is of the opinion that generalizations are passé, and housing should be designed in collaboration with the inhabitants.

Architectural style. Ithaka has a minimalistic and functionalistic style. The exterior of the building is spatially determined by the composition of the interior housing units and the shape of the site. Visually, the building is very minimal, consisting of a sand-coloured brick with simple windows.

Building description. Ithaka is a U-shaped building, formed around a large communal garden. The height of the building varies between two and five stories, and is lower towards the interior. A lot of the apartments are connected to the ground floor, creating a direct connection between the interior and the exterior. The façade consists of sand-coloured bricks with an excessive amount of mortar which flows out to the

68 VMX Architects.
Photograph. VMX Architects.
2023.
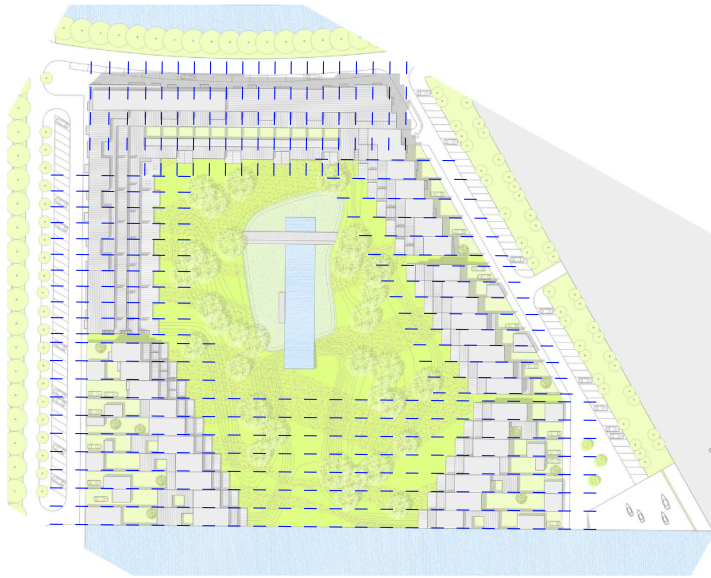
69 Structural grid of Ithaka.
Drawing. Own work, using image of VMX architects.

side, creating an interesting pattern of texture and shadow.

2 - Affordability. In the DASH interview, Oostmeijer mentions that "in the Ithaka project demand and supply go hand in glove" (Frijters & Klijn, 2018, 48). This balance of demand and supply also ensures a balance between standardization and versatility. The architects designed a limited number of different spaces of different use – the supply – and allowed the future residents to choose a combination of these spaces based on their personal needs – the demand. Choosing to provide a limited supply of building elements that can be organized in various ways makes the complex more affordable without sacrificing versatility.

3 - Mass production. As mentioned, the limited amount of spaces also limits the amount of specific requirements for the construction of the building. Additionally, the construction has a simple grid that is rarely deviated from (see figure 69).

4 - Aesthetic coherence. The simplistic style of Ithaka makes the complex appear aesthetically

coherent and calm. This is achieved by the use of one single façade material – brick – and the repetitive structure of the building. The simple appearance of the building emphasizes the natural design of the collective garden, creating a contrast between the repetitive man-made form and the spontaneity and versatility of nature.

A - Visual/spatial diversity. The visual appearance of Ithaka is very standard, apart from the unusual choice to lay the brickwork with an excessive amount of mortar. The mortar leaking out between the seams creates a visual interest in the façade when viewed up close. The spatial composition is less standard, because the building gets its form from the large diversity of housing units of varying sizes. This results in a building that has different heights and depths, placed along the edges of the site. The spatial composition is still very readable, because the standard grid can be easily recognized from the outside. The interior courtyard of the complex is an integral part of the whole design. Oostmeijer is of the opinion that the quality of a house is formed largely due to its connection to its context, the transition and contact between the inside and outside (Frijters & Klijn, 2018, 52). The courtyard of Ithaka is design by Ronald Rietveld and features natural flowing paths

70 Close up of the façade of Ithaka.
Photograph. No date. VMX architects.
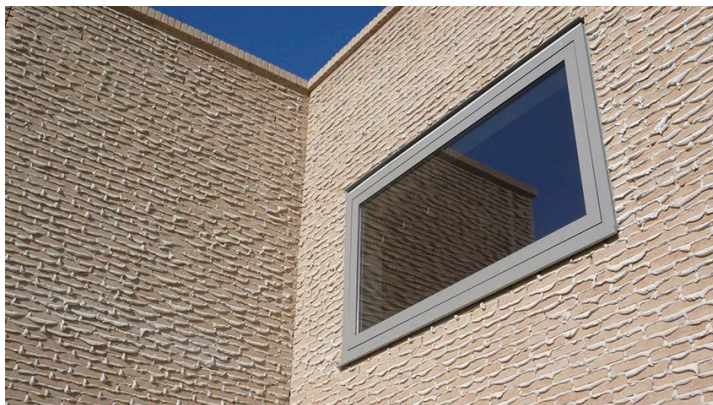
and a shared swimming lake. The inner garden greatly enhances the living quality of the block – which was a convincing factor for some of the inhabitants to move in (Frijters & Klijn, 2018, 52) – and underscores the positive impact an exterior space can have on living experiences in housing complexes. A standard housing complex can become more versatile with the addition of well-designed outdoor spaces.

    C - Diversity of households. Ithaka was specifically designed in collaboration with the future inhabitants. This has resulted in a large variety of apartments and the corresponding households that live in them. Oostmeijer emphasizes that this collaboration with specific individuals helps to create housing that is suitable for households other than the standard family household. Coming in contact with the future inhabitants of a housing complex also shows the true demand, specific to each location. As Oostmeijer said: "It's no longer about averages, it's much more about niche markets, I think" (Frijters & Klijn, 2018, 50).
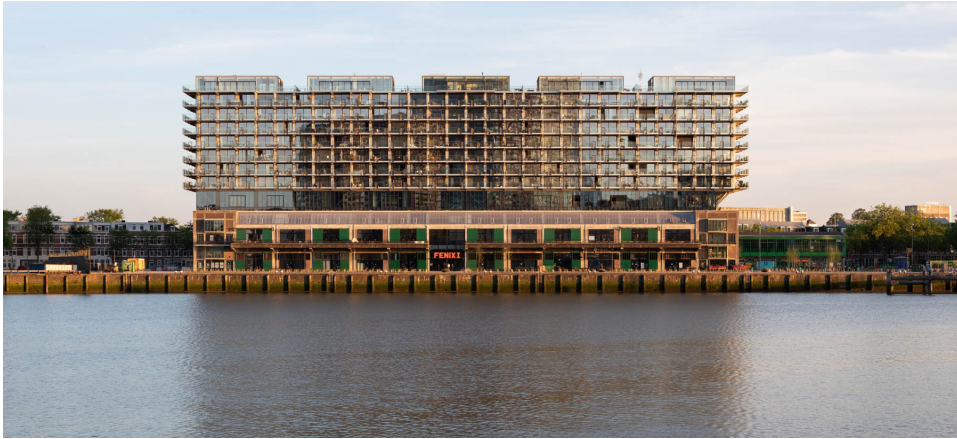
71 Close up of the façade of Ithaka.
Photograph. No date. VMX architects.

72 Different floor plans of Ithaka.
Plan. No date. VMX architects.

MEI architects and planners (2019). Fenix I. Rotterdam.

This project is chosen because it touches on standardisation goals 1, 3, and 4, and versatility goal A, B & C.

73 Fenix I.
Photograph. B van Hoek. n.d.

Societal sketch. Fenix I is a housing complex that is built on top of an existing industrial storage building. The first storage buildings that existed on the site were named the 'Fenixloodsen,' built in 1922 for the Holland Amerika Lijn (Rotterdam Architectuurprijs, n.d.). During the WWII bombings of Rotterdam, the storage building was destroyed, and rebuilt in two parts in the 1950s. The two storage buildings were called Fenix I and Fenix II, which is were the 2019 projects owes its name. During the 80s, the harbour of Rotterdam expanded towards the East, and the Fenix I and II became unused. Starting from 2007, the municipality started the redevelopment of the docks, and to preserve the maritime heritage of the area Fenix I and Fenix II remained. Instead of demolishing, the buildings had to be redeveloped. MEI architects and planners won the architectural competition for this redesign.

Architect. MEI architects and planners are a multidisciplinary and international team that work together on a wide range of projects. One interesting aspect of MEI's design vision regarding the topic of this thesis their progressive focus on circularity, which is apparent in many of their buildings.

Architectural style. The style of Fenix I is defined as 'metamodernistic' in an article published in a journal on architecture and heritage (Danilova & Bakshutova, 2021). Metamodernism is a contemporary architectural style which is defined by the appeal to traditional cultural ideas in order to find contemporary inspiration. More specifically, Fenix I falls in the retrospection level of this style. The article describes that the adaptation of industrial heritage is a relatively new practice. Industrial heritage has a certain experience that inspires designers in their redevelopments, often with emphasised contrasting combinations of old an new as a result.

Building description. Fenix I consists of three connected parts. At the bottom is the existing storage building, a concrete structure with large gates. On this level cultural and culinary facilities are housed. The second part is the connection between the existing building and the newly constructed housing complex above. This part is built using an enormous steel structure, above which the third part is constructed. The third part of the building is a large closed building block, with apartments centred around an inner

74 Team MEI.
Photograph. Ossip. 2021.
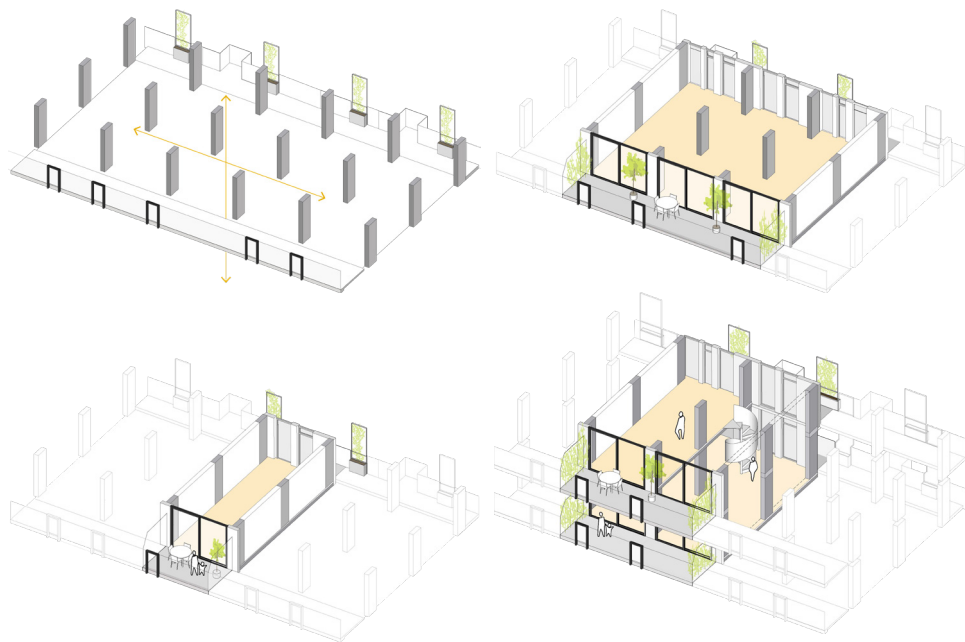
75 Diagram of the DfD approach of Fenix I.

Diagram. No date. MEI architects and planners.

courtyard which sits on the roof of the existing building. The apartments are accessible via galleries.

1 - Circularity. The design of Fenix I follows the circularity principle of Design for Disassemby (DfD). This design principle allows for differentiation, reparability and changeability of the housing units within the complex. The flexibility is achieved by making use of the open building concept (MEI Architects and Planners, n.d.), as theorised by John Habraken (see figure 75). The load-bearing construction of the building is designed to be as open as possible, with many predetermined connection points for service shafts and fuse boxes. Besides being a sustainable approach to building, this allowed the designers to efficiently fit different types of apartments in the complex. Additionally, a large amount of the higher-income apartments were put together by the individual buyers. They could create

their own preferred composition within a loft space of two floors. This enables the inhabitants to make room divisions based on their needs, in some case the inhabitants would choose to add a mezzanine in the apartment. The scale of this individual design freedom and circular building approach is a unique concept in Europe (MEI Architects and Planners, n.d.).

3 - Mass production. The DfD approach applied to Fenix I is most beneficial when the structure is standardised. This way interior dividers, façade elements and services can be prefabricated with predetermined sizes and connections. The design of Fenix I is standardised with a repeating structural grid to make this possible.

4 - Aesthetic coherence. The façade of the newly constructed section of Fenix I is highly symmetrical and repetitive. Despite the building's interior offering a diverse range of apartment types, this variety is not visually expressed in the façade or overall massing, except for the penthouses on the roof.

A - Visual/spatial diversity. The repetitive appearance of the newly constructed part of Fenix I might be visually uninteresting on its own, but in combination with the existing redevelopment of the storage building it becomes more appealing. Robert Winkel, architect at MEI mentions that "we are not looking for contrast, but a fusion of the existing and the new construction" (Architectenweb, n.d.). Still it remains true that there is a contrast between the old and new that brings forward a distinctive atmosphere. The inner façade is designed differently from the outer façade, featuring white concrete and wood. The galleries also have been designed to incorporate flowerbeds. This creates a more friendly ambiance than the more industrial exterior.

76 View of the interior courtyard of Fenix I.

Photograph. Marc Goodwin. MEI architects and planners. n.d.

B - Individual styles of living. The floor plans of the apartments in Fenix I are designed with distinct separation between the more private rooms (bedrooms and bathrooms) and the shared rooms (living room, kitchen, dining room, study/work). Whereas the private rooms are divided to separate personal spaces, the shared rooms are designed as one large open space. This means that the furnishing of this space remains ambiguous. Different people will make use of the large space in different ways, creating a versatile living environment within a given standard.

C - Diversity of households. The first three layers of Fenix 1 consist of around 80 lower income social housing units. These units don't have much variation. The upper levels, featuring apartments for higher income households, have much more flexibility and personalisation. Winkel mentions that almost none of these 130 loft apartments are the same (Architectenweb, n.d.). In this project it is notable that the versatility of the floor plans exclusively holds for the higher income households.

77 Examples of open floor plans in Fenix I.

Drawing. Own work.

Conclusions

The conclusions of this thesis are organised around the research questions, starting with the subquestions.

1. "What are desirable elements of standardisation that support efficiency, functionality and sustainability of a large-scale social housing complex?"

Standardisation in housing design serves multiple purposes, but for contemporary housing, its benefits can be summarized in four key values: circularity, affordability, mass production, and aesthetic coherence.

Fenix I by MEI architects & planners exemplifies the underlineof circularity approach *Design for Disassembly*. The building's standardised, open structure - first theorised in the 20th century by Habraken - allows for differentiation, reparability and changeability of the housing. Similarly, *Kruisplein* by Mecanoo demonstrates the circularity approach *Design for Adaptability*. Its spacious, open layouts accommodate a wide variety of household types and functions, ensuring long-term utility.

When it comes to affordability and mass production, *de Eendracht* by Jo van den Broek stands out as an example. Though the original plan to replicate the design along the street was not realised, the efficient use of floor space and the consistent quality across apartments show a clear focus on cost-effectiveness and scalability.

Aesthetics, while often viewed as subjective, are also shaped by standardisation to create coherence. In most cases, standardisation tends to simplify visual and spatial composition, making it more cohesive and comprehensible. For instance, architects of the Amsterdam School used the rules of the 1901 'Woningwet' (housing act) - such as the requirement to visually express the location of staircases - as identifiable and repeated elements in their richly detailed façades. Architects of the 'Nieuwe Bouwen' instead showcased materials and construction techniques in their purest forms, resulting in rhythmic patterns and symmetry across the façades and massing of their buildings.

2. "To what extent can a large-scale social housing complex create a cohesive, yet visually and spatially diverse environment that reflects the unique identities of its users?"

There is no straightforward answer to this question, as architects have an almost limitless range of approaches for creating housing complexes that balance cohesion with visual and spatial diversity. However, it can be argued that cohesion and diversity are on a spectrum, with some architects prioritizing simplicity and clarity in their design, while others embrace variety and surprising details.

For example, the façade of *Fenix I* is complex yet highly standardised and rhythmic. Although the building houses a large diversity of apartment types, this internal variety is not visually reflected in the façade or massing of the building, apart from the penthouses on the roof. In contrast, *De Zilvervloot* by Dag Boutsen and Lucien Kroll, is an extreme example of this visual representation of the inhabitants. Its façade features a mix of materials and compositions, and its massing is highly varied, resulting in a somewhat disorganised appearance. Another example is *'t Schip* by Michel de Klerk, which takes a different approach by symbolizing the collective identity of the working class, rather than representing its individual inhabitants.

3. "To what extent can a large-scale social housing complex stimulate and accommodate individual styles of living?"

To address this question, the design of the floor plan is particularly relevant. In the literature study, two main types of floor plans aimed at accommodating individual living styles were identified, the flexible floor plan and the neutral floor plan.

The *flexible floor plan* – as it is implemented in *de Eendracht* – although theoretically well-suited to this purpose does not inherently stimulate creative living. In *de Eendracht*, the use of flexible elements is required for making the floor plan function as intended. The design features a separate day and night layout, which can only function through predetermined arrangements. While flexible floor plan elements can theoretically enhance individual living style, they work best in areas of the home or building complex that are not essential to basic living functions.

The *neutral floor plan idea*, implemented in *Kruisplein*, provides greater freedom. The spacious, undefined rooms allow residents to decide how to use the space - whether as a bedroom, living room, or study. This way, individual ways of organizing the homes are encouraged.

A third way to accommodate individual styles in a social housing complex does not involve the floor plan, but the introduction of common spaces. The more diverse and multifunctional the common spaces are, the more freedom residents have to use them in ways that suit their personal preferences and needs.

4. "To what extent oppose/strengthen aspects of standardisation and versatility each other in a design for a large-scale social housing complex?"

This question highlights the implied paradox between standardisation and versatility, a conflict that indeed exists. From the historical research, we learned that views on this topic are heavily influenced by the economic and political context of the time. Periods of economic deficits and housing shortages often result in a strong focus on standardisation, typically at the expense of versatility and general quality of the housing.

However, some design strategies, like the circularity approaches Design for Disassembly and Design for Adaptability have positive implications for both standardisation and versatility. These strategies allow housing to be efficiently mass-produced at relatively low cost, while still maintaining flexibility for adaptation to different needs (both at the time of construction and for possible future changes). Additionally, there are ways architects can make creative use of standardisation that in fact enables versatility, as seen in Habraken's ideas of the open structure, where a standardised frame allows for versatile infill.

After addressing the four subquestions, we now turn to the main question of this research: "How can a large-scale social housing complex with standardised elements still be versatile?"

This question does not have a single definitive answer. Throughout the research, multiple case studies were analysed, each addressing different ideas regarding standardisation

and versatility. As mentioned before, this topic was already relevant a century ago when mass housing started to emerge, and remains relevant today. Architects have developed various strategies to address specific challenges at the intersection of standardisation and versatility. While some strategies are more effective than others, they all express the personal views of the architect on the topic. The diversity of approaches throughout history suggests that the stance an architect takes on this matter is not only based on finding and substantiating a single solution, but is also largely shaped by societal context and personal interests and opinion.

That being said, there are some key strategies identified in this research. One successful approach is the use of modular, neutral floor plans, which allows residents to organise their homes individually, without sacrificing important benefits of standardisation. Another approach is the concept of 'open building,' a standardised structure that allows for versatile infill.

The issue of how aesthetics are affected by standardisation remains complex. Aesthetics are subjective, and architects find beauty in both simplicity and functionality, as well as in diversity, detail, and human imperfection. Notably, standardised ornamentation was absent in the case studies that were analysed. No examples of such standardised ornamentation were found, and perhaps do not exist since standardisation would remove beautiful specificity and variation.

Standardisation enables societies to create large-scale social housing as a social service, ensuring access to high quality housing for all types of income. Thus, standardisation should not be viewed as a constraint, but instead as a means to create a foundation for flexibility and adaptability, resulting in more versatile, higher quality housing for everyone.

Looking ahead, the exploration of effectively implementing versatility in housing with elements of standardisation will need to be continued. Architects should strive to find new ways to create living environments that are sustainable, affordable for all income groups and efficient, while also being spatially and visually beautiful and reflective of the diverse identities and needs of their inhabitants.

Reflection

While searching for a research topic, I was driven by a simple dream: to create beautiful housing. However, as I reflected on how and why I wanted to achieve this, I quickly realised that the dream was far from simple. When I first defined my research topic – initially called *standardisation & individuality* – I was motivated by a certain frustration. I found much of contemporary housing boring, even ugly, due to standardisation and a general lack of creativity. This raised the central question of my research: why are so many new developments so standardised, and how can we make housing more beautiful, diverse, and suited to different styles and individuals?

As I delved deeper into my research, I came to appreciate the benefits - and even the beauty - of certain forms of standardisation, which shifted my perspective to a more nuanced view. What surprised me most was discovering that this debate has been ongoing for a long time. In fact, nearly every architectural project, especially in housing, engages with this paradox in some way, though not all architects may actively seek answers to it. Looking closely at my case studies, I learned to love aspects of all the projects I examined.

In the case of 't Schip I was surprised to find standardisation; initially I had chosen the project as an example of ultimate versatility. The opposite happened with the case of de Eendracht; I found unexpected subtlety and beauty in the façade and floor plan design, which set it apart from the typical portico flat. Another memorable moment was during a group excursion to Amsterdam, where I didn't really understand why Piraeus was regarded as a great architectural work while viewing it from across the water. What I saw was a large, dark façade with monotonous rows of windows – certainly not helped by the rainy weather. When we biked towards it to have a closer look, I began to understand its design, and during further research, I even found myself dreaming of owning one of its apartments. All of this goes to show that these projects are all examples of beautiful housing, even though they have very different qualities.

Over the summer, I reflected on my work and realised the need to change the title of my thesis. 'Individuality' initially came from my striving to create housing that could fit *individual* styles and households. I found 'versatility' to be stronger, as it avoids connotations of loneliness, isolation or disconnection. In the current time, I think its important to promote togetherness and connection, whilst creating and stimulating versatility.

(for a formal reflection based on the graduation manual guidelines see page 118)

Relation between research and design

In addition to conducting theoretical research on standardisation and versatility, I also developed a design project to further explore this topic. The project is set in Amsterdam's Minervahaven, an area where a large number of industrial storage buildings are planned for demolition to make way for new, high density housing. Given the scale of the redevelopment, my design intends to create a city that can function on its own, with integrated work and living facilities – ensuring that the area remains vibrant throughout the day, rather that becoming a purely residential zone that would be deserted during working hours.

For this design project, I took inspiration from my research paper. In this section of the graduation report, I will evaluate my housing project by applying the standardisation and versatility goals established for the analysis of the case studies.
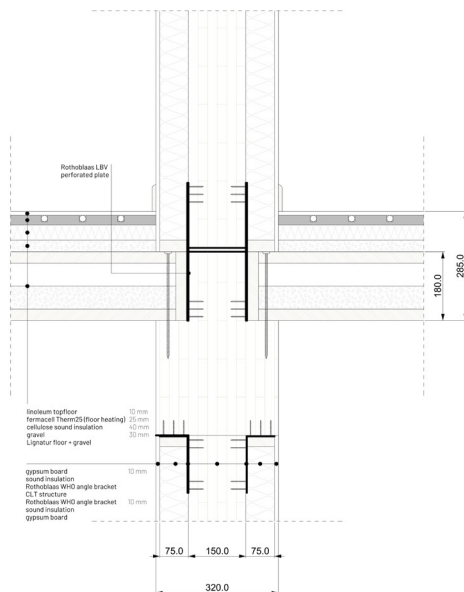
Circularity

To increase the circularity of the design, I implemented principles from both the *Design for Disassembly (DfD)* and the *Design for Adaptability (DfA)* approaches.

Design for Disassembly. Several interventions were implemented to enable disassembly. The structure is built using standard CLT components, allowing for deconstruction if needed. The façade combines wood, recycled corrugated sheets from the former industrial storage buildings, and Nabasco panels - lightweight façade panels made primarily from biobased waste streams. These materials can be removed for repair or reuse. To replace traditional cast concrete screed floors, the design uses a product called Fermacell, a more easily dismantled alternative. Two elements of the building are not designed for disassembly. The basement is constructed using cast concrete to ensure water tightness and structural stability. The roof, made from bitumen, is another exception, as (to my knowledge) there are currently no flat roofing materials on the market that support disassembly.

Design for Adaptability. The project also integrates DfA principles in the design of the floor plans. The individual rooms in apartments are intentionally left open for interpretation of what the function should be. Two variants of ambiguous floor plans are discussed in this research. The first features rooms of uniform size, allowing users to assign a variety of functions freely. However, I believe that identical room sizes alone do not meaningfully impact the living experience. Instead, I adopted the second variant, which introduces variation in room size, lighting, form and orientation, still without assigning deliberate functions to these rooms. In this case, the unique characteristics of each room enable highly specific and personal uses.
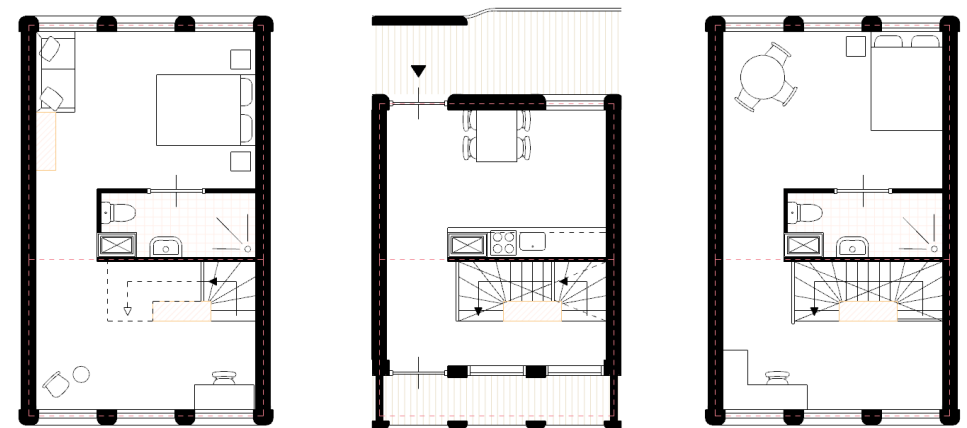
Affordability & mass production

In order to make the design more affordable, I implemented the following strategies from the research.
High density & large-scale standardisation. The first approach to maintaining affordability was designing a standard urban plan for the entire site of the Minervahaven. I propose a relatively high-density development that utilises standardised structural components throughout the area. The site conveniently sits at the waterfront of the Amsterdam harbour, so modular building parts could be prefabricated off site to reduce costs. I suggest that different architects could design individual buildings in the area, balancing design freedom and versatility with constraints set by the standardised, modular structural framework, and the urban scheme. The aim of this approach is to promote efficiency and cost-effectiveness while allowing for architectural diversity. The scale of the redevelopment area is large enough to set up prefabrication for long-term cost efficiency and reduced labour cost. This approach to standardisation and prefabrication could be scaled to other locations, which could benefit not only from the cost efficiency, but also aid in the circularity transition.

80 Standardised CLT system for prefabrication.
Drawing. Own work.

The three sizes of rooms allow for great design freedom and versatility.
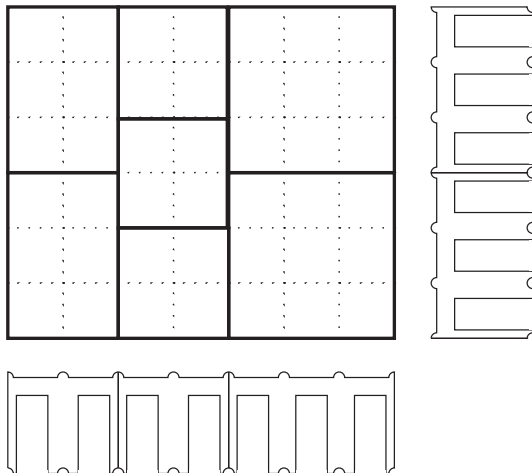
Combination of lower and higher income apartments. Integrating lower-, middle-, and higher-income apartments within the design contributes to a more diverse and versatile housing complex. While my primary motivation for this approach is to enhance social diversity, it also plays a financial role. Income from middle- and higher-income units can help subsidise the cost of more affordable housing, making social housing projects more feasible and of higher quality.
Balance between simplicity and versatility. The design is based on a structural grid with three standardised room sizes, built using prefabricated CLT components. These standard dimensions help reduce material waste and streamline construction, improving cost efficiency. By limiting deviation from the grid, this approach aims to maintain both simplicity and versatility, allowing for design freedom without compromising financial feasibility.

Aesthetic coherence

The beforementioned balance between simplicity and versatility not only contributes to the affordability of the project but also ensures a balance between aesthetic, visual interest and coherence. The strict structural grid used in the design translates directly to the massing and façade design possibilities. The visual readability of this grid makes the design more rhythmical, helping to make the appearance more aesthetically coherent. Furthermore, the standard grid allows for the use of modular façade elements, offering opportunities for customisation within a set framework. To prevent monotony, I made sure to also create visual and spatial diversity, which I elaborate on in the next section.

Visual/spatial diversity

Visual variety. To add visual variety, I used a variety of façade materials, namely reused corrugated sheet metal, Nabasco panels and wood. The Nabasco panels and wood come in various colours. The façade also has three different window types, and a variety of protruding elements, such as balconies, French balconies, and verandas on the bottom floors. Another

aspect that makes the design more versatile, is that the four outer façades of the building have been designed separately.

Spatial variety. The spatial variety of the building is shaped by incorporating a variety of urban and private spaces. The building incorporates multiple courtyards, each with varying levels of public accessibility. The concept of a city consisting of connected courtyards and alleyways aims to evoke a sense of curiosity, encouraging exploration. Each courtyard offers unique qualities, enhancing the experience of moving through the city.
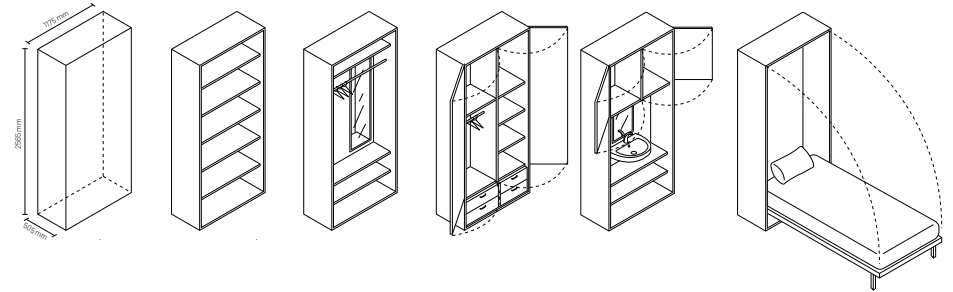
The urban spaces are organised along three primary routes; long streets with easy access to urban facilities such as shops, cafés, restaurants, and cultural and recreational facilities; the courtyards that are designed to be tranquil and enhance urban biodiversity; and the rooftop route, which connects the buildings and offers an elevated view of the city. These three routes provide residents with different ways to live in the city, catering to a range of individual preferences.

In addition to the versatility of the urban spaces, the spatial variety of the design is further enhanced by the sculptural approach to the building's massing. While the overall structure follows a standardised structural CLT grid, certain sections are shaped to include slanted roofs with varying pitches. The arrangement of the building also introduces multiple gateways, inviting exploration and enhancing visual interest.

Individual styles of living

The design choice for the ambiguous floor plan, as discussed in the circularity section, enhances the personalisation potential within the apartments. In addition to the ambiguous floor plan, two additional features have been implemented to allow for individual styles of living.

Interchangeable built-in elements. Each apartment includes one or more designated space for prefabricated built-in elements such as a cupboard, coat rack, wardrobe, foldout-bed or foldout-desk. These modular elements allows resident to modify their space to suit their lifestyle and needs, creating a more personalised environment.

Flexible common rooms. The building also features shared spaces designed to support diverse activities. A large, multifunctional common room is centrally located within the complex. This space is equipped with extra soundproofing and tile flooring, making it suitable for various uses, including hosting parties, practicing music, doing art activities, watching movies – all without disturbing other inhabitants. In addition to the larger common room, smaller, more flexible common rooms are distributed throughout the building. These smaller rooms are designed using principles from the flexible floor plan, incorporating movable walls and fold-out furniture.

While flexible elements like movable walls are often impractical for essential living spaces due to issues like poor soundproofing, higher costs and impracticality, they are well suited to these communal areas. Here, the goal is to offer versatility and space efficiency for a range of non-essential uses. The flexible common spaces include laundry rooms, guest rooms, game rooms and shared workshops. Different residents can

81 Maquette showing the materialisation of one of the interior courtyards.
(WIP) Maquette. Own work.

82 Interchangeable built-in units.
Drawing. Own work.

make use of these spaces according to their individual needs and activities. This variety in shared spaces further support diverse lifestyles within the building.

Diversity of households

The design features a range of apartment types, ranging from small to large. Besides the size difference, the apartments offer possible housing for alternative household compositions, besides the standard family. Other living possibilities include intergenerational housing, co-parenting apartments and friends apartments.

83 A few examples of the many
   apartments in the complex.
Drawing. Own work.

Final reflection

In addition to my reflection on page 108, in which I reflected on my personal journey and development during the graduation process, I will shortly answer the questions below, taken from the graduation manual.

1. How and why did my approach work/not work? To what extent?

My research consisted of a literature study followed by an analysis of case studies. These methods allowed me to explore the relation between standardisation and versatility in housing design. I came to realise that my initial understanding of the interplay of these two concepts was false. The research helped me nuance my view and position on the topic. This helped to inspire my design and formulate my conclusions, see figure 4 on page 13.

2. Reflection on feedback.

Discussions with my supervisors, with their experience and expertise in housing design, have been of great help. After my P3, one main point of feedback for my research was that the word 'individuality' (my research was initially titled standardisation and individuality) did not accurately cover my aim. Instead I redefined it as 'versatility,' which sharpened my thinking about the paradoxes between standardisation and versatility.

Regarding the architectural design, the conversations with my tutor have helped my understanding of 'soft' concepts of housing design qualities. For example, how something as simple as the placement of a bathroom in a floor plan can greatly affect the quality of the living experience. It was insightful to talk about these subtle, intangible, yet universal qualities of architectural design.

In my experience, the curriculum of Architecture and the Built Environment gives little aid in the design of construction details. This makes the process of designing these details difficult, time consuming, and it costs a lot of energy. Discussions with my construction tutor helped to make my details more concrete.

3. How did I translate the feedback?

Meetings between me, my studio colleagues and the supervisors took place every week. Based on the feedback given on my work, I adjusted my products. As well as personal feedback, it was of great help to listen to feedback that my tutors gave to my peers. They often dealt with similar design issues as mine, so discussing ideas and solutions together was also valuable to my process. A fellow student did research that had similarities to my research, specifically about personalisation of individual living experiences in social housing. I found it insightful that this student chose different solutions to the issue than I did. In a way, it reconfirmed and refined my personal design choices.

4. How have I learned from my work?

Please read the reflection on page 108 for a more in depth review of my development and the lessons learned during my graduation process. I feel that by creating this research and design, I greatly expanded my knowledge on the topic of standardisation and versatility in architectural housing design, and consequently I also expanded my general knowledge of architectural design.

5. Final part of my graduation period?

For the time period between my P4 and P5, I plan to focus on refining my products and presentation. I plan to proceed by making a large model of my design, making a façade fragment model, making extra drawings to more beautifully show my ideas and design and formatting my research into a well-designed booklet.

6. What is the relation between your graduation project topic, your master track (A, U, BT, LA, MBE), and your master programme (MSc AUBS)?

The topic of standardisation and versatility is a core subject in housing architecture. The studio 'Advanced Housing Design'

was a perfect environment to study this subject, and the location Amsterdam and cooperation with the designers of the municipality offered inspiring practical opportunities. Housing design is central in the track Architecture and within the master Architecture, Urbanism and Building Sciences. My final design touches upon different aspects of the built environment, including architecture, urbanism and landscape design.

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

I recommend to read the chapter on page 110 for a detailed description of the relation between the research and the design. The research I did very directly influenced my design. Not only did the theoretical research inspire certain design decisions, the case study analysis also gave direct inspiration. For example, the floor plans of case study Kruisplein served as the basis inspiration for many of the floor plan designs I made. Additionally, the urban concept developed by Piet Blom inspired me to think of an urban concept of my own.

Whilst working on my design, certain questions came up, like 'how should I design my façades?' or 'what alternative household types and corresponding apartment types can I incorporate into my design?'. Questions like these helped me specify my research findings to be properly aligned with my design goals. The design goals I used to structure the analysis of my case studies were set up for this reason.

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

I worked on my research on varying times, in various places. While this helped to develop ideas and spark my creativity, this irregularity was also a cause for unrest. I often tried to adjust my working schedule to more regular times, and especially in the latter half year of my graduation this helped bring rest. During the graduation period, I often tried to make specific plannings to guide my process. While this was beneficial, I still struggle with following these plannings consequently, which meant I had to readjust them regularly.

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

Within the academic world, this topic is and has been often addressed. For instance, in 1918, Berlage published in which he recognises the necessity for standardisation but acknowledges and shares the concerns of the workers and architects about suppressing the individual needs and wishes and the lack of architectural diversity. And more recently, in 2011, an edition of the DASH journal was dedicated to the discussion of mass production and the ideal floor plan.

Social: Housing is an ongoing problem for many in the Netherlands, especially so in Amsterdam. Cities are growing, and there is a shortage of affordable housing of good quality. The problem goes beyond the need of quick development, and new ways of quality housing in the future have to be explored.

Ethical: I big motivation for me in the development of this research was that I felt angry about the current state of many social housing developments. A lot of buildings are currently guided by financial incentives, instead of quality and diversity. The case study projects I chose proved that social housing of high quality can and has been built. In the future, I would like to design quality housing that is accessible to all income groups, and that enables a large diversity of people to live according to their personal needs.

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

The balance between standardisation and versatility is a universal architectural challenge, particularly in mass housing. My approach - using modular construction, a structural grid with adaptable floor plans, and an urban strategy based on connected courtyards - can be applied beyond my design for a neighbourhood in Amsterdam. Furthermore, I believe that these ideas are very relevant for the future of the architectural field.

11. We also expect you to develop 2 reflection questions yourself which relate to the content of your work.

How does your final research differ from your initial research plan?

Before starting my research, I had planned to use an additional research method. The idea was to do experiments in public libraries to test my design on its personalisation potential. I wanted to bring my theory to practice, and adjust my design based on the findings. While this method would still be very interesting, I found that my research and design were already very extensive and took up all my time. Therefore, I made the decision to drop this part of the research. In future research, this would still be interesting to do.

Does balancing standardisation and versatility lead to designs that are better or worse than expected?

My literature and case study analysis showed me that more is possible than I expected on the intersection of standardisation and versatility. One does not necessarily rule out the other. That said, when looking at history and current examples, we can see that a lot is possible – and a lot is not possible. The possibilities and design freedom for the architect is greatly dependant on societal, pollical and cultural context. I found enjoyment in the puzzles that came with trying to find a balance between standardisation and versatility. The research topic helped me restrain myself and search for feasibility instead of creating something that is mainly conceptual and idealistic.

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