

Futureproof industrial housing



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Picture cover
Kubus woningen, Rotterdam (Imgur, n.d.)

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Architectural Engineering offered a chance to **tackle the struggles** of our time like the housing crises and the climate change effects, **with the strengths** of our time: technological developments, and industrial produce. All this is done within the architectural field, thus with the need of considering the societal, esthetical impacts of the solutions.

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KEY TERM DEFINITIONS

ARCHITECTURAL FREEDOM

BIOBASED MATERIALS

Biobased materials refer to products that mainly consist of a substance (or substances) derived from living matter (biomass) and either occur naturally or are synthesized, or it may refer to products made by processes that use biomass.

BUILDING METHOD

An assembly process utilizes machines, equipment, and/or workers to assemble parts and materials in a pre-defined sequence until there is a finished product.

INDUSTRIAL BUILDING PROCESS

The combination of machines and software that are used to create certain building parts/systems.

INDUSTRIAL BUILDING SYSTEMS

A building system is created using building processes and consists of an assembly of building parts. The building systems are physical building parts, which vary from being almost complete (a 3D module) to a pre-assembled wall or floor.

INDUSTRIAL HOUSING

Industrialized Housing means a residential structure that is designed for the occupancy of one or more families; constructed in one or more modules or constructed using one or more modular components built at a location other than the permanent site; and designed to be used as a permanent residential structure when the module or the modular component is transported to the permanent site and erected or installed on a permanent foundation system.

*"A car must drive, a house must root: it may have
to be there for centuries."*

~ Frits Palmboom

GENERAL PROBLEM STATEMENT

THE CRISIS

The Netherlands finds itself entangled in a persistent housing crisis rooted in the aftermath of World War II. The urgent need for swift reconstruction collided with scarce resources, leading to the utilization of expedient and cost-effective building methods. Consequently, substandard housing was created, triggering a housing crisis that has endured for decades and continues to impact the nation today (NOS, 2021).

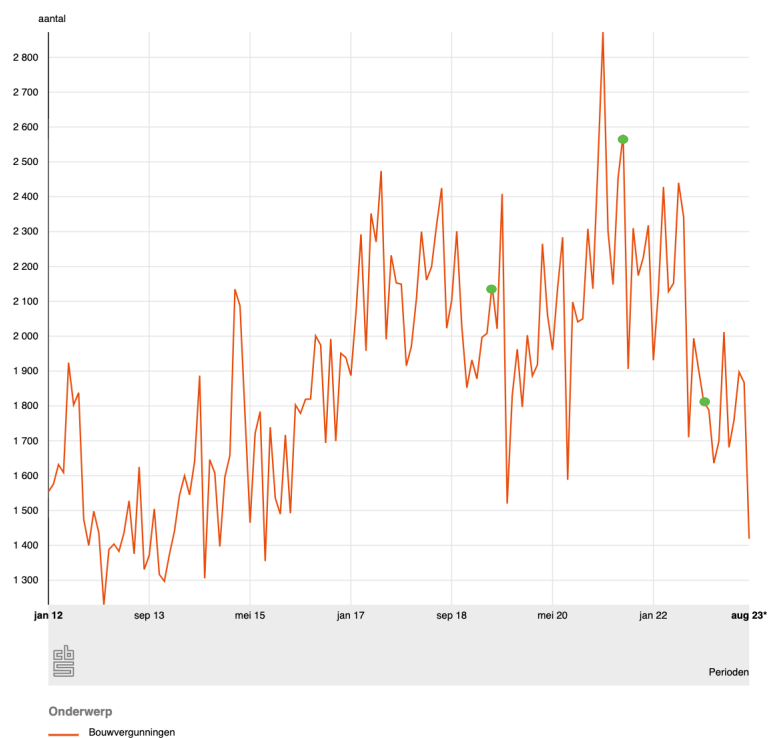
The 2008 financial crisis further intensified the situation. Between 1995 and 2008, housing prices consistently rose at an average rate of 8% to 10%. However, this growth ceased following the global economic recession, resulting in job losses and diminished confidence in the housing market. The housing market stagnated, leading to insolvency for builders, and around 5,000 contractors ceased operations (Van Oirschot & Van Oirschot, 2023). Consequently, the housing market effectively “locked,” and individuals postponed their housing decisions until a more predictable period, which has now arrived (HIBAU, n.d.).

The situation is complicated by self-imposed regulations designed to protect the environment. Construction projects face strict limits on nitrogen and PFAS emissions, along with post-construction output. New projects must adhere to rigorous regulations associated with nature permits, resulting in fewer granted building permits and a reduction in the number of constructed houses, as illustrated in Figure 3.

The convergence of diminishing labor resources, global material scarcity, and inflation has significantly inflated the overhead costs of constructing a single house. Between 2019 and 2023, the cost surged from 168,000 euros per house to 216,000 euros, as visible in Graph 2. This shift in cost dynamics, particularly considering the relatively stable period from 2012 to 2017, presents a formidable challenge, ultimately making new houses less accessible to a growing demographic (Krachten, 2023).

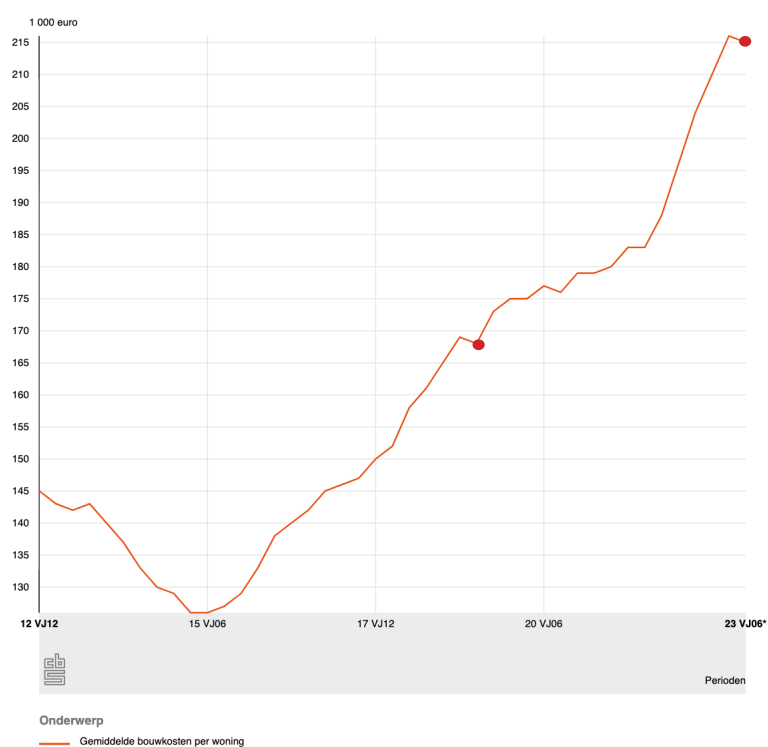
Adding to the complexity, recent global events, including migration due to conflicts and uncertainties, have further strained the housing situation. The number of immigrants in the Netherlands has doubled, encompassing refugees, labor migrants, and students, all seeking accommodation in an already stressed housing market (CBS, n.d.).

Lastly, the perennial issue of space exacerbates the crisis. The Netherlands has long grappled with the challenge of limited space and is ranked 21st among the world’s most densely populated countries (Ritchie & Mathieu, 2019). Competition for space intensifies as infrastructure, industry, and natural landscapes all vie for square kilometers. Stringent regulations demarcate each sector’s boundaries, further entangling the Netherlands in a convoluted puzzle (Bouwman & Vahl, 2020).



GRAPH 1 BUILDING PERMITS FROM 2012 TO 2022 IN THE NETHERLANDS

source: <https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83668NED/barv?ts=1698927155400>



GRAPH 2 BUILDING COSTS PER HOUSE FROM 2012 TO 2023

source: <https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83673NED/line?ts=1698926066874>

THE PROMISED SOLUTION FALLS SHORT

The government is obligated to contribute to ensuring an adequate housing supply (Van Bockxmeer, 2021). To fulfill this commitment, they established the “Taskforce Versnelling Tijdelijke Huisvesting” or the Temporary Housing Acceleration Task Force. However, this ostensibly solution seems to fall short of the housing minister’s expectations. Multiple issues arise from the fundamental nature of this solution, primarily its temporariness.

Temporary housing is facilitated by the temporary departure from government zoning plans, allowing housing on non-residentially designated land (Flexwonen, 2021). Nevertheless, this arrangement presents its own set of challenges, with residents required to vacate their homes after a period ranging from 10 to 15 years (Flexwonen, 2022). While temporary housing occupies different locations than permanent housing, it still necessitates a substantial amount of resources, equipment, infrastructure, and installations. These resources are consequently unavailable for permanent or longer-lasting solutions.

Municipal support for temporary housing is also lacking. Municipalities often express reservations regarding the aesthetics of temporary buildings and exhibit apprehension in authorizing their placement. Legal consultations and opposition to housing projects can be barriers, and municipalities may perceive temporary housing as less lucrative. Concerns about the future of movable buildings at the end of the 10- to 15-year permits, an issue that does not afflict permanent housing, also contribute to hesitance (De Jonge, 2022). Consequently, a top-down strategy has been deemed necessary, compelling municipalities to designate preferred locations and cover associated expenses (Rijks Overheid, 2023).

Furthermore, temporary housing is not held to the same building regulations as permanent construction. It is not obliged to meet the same standards outlined in the “Bouwbesluit,” which are designed to enhance the quality of life for permanent residents (Artikel 1.14 Tijdelijke Bouw, n.d.). Temporary housing is allowed to have less soundproofing, daylight intake, outside space, ceiling height, and steeper staircases can be used (“Kansen En Risico’s Van Tijdelijke Woningen,” 2023). As a result, a disparity in housing rights and living standards is anticipated, prompting the Netherlands Environmental Assessment Agency (PBL) to question whether the trade-off between unequal housing rights and the accessibility and affordability of the housing market is justifiable or preferable to the current affordable housing shortage (Pbl, 2021).

RESEARCH INTRODUCTION

As established above, the solution does not lie within temporary housing. However, the workforce created to provide all these flexible homes is far from fading. The companies that took on the task are now capable of industrial building, often within factories, with great speed, consistency, and precision. It is only logical to redirect their efforts from temporary housing to permanent solutions, creating lasting solutions. This will be the focus of my graduation, and how and where this is done will be explained in the coming chapters.



ILLUSTRATION 1 BAM FLOW INDOOR ASSAMLED HOUSING

source: <https://www.cobouw.nl/306638/daar-staan-ze-bams-eerste-houten-rijtjeswoningen>

DESIGN QUESTION

The central objective of this graduation project is to propose a sustainable and innovative solution to the persistent housing shortage. The project seeks to leverage industrial techniques and advancements to redefine and optimize housing solutions.

Informed by historical lessons, particularly from the industrial housing ventures of the 1960s, and considering the inadequacies of temporarily stacking industrial homes, the research continues based on conclusions and suggestions offered by Frits Palmboom. It focuses on creating industrial buildings that seamlessly integrate with existing urban spaces to address the challenges of industrial housing and the limited compositional options available. The architectural and technical challenge is to infuse these structures with unique characteristics that resonate with the inhabitants, transforming them into personalized and cherished homes. These unique features can be situated on corners, plinths, or entry halls, as illustrated in illustration 1.

Industrial precision is employed to mitigate material scarcity and labor shortages. The existing workforce engaged in temporary housing construction has made significant progress. The goal is to establish a robust and efficient industrialized approach to housing construction aligned with sustainability principles, contributing to a circular economy.

Furthermore, the project aims to bridge the gap between industrial efficiency and personalized living experiences. By exploring novel design methodologies and architectural elements, it seeks to strike a balance between standardized industrial construction and individualized features that reflect the diverse preferences and identities of the occupants. This approach creates future-proof homes that residents want to preserve, fostering the sustainability of the building and the neighborhood.

In summary, this project envisions a future where industrial housing, guided by sustainability and architectural ingenuity, addresses the housing deficit, ensures environmental responsibility, and nurtures a sense of belonging and uniqueness among residents by answering the following question:

“How can industrialized housing be designed to seamlessly integrate within existing urban spaces of the Netherlands while providing unique and personalized living experiences?”

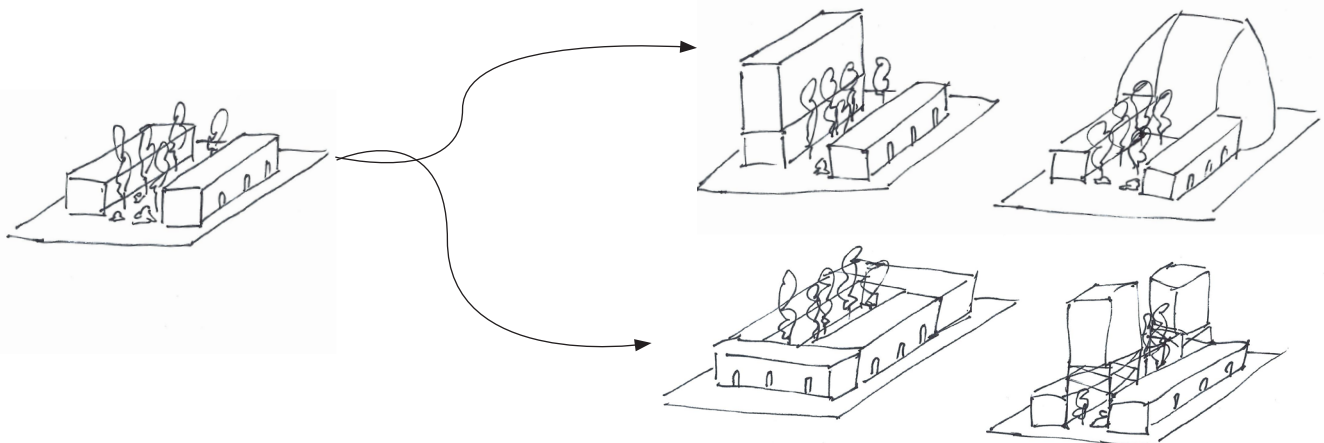
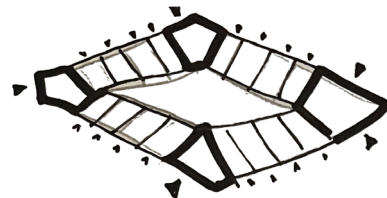
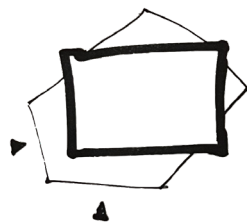


ILLUSTRATION 2 DENSIFY THE CITY: SOME OPTIONS

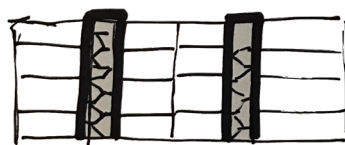
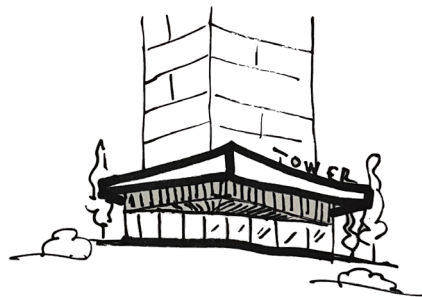
source: authors own work



UNIEKE HOEKEN.



UNIEKE BASIS/PLINT.



UNIEKE GALERIJ
TOEGANG

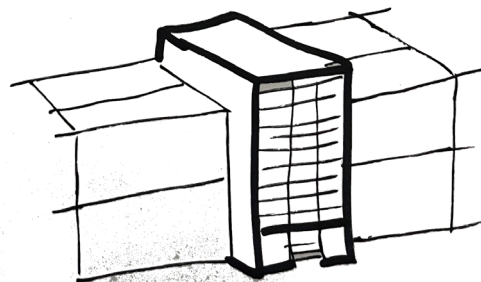


ILLUSTRATION 3 UNIQUE PART OPPERTUNITIES WITHIN INDUSTRIAL HOUSING COMPOSISTIONS

source: authors own work

DESIGN QUESTIONS

To answer the main question, the following sub-questions have been developed:

1. What are the opportunities and limits of the specific site being designed for with industrial flex housing methods in terms of function and public space?
2. Which layout of the building offers both a high degree of densification and a fine living environment to the residents?
3. What architecture best serves both the location, the building method and the housing form?

On page 15 a diagram is made to visualize the design questions into a working method. Used methods and expected results are explained and flow within the process is visible through arrows. As can be seen the end result is an answer to the design question in the form of two products

RELEVANCE

The relevance and value of this project are profound, benefitting Dutch society at large. The project alleviates the housing crisis, making a more extensive and varied range of affordable housing accessible to the population. From a societal perspective, it addresses the imperative need for a substantial number of homes. The project also recognizes that the unique aspects of a building, such as the entry halls, corners, or plinths, must exude distinctiveness and create a sense of "coming home." This is all done in the space of the existing urban fabric; the city. This way, by densifying, more of the limited space available in the Netherlands stays available for nature, agriculture, infrastructure and industry.

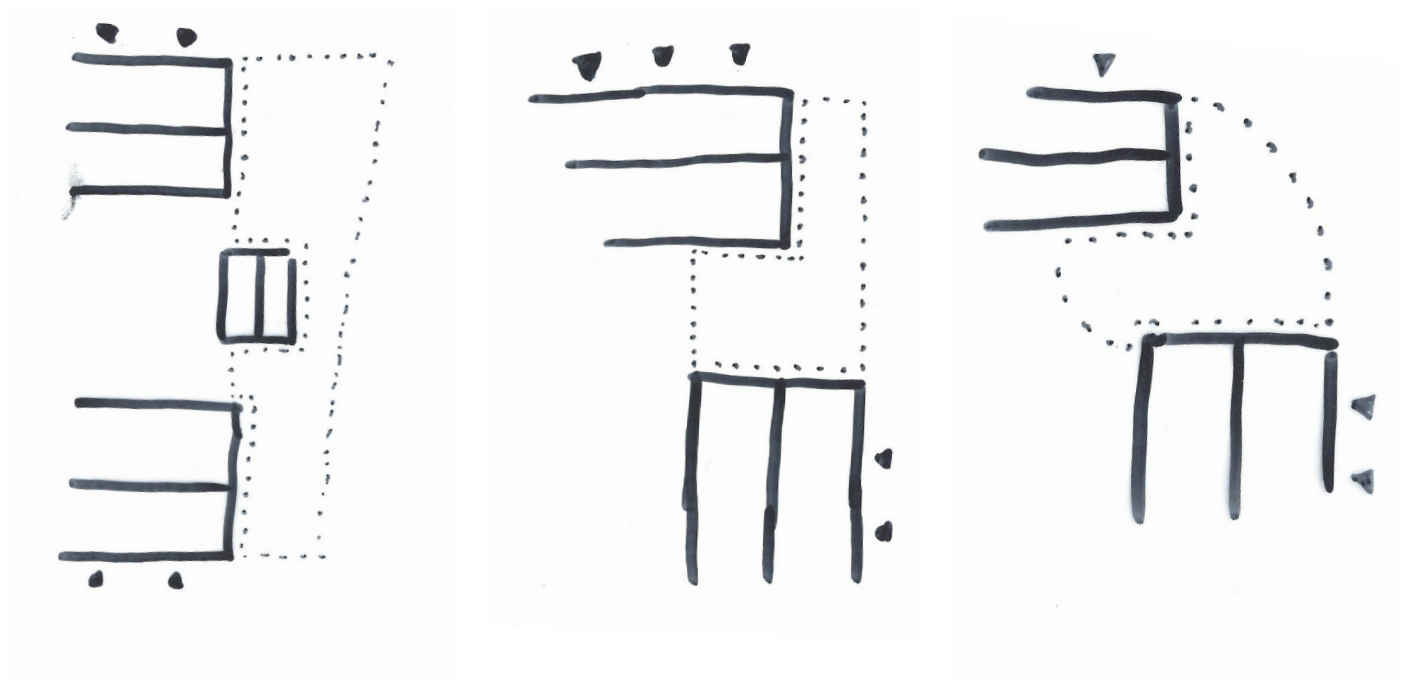


ILLUSTRATION 4 ENVISIONED NEEDED PLASTICITY OF THE BUILDING METHOD

source: authors own work

DESIGN QUESTION

How can industrialized biobased housing, be designed to seamlessly integrate with existing urban spaces of the Netherlands while providing unique and personalized living experiences?

SUBQUESTIONS

1.

What are the opportunities and limits of the specific site being designed for with industrial flex housing methods in terms of function and public space?

2.

Which layout of the building offers both a high degree of densification and a fine living environment to the residents?

3.

What architecture best serves both the location, the building method and the housing form?

METHODS

SITE ANALYSIS

- Mapping the context and its different functions.

Interviews

Learn current residents opinions about the matter.

Case- and Literature

Learn from earlier projects and literature.

Research by design

Iterative design process for layouting within the boundaries of the context

Research by design

Iterative design process for the architecture of the building, a study which runs parallel to the layout design.

EXPECTED RESULTS

A site analysis that has addressed various aspects substantively and is therefore a well-founded source of information for a design.

A layout which considers the residents, the flex industrial building method derived from thematic research, and the neighborhood.

A form of architecture tells the story of the goal of the building is: biobased, permanent houses within a dense urban network, a improvement of the neighborhood for current and new residents.

PRODUCTS

Overview of the site and its architectural and social qualities and deficiencies

Complete design of a building within this context: a proof of concept.

DIAGRAM 1 DESIGN PHASE VISUALIZATION

source: authors own work

THEMATIC RESEARCH

QUESTIONS

To answer the previously stated design question, research is required. The goal is to determine:

“Which existing (flex)industrial housing construction method is most suitable to create biobased houses that can be designed to seamlessly integrate with existing urban spaces?”

To find an answer the following questions have been set up:

1. Who are the key stakeholders involved in flex-industrial housing construction in the Netherlands?
This question seeks to identify the major players in the field, such as construction companies, developers, and innovators, to understand the landscape of flex-industrial housing construction.
2. What are the primary methods employed in flex-industrial housing construction, and how can they be categorized?
This research question delves into the specific construction methods used in the industry and aims to categorize them based on key criteria, such as efficiency, sustainability, and architectural flexibility.
3. What level of architectural freedom is attainable when employing the categorized construction methods in flex-industrial housing?
This research question explores the architectural flexibility offered by different construction methods and their capacity to provide unique and personalized living experiences for residents.

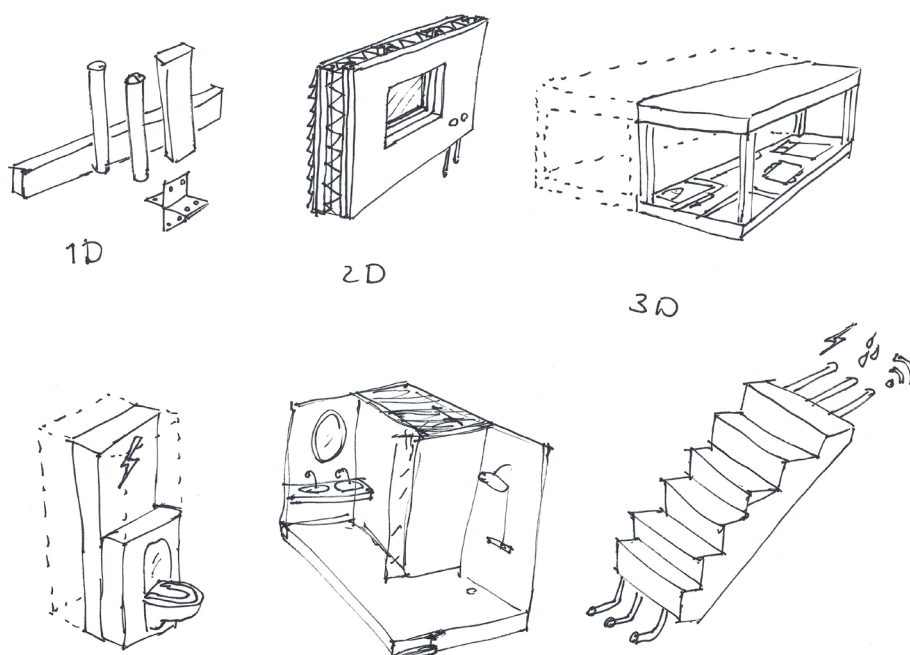


ILLUSTRATION 5 BUILDING METHODS

source: authors own work

METHODOLOGY

This methodology outlines the approach for conducting thematic research, focusing on flex-industrial housing construction methods in the Netherlands. The research aims to address critical questions related to the thematic research objectives by primarily utilizing existing literature and case studies. This approach will provide comprehensive insights into the subject matter, industry landscape, and relevant practices.

1. Identifying Key Players: The first step is to identify and characterize key stakeholders involved in flex-industrial housing construction in the Netherlands. Existing literature sources, including academic papers, industry reports, and government publications, will be reviewed to create a comprehensive list of major players and their roles in the industry. Case studies may supplement this process by highlighting specific companies and projects. According to Mint architects, there are two kinds of housing factories used by stakeholders. One with limited flexibility and high capacity works with a few layouts, building volumes, ready-made parts, and some modules with which one can 'play'. The second has lesser capacity. In this factory, the buildings are not thought out but only constructed. The creative process is done by other parties, and in the factory, they make a 'batch' or 'series' of houses based on their designs (Tol & Maas-Film, n.d.). The second factory is, of course, very interesting for this research. MINT architects do not mention a list of factories divided into the two categories. Therefore, selection criteria will apply to the stakeholders included in the list. Criteria might be added once the literary review and case studies have started, but based on the knowledge right now, these are the selection criteria:

- The building method does not consist solely out of 3D methods
a 3D building method will intervere to much with the flexibility asked of the method, and therefore can no longer adapt to its dense urban surroundding.
- Nave sizes that should be handeld very strictly
Stict nave sizes leave no room for flexibility and are therefore not suitable for this research.
- The building method does not target one group but multiple types of households
It is important to create houses for a variaty of households. Targeting only single person houses or only 4 member households would therefore not be suffiecient

2. Categorizing Construction Methods: The industrial construction methods have already been assessed as primary construction methods through criteria for the purpose of data collection. This sub-question aims to delve deeper into the construction method. By exploring the (theoretical) possibilities through a literature study and incorporating these findings into the assessment tool for the case studies, the selection will be further narrowed down. With today's knowledge, it is expected to address:

- Building speed

A great advantage of industrial building methods over conventional building is the building speed. Therefore, this is an important aspect of the equation.

- Degree of difficulty of the building method (the simpler the better)

Within building methods, simplicity is often key. When overcomplicated operations must be executed on the building site the risk for error is of course greater.

- Application of the SKID for the specific question.

The SKID has great potential to play a central role in industrial building methods. However, they come in many shapes, forms, and functions. Therefore, it must be examined of course which functions can be best applied to the design question.

4. Architectural Freedom: Literature will be reviewed to determine the level of architectural freedom attainable with different construction methods in industrial housing. Architectural freedom, in this case, refers to the flexibility to adapt to the surroundings of the urban fabric in which the plot is located. This adaptability is illustrated on page 14, illustration 4. Additionally, architectural freedom encompasses the liberty in facade composition and materialization. This is crucial as the design needs to harmonize within the diverse spectrum of architecture present in the urban fabric of cities. Case studies will be valuable for illustrating how specific projects have achieved architectural uniqueness within the constraints of industrial methods. The necessity is illustrated in the sketches below, representing a mission to create unique homes rather than anonymous stacked boxes.

For the criteria, freedom means:

No rigid facade system is needed.

Free choice of materials is allowed.

Adaptations can be made.

Room to work with corners, entrances, heights, openings, etc.

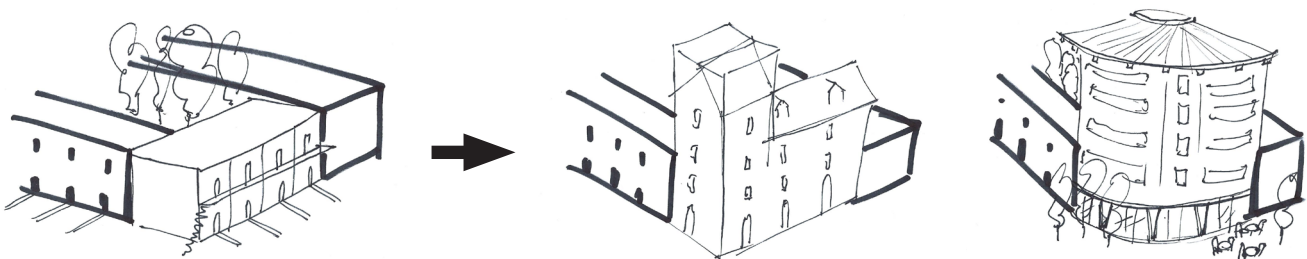


ILLUSTRATION 6 ARCHITECTURAL FREEDOM TO CREATE UNIQUE HOMES

source: authors own work

THEMATIC
QUESTION

Which used flexhousing methods in the Netherlands are; industrial, biobased and offer architectural freedom?

SUBQUESTIONS

1.

Who are the key stakeholders involved in flex-industrial housing construction in the Netherlands?

2.

What are the primary methods employed in flex-industrial housing construction, and how can they be categorized?

3.

What level of architectural freedom is attainable when employing the categorized construction methods in flex-industrial housing?

METHODS

DATA COLLECTION

By the use of literature, the internet, advertisements etc collect data of the current flex house builder in the Netherlands

Literature review

Study in general to flex industrial housing construction to set up a assessment system

Case study

Catogriz casestudies trough data according to the assesment system

Literature review

Study in general about architectural freedom within industrial flex housing

Case study

Catogriz casestudies trough data according to the assesment system

Research by design

Test method on location urban fabric

EXPECTED
RESULTS

INDEX

an collection of relevant builders and information about them

SCORE

Trough the assesment tool one or multiple favorable techniques will emerge

SCORE

Trough the assesment tool one or multiple favorable techniques will emerge

PRODUCTS

A most suitable (combination of) building method to proceed with for the design question

DIAGRAM 2 THEMATIC RESEARCH VISUALIZATION

source: authors own work

LITERATURE

Architecture:

"Prefab Architecture: A Guide to Modular Design and Construction" - Ryan E. Smith

"Cradle to Cradle: Remaking the Way We Make Things" - William McDonough and Michael Braungart

"Affordable Housing and Public-Private Partnerships" - Nico Calavita

"Modulair, circulair, opschaalbaar en betaalbaar: So You Think You Can BUILD challenge" - L.M. Oorschot

"Gelukszoekers Welkom: Door omdenken draagvlak creeëren voor het huisvesten van statushouders" - Dinger Erçel

Urban Planning

"Stratenmaken" - Jeroen Boshc and Harm Veenenbos

"Stedenbouw" - Han Meyeren

"De stad van de toekomst" - Hans de Boer

"Delirious New York" - Rem Koolhaas

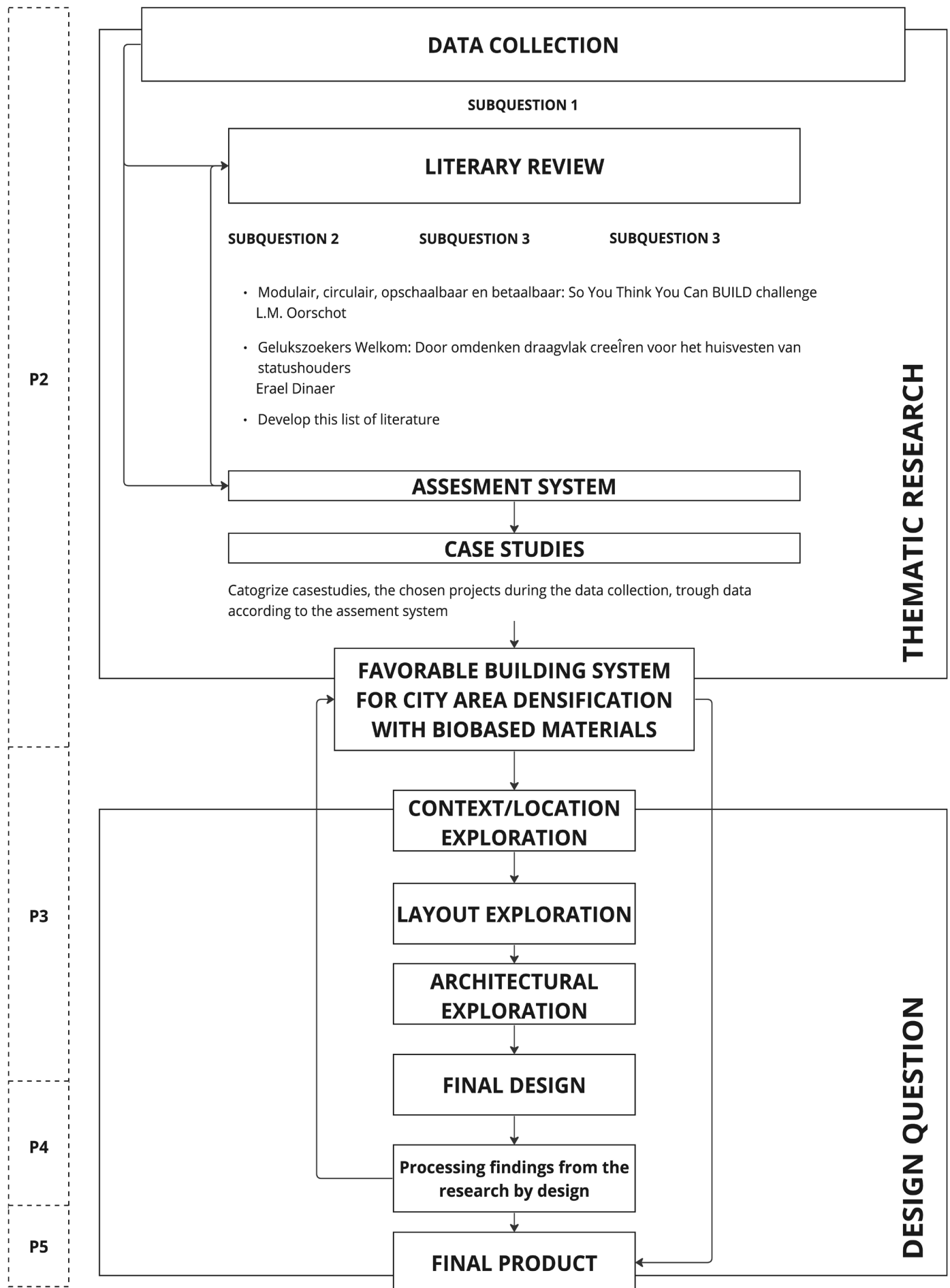


DIAGRAM 3 OVERALL GRADUATION YEAR VISUALIZATION

source: authors own work

LOCATION

CASE STUDY

The importance of location in architectural design cannot be overstated. When overlooked, architecture becomes speculative, missing a key influence.. While location is crucial for the design question, its importance is somewhat diminished in the thematic research phase. In thematic research, the primary focus is on exploring industrial building methods, a technical consideration. As a result, the social and demographic aspects of the location do not require extensive study and inclusion in thematic research, making it more objective. This approach is expected to develop a widely applicable system that remains flexible enough to respond to social and demographic influences and issues specific to each location.

The architectural firm KAW conducted extensive research on available space within Dutch cities, termed “Ruimte zat” (enough space). This approach not only preserves scarce space for agriculture, nature, infrastructure, and industry but also allows for the upgrade of existing neighborhoods through careful redesign and new housing implementation (KAW, 2022).

According to “Ruimte zat,” post-war industrial neighborhoods that are at least 40 years old might be the most promising for densification. The chapter on “surgical procedures” provides a comprehensive explanation of the project’s intentions. KAW suggests that 279,000 housing units can be added to post-war neighborhoods through surgical interventions, with a 70% success rate on sites they have identified as suitable. This is achieved by adding buildings in blind spots and parking lots.

However, these neighborhoods often have a layout based on rectangular shapes (Blom et al., 2004). This situation is not expected to push industrial building methods to their limits. More organic urban shapes are anticipated to have this effect. Therefore, this research focuses on worker houses found in cities like Amsterdam, Rotterdam, and Utrecht, dating from the late 19th and early 20th centuries. Examples such as de Pijp, de Jordaan, Zuilen, or Delfshaven in these cities exhibit distinct city planning in comparison to their surroundings. Despite having angles, curves, and meandering street patterns, these neighborhoods offer opportunities for densification within their current layout, making them highly suitable as a study location for thematic research.

CHARLOIS

Charlois, located in the southern part of Rotterdam, has been selected as the initial testing location for this project. This area boasts numerous working-class neighborhoods characterized by relatively low-row housing, akin to many other worker neighborhoods. Notably, while neighborhoods like de Pijp and de Jordaan have undergone gentrification, Charlois and several similar areas have not experienced such transformations (Centraal Bureau voor de Statistiek, 2023).

As previously mentioned, social and demographic influences will not be a focus in the thematic research, although they are crucial for determining a neighborhood's suitability for densification or renovation. For this research, the leftover spaces within Charlois will be used as the testing ground. This ensures that the location is realistic, with existing boundaries and urban influences. One such leftover space is illustrated in Image 9. The presence of two 'blind facades' creates a slightly irregular corner, providing an opportunity for densification. Image 10 offers a street-level view of the same location, while Image 11 presents some potential infill sketches for the space.



ILLUSTRATION 7 OVERVIEW OF THE NEIGHBORHOOD CHARLOIS SOUTH OF THE RIVER MAAS

source: <https://www.google.com/maps/place/Charlois,+Rotterdam>

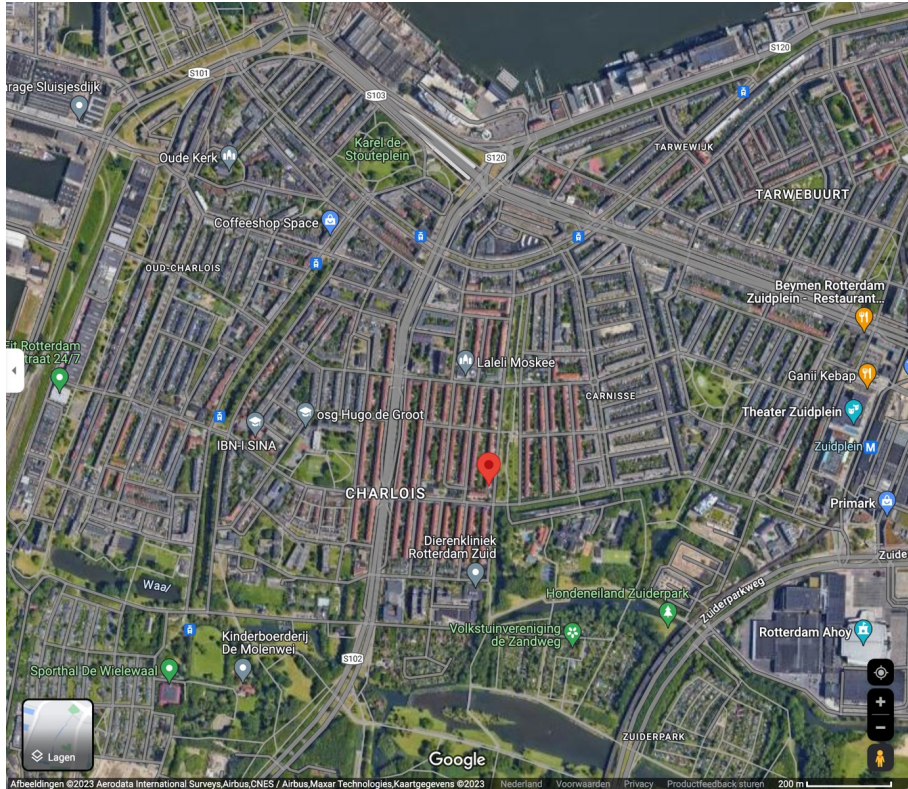


ILLUSTRATION 8 OVERVIEW OF THE NEIGHBORHOOD CHARLOIS SOUTH OF THE RIVER MAAS

source: <https://www.google.com/maps/place/Charlois,+Rotterdam>

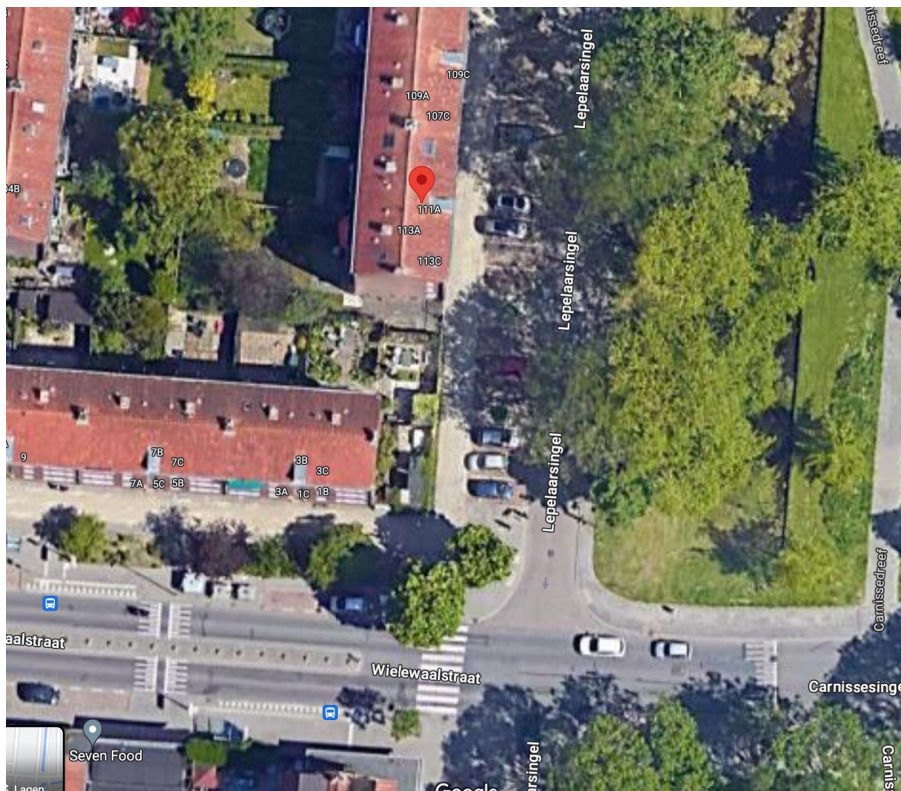


ILLUSTRATION 9 CORNER WITHIN THE NEIGHBORHOOD CHARLOIS

source: <https://www.google.com/maps/place/Lepelaarsingel+113C>



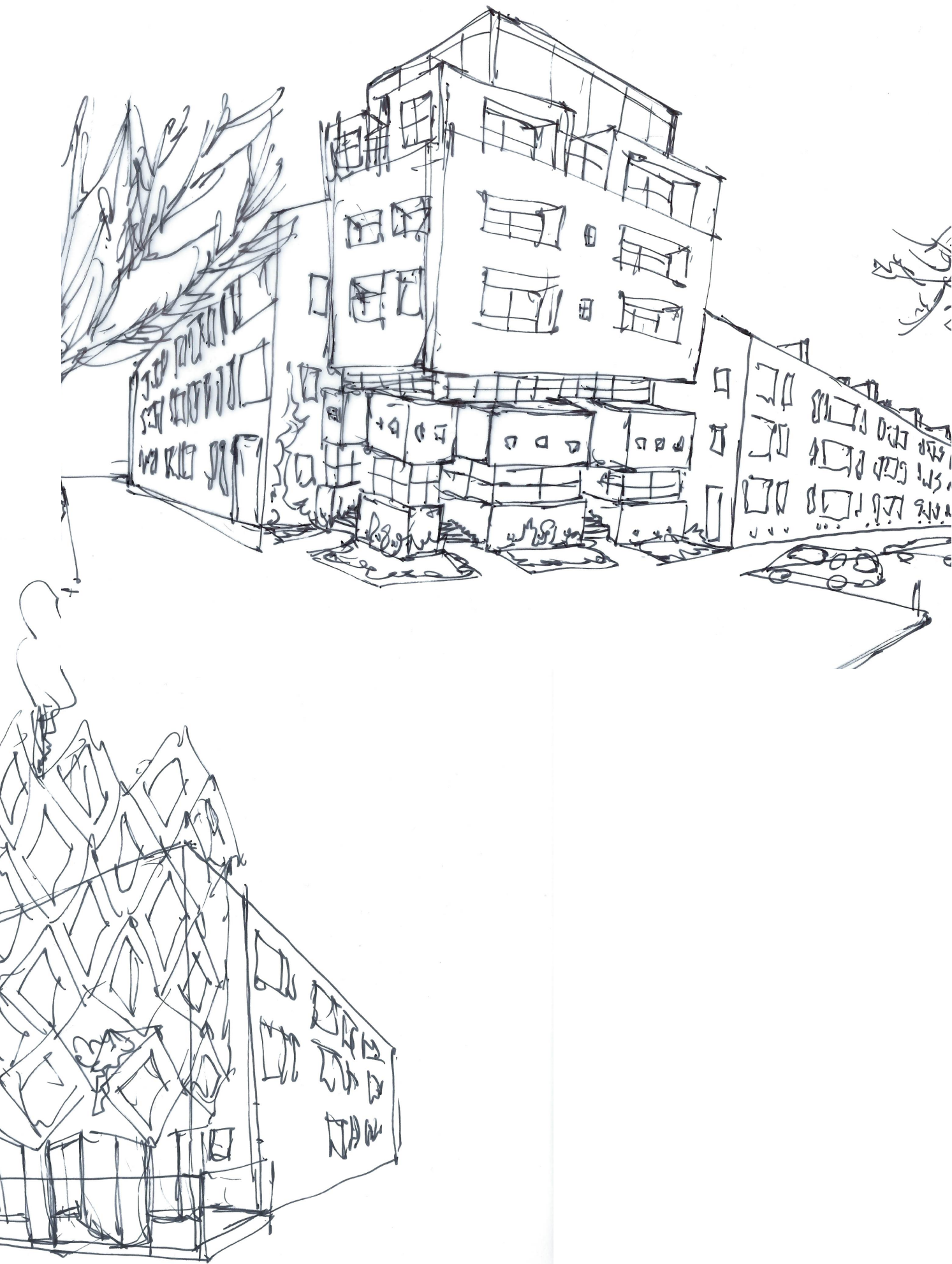
ILLUSTRATION 10 THE CORNER OF “LEPERAARSSINGEL” SEEN FROM EYEHEIGHT

source: <https://www.google.com/maps/place/Lepelaarsingel+113C>



ILLUSTRATION 11 COLLAGE OF POSSIBILITIES

source: Authors own work

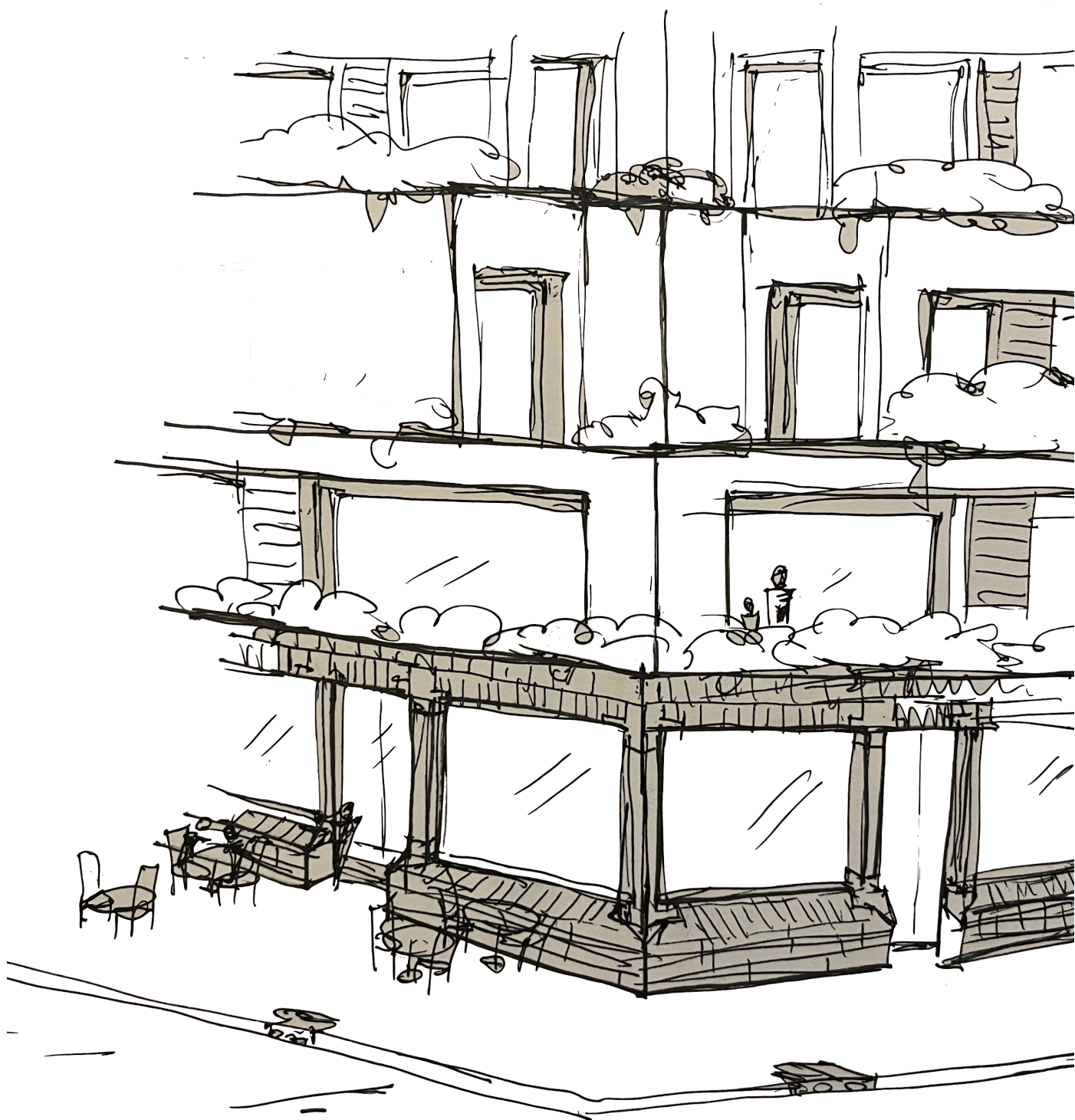


EXPECTED RESULTS

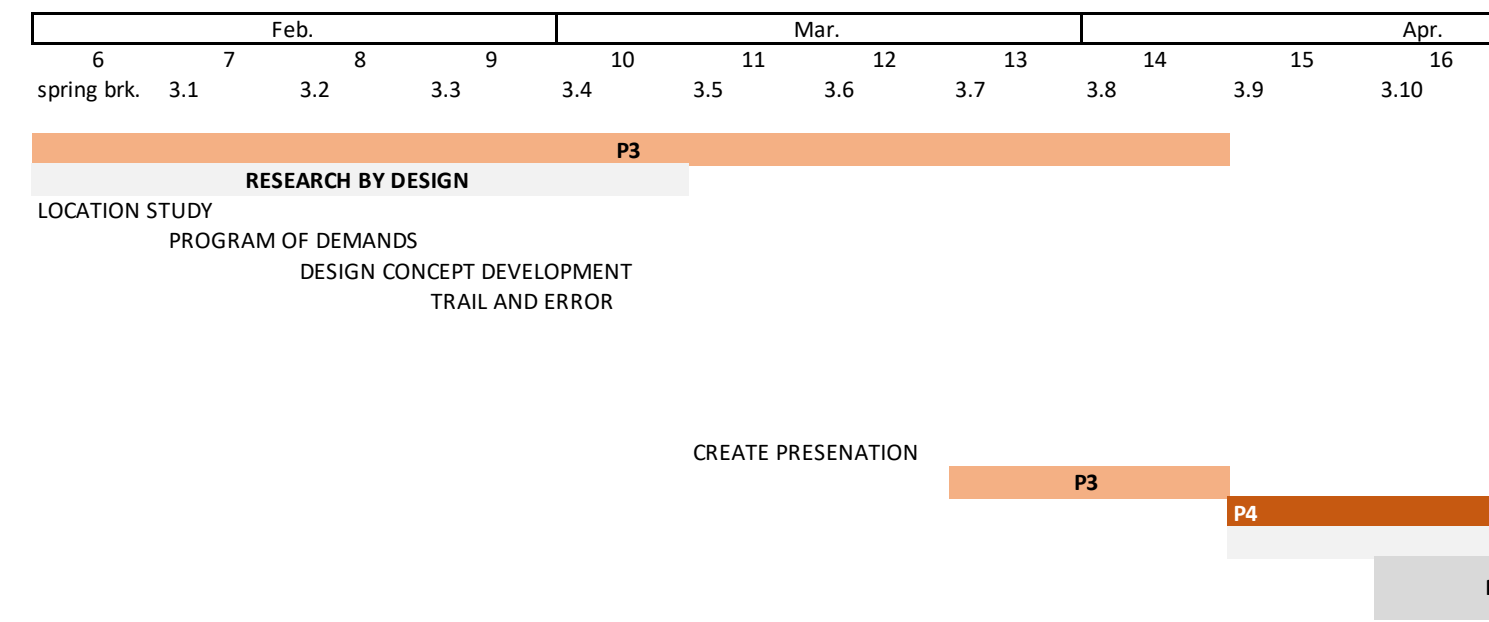
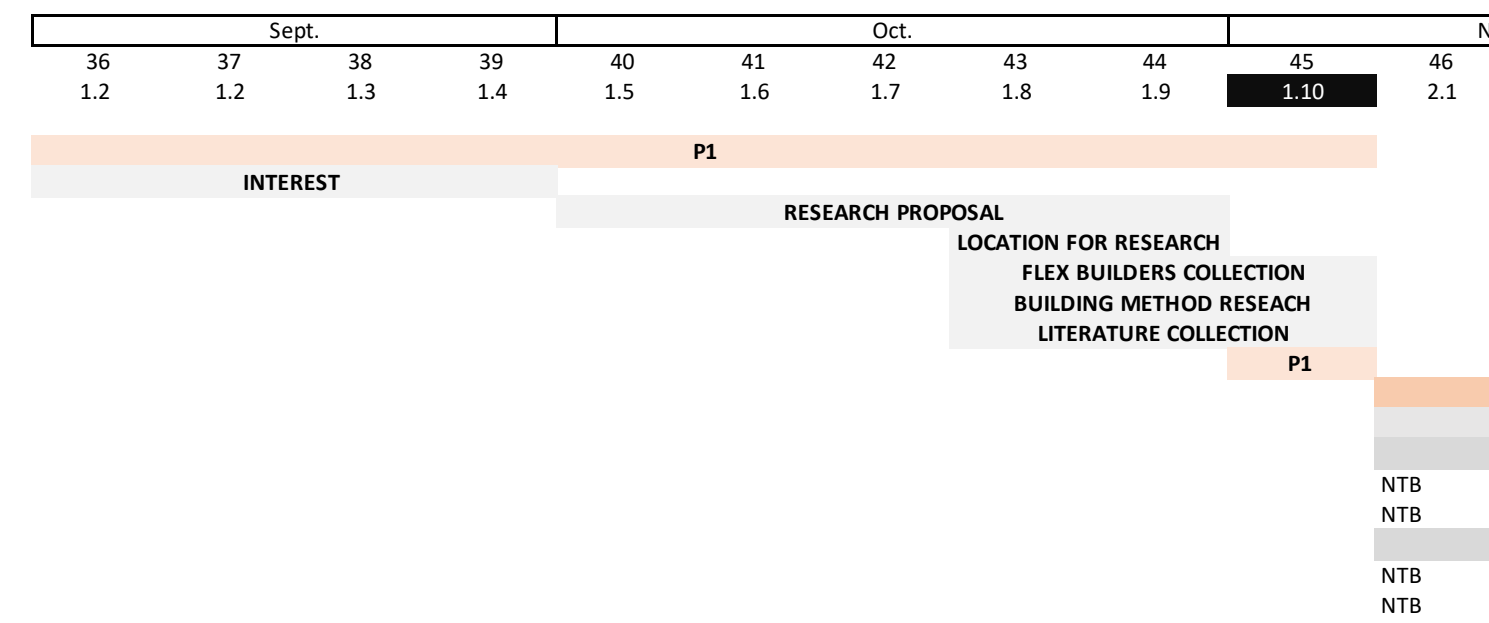
Understanding Flex-Industrial Housing Construction Methods in the Dutch Context.

This research aims to gain a comprehensive understanding of flex-industrial housing construction methods in the Dutch context. The approach involves delving into key aspects such as stakeholders, construction methods, materials, architectural freedom, sustainability, market dynamics, affordability, and regulatory compliance. By employing this research, the goal is to offer a well-rounded assessment of the thematic research objectives and provide practical insights to address the housing crisis in the Netherlands.

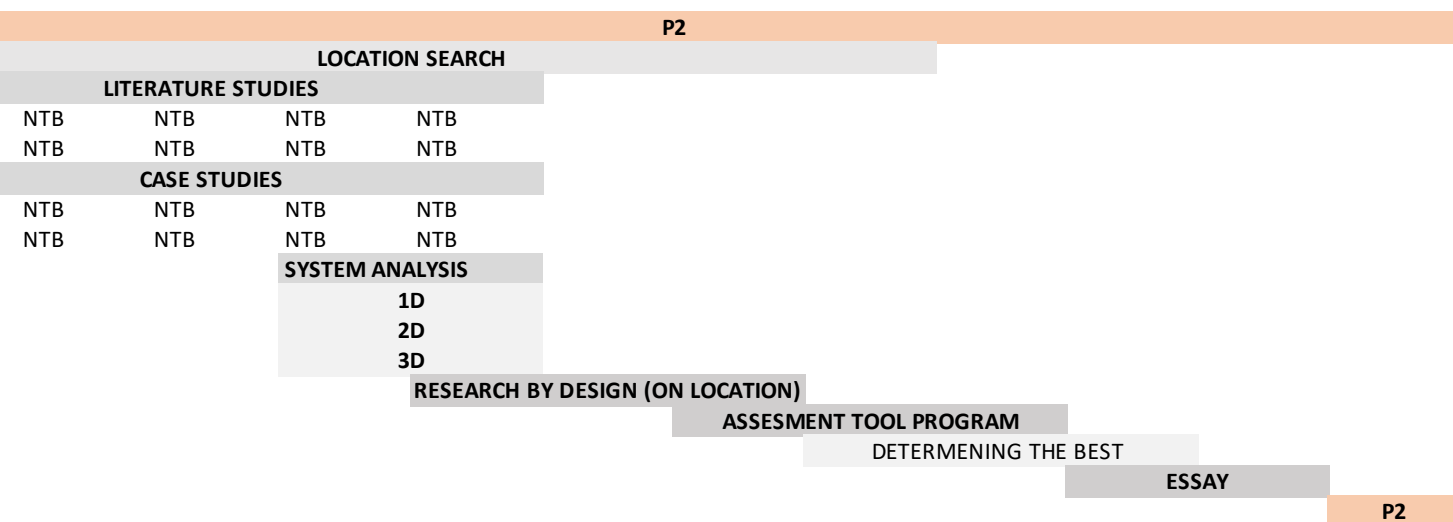
The overarching goal of this project is to shed light on why flex construction techniques can be effectively employed for permanent housing construction, especially in areas of the city characterized by complex urban fabric, vacant corners, or properties earmarked for demolition, requiring a high degree of customization. Through thoughtful design, the project aims to demonstrate how industrial construction methods can still be harnessed to provide sustainable and tailored housing solutions.



PLANNING



Nov.		Dec.					Jan.				
47	48	49	50	51	52	1	2	3	4	5	
2.2	2.3	2.4	2.5	2.6	Christmas		2.7	2.8	2.9	2.10	



		May					June					July
17	18	19	20	21	22	23	24	25	26	2.7		
4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10	5.1		



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APPENDIX 1

WORK FORCE SPLIT

With the emphasis on temporary building the permanent solution might be neglected in this process. Everybody occupied with temporary solutions have less time to work on permanent solutions. [Source](#)

CAUSE

However space is not an issue, temporary housing is realised on other locations than permanent, it however demands a great amount of resources, equipment, infrastructure and installations. [Source](#)

IT IS TEMPORARY

A flex house only offers a shelter for around 10 to 15 years, after that inhabitants need another place according to Marieke van der Staak, researcher at PBL + [Source](#)

EMERGENCY LAWS

Because of the temporary departure of the zoning plan set by the government, temporary housing can be realized on grounds which have a description other than residential in the zoning plan [Source](#)

DIFFERENT HOUSING

"It is conceivable, for rights' and housing en not meet prevailing st security. This leads trade-off between "un hand and the acces housing market on the to the current affordab

EMERGENCY LAWS

The differences between and permanent housing have to meet the same "Bouwbesluit" as their p These demands for the enhance the living qua [Source](#)

A central circle contains the text "TEMPORARY INDUSTRIAL BUILDING IS NO SOLUTION". An arrow points from the top of this circle to the "TOP DOWN" section. Another arrow points from the right side of the circle to the "TOP DOWN" section. A third arrow points from the bottom of the circle to the "EMERGENCY LAWS" section. A fourth arrow points from the bottom of the circle to the "IMPLICATIONS OF SING RIGHTS" section.

TEMPORARY INDUSTRIAL BUILDING IS NO SOLUTION

TOP DOWN

The flex housing is a top down solution with little support from municipalities, the government now starts to force municipalities to appoint appropriate locations and promises guarantees for negative economical results of the placement of the Flex housing [Source](#)

[Source](#)

EMERGENCY LAWS

Municipalities do not like the looks of the buildings, lack the bravery to place them, and hire lawyers and make them point out why it would not be wise to place these temporary houses. Also, they do not deem the temporary housing business as lucrative and worry about what needs to happen with the (movable) buildings once the 10 or 15-year permit ends.

[Source](#)

IMPLICATIONS OF SING RIGHTS

For example, that 'unequal housing environments could emerge that do not meet standards of safety, amenities and quality' leads to the question of whether the 'unequal housing rights' on the one hand and the possibility and affordability of the other is justifiable or preferable in the context of the housing shortage." [pagina 28](#)

EMERGENCY LAWS

The advantages of temporary housing are great. They do not require special regulations within the existing framework. Permanent opponents of the permanent building industry are not in the quality of its inhabitant.

[Source](#)

APPENDIX 2

HOUSING MARKET ON LOCK

From 1995 until 2008 the housing prices rose with an average of 8% - 10%. This stopped after the recession that came from the USA.

People got fired, lost faith in the housing market and stopped moving. As a result the housing market got 'locked' and builders went bankrupt. 40% of construction workers find another job. 5000 contractors stop their business

[Source](#) [Source](#)

Financial Crisis 2008

The financial crisis in America, caused by the banks who risked too much mortgage lending. The Netherlands is an export country with an open economy. The impact of the financial crisis in America therefore had a great impact on its economy

[Source](#)

REDUCTION BUILDING PERMITS

Projects which are not yet finished and have no 'nature permit' might need to apply for one and lay down work until approval. New projects always have to apply to strict rules that come with the nature permits. Less building permits are given and less houses are constructed + [Source](#) [Source](#)

NITROGEN AND PFAS APPROACH

The Dutch government made laws and decisions to reduce the effects of harmful output released during construction. They included a way around this law for projects of national importance and urgency and applied this on many projects which made it seem like it did not affect the amount of building permits that much. Until the 2d of November 2021, when the 'emergency law' had been declared inapplicable [Source](#) [Source](#) [Source](#)

Through uncertainty of the world in 2022 the migration to the Netherlands is stressing the even more

POPULATION GROWTH

Mainly because of our population growth. These people in the Netherlands are fleeing from circumstances

he
+ .

HOUSING CRISIS NL

why temporary building is no solution

EXPENSIVE BUILDING SITES

We can not just broaden our cities to fill in the need of housing but have to carefully intrergrate into the exsisting urban network + [Source](#)
[Source](#)

SPACE IS LIMITED

While the Netherlands is allready 'overcrowded', not only the housing asks for space; infrastructure, industry and nature are in dire need + [Source](#)

EXPINSIVE PROJECTS

It is more expensive to invest in building projects and new build housing remains available for a more select group of people within the Netherlands + [Source](#)

HIGH COSTS

The overall costs of building projects has increased, this is due to inflation, manpower and building material + [Source](#)

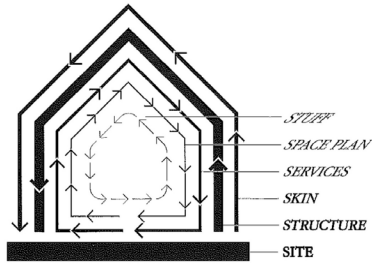
RAIN

h wars and
es in other parts
ld from 2021 to
people with a
mackground in
lands doubled,
e housing crisis
re + [Source](#)

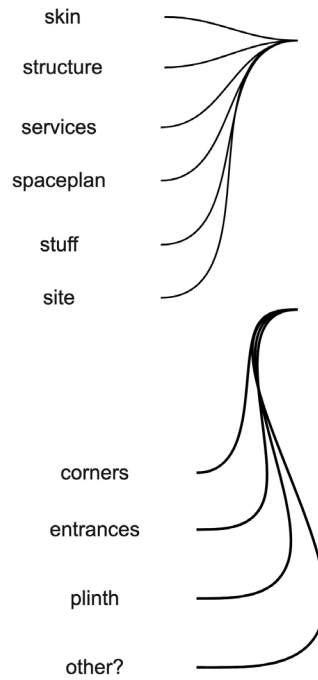
ULATION OWTH

use of immigrants
on is still growing.
ple come to the
s to work or are
rom unlivable
and are in need of
ousing
[Source](#)

APPENDIX 3



SHEARING LAYERS OF CHANGE. Because of the different rates of change of its components, a building is always tearing itself apart.



Amount of expected architectural freedom

What unique elements are important to people

**BUILD BA
BETTER
REALIZING
FUTUREPRO
INDUSTRIAL BIO
HOUSING WITH
URBAN RELM OF
CITIES**

This tool summarizes your vision and all possibly related themes.

You can fill in the canvas in any order: no need to start at on the left side! Also include for who you will be realizing your dream - and if you already know - where.

By having this overview, you can visualize possible focuses of (Sub)Themes that go well together by highlighting these

This selection will be the foundation for the Design Question of your graduation project.

Try to be ambitious here: your graduation project might be the only one in your career in which you have all freedom to realize your dream - without tight budgets, packs of rules and complaining clients!

Example:
Creating the healthiest all-wood housing block for single-person starters in Amsterdam that facilitates social interaction.

Exa
Healthy

ARCHITECTURE

INDUSTRIAL
METHODS

1D

columns

beam

2D

Walls

Floors

3D

Modules

BACK
R
G
DOOF
BASED
IN THE
DUTCH

BIOBASED
MATERIALS

How they are
used

In industrialized
building

What materials for
what part

to what extend ?

How they could
be used

in other parts ?

more?

LOCATION

Existing urban network

Abandoned urban
network

Empty space, seeks
relation with the
boarders of exsisting
urban network

of great
influence on the
design task

less

ample:
y buildings

Biophilic Design

Daylight

Vapor Open
Building

Architecture of 20's to bath
in daylight as therapy

Grasshopper scripts to
optimize design for daylight

Potential conflict with energy
neutral building