Productive postwar neighbourhoods

Thijs de Boer

Author
Thijs de Boer
5893569

Supervisors
Rients Dijkstra
Birgit Hausleitner

P5 report
15 January 2026

Delft University of Technology
Faculty of Architecture and the Built Environment

Msc. Architecture, Urbanism, and Building Sciences
Urbanism Track

Abstract

This thesis aims to understand how urban manufacturing can be integrated into postwar neighbourhoods in ways that support spatial quality and liveability. While mixed-use development is increasingly promoted, manufacturing is often seen as incompatible with residential environments. The research therefore examines the specific spatial and regulatory challenges of introducing production into existing neighbourhoods and develops a pattern language that offers guidance for doing so responsibly.

The thesis is situated within the context of postwar neighbourhoods, with a particular focus on garden city high-rise areas. Analyses of these neighbourhoods in the metropolitan region of The Hague–Rotterdam reveal spatial opportunities for integrating urban manufacturing across multiple scales, including the dwelling, building, block, and infrastructural levels. In addition, international examples of mixed manufacturing–residential building blocks and on-site observations are analysed to understand how such integrations are successfully realised elsewhere.

These insights inform the development of a pattern language, which is subsequently tested through a design for the Nolensbuurt in Schiedam. For this, the findings from all preceding analyses are synthesised to guide interventions across scales within the neighbourhood. The results demonstrate that manufacturing can be integrated in ways that activate under-used spaces, enhance spatial quality, and maintain liveability within garden city high-rise neighbourhoods.

1
Contextualisation

This chapter outlines the historical and spatial relationship between manufacturing and urban areas and the modernist planning ideals that it eventually led to. Schiedam is used as an exemplary city to show how these developments manifest themselves spatially, as the city portrays both themes particularly well.

After this contextualisation, the urgent need to strengthen manufacturing within urban areas is explained along three main themes: space, people and flow.

Lastly, the research gap that exists within literature on urban manufacturing is proposed and with it the topic of this thesis: how manufacturing can be reintegrated into urban areas while maintaining spatial quality and liveability.

FABRIQUE
DE
CUIRS FORTS

Figure 11: Demolition work in
Rue des Franc-Bourgeois
St. Marcel. Source: Jongkind,
1868.

The relationship between urban areas and manufacturing has continuously shifted alongside technological progress, social change, and economic development. Where making was once part of daily urban life, it gradually got separated and distanced from it. Understanding this evolution offers insight into how shifts in places of production have impacted the social and spatial fabric of cities.

1.1 The city as a place of production

Historically, manufacturing has played an intrinsic role in cities. In the early stage of human settlement, increased food stability allowed people to specialise in other professions than those related to agriculture. These new professions profited more from a location within cities where there was a constant supply of labour and resources (Hill et al., 2020). Production then was governed by the traditions of the crafts of artisans and the limits of available resources (Wilkinson, 2025). Here, **working and living were fundamentally interwoven** as most of the work was done by the whole family within their home (Wilkinson, 2025).

Although social developments are far more complex than described here, for centuries this social structure remained the norm. This was until the 18th century with the emergence of the **industrial revolution** in Britain which radically reconfigured patterns of human settlement and social structures (Wilkinson, 2025). New inventions led to production processes being automated, which permitted increased production with less human energy put in (Buchanan, 2025). This also asked for another type of labour: where workers historically were working as craftsmen with hand tools, they became part of a mechanical production process (Buchanan, 2025). This required a large pool of cheap labour, resources and infrastructure which made cities ideal places to settle for manufacturing firms (Hill et al., 2020). To find employment, many people left their agrarian settlements which led to rapid urbanisation and eventually population growth; in just a couple decades the urban population in Britain had grown by 150% (Wilkinson, 2025).

Though industrialisation led to more affordable products and a larger middle-class, the pollution caused by the factories led to severe environmental degradation and poor living conditions (Hill et al., 2020). In response to these foul urban conditions, new planning ideas emerged aimed at improving quality of life. Influenced by emerging modernist ideals, these ideas promoted a clear separation of urban functions, relocating manufacturing away from housing to create healthier living environments.

Figure 1.2: Unloading of a truck at a perfume factory in the city centre of Schiedam. Source: Dralle, n.d.

1.2 Deindustrialisation

These new planning ideas became visible with the first wave of manufacturing's departure from cities. This wave was marked by large-scale factories relocating to **industrial estates** developed on peripheral greenfield sites (Ferm et al., 2021). This trend can be seen in relation to the development of environmental regulations, which forced manufacturers to become responsible for their environmental impact (Hill et al., 2020). As these newly developed industrial estates came with more flexible regulations and less neighbours, many large-scale manufacturers chose to relocate from their urban sites. With the loss of bigger firms, smaller businesses further down the supply chain disappeared as well since urban manufacturing can be seen as an ecosystem of many firms built on interdependencies (Sassen, 1990; Hill et al., 2020).

While at first manufacturing shifted away from urban areas, due to globalisation they moved away from Europe as a whole during the second half of the 20th century. Because of the increasing wages and international competition, manufacturers chose to **offshore** to the Global South made possible by affordable transportation costs (Hill et al., 2020). This trend has had, and still is continuing to have, influence on urban manufacturing as businesses not able to profit from the economies of scale, have difficulties making producing and repairing locally profitable (Meyer, 2023). Moreover, separating the production process from the rest of the value chain risks disrupting the transfer of tacit knowledge, potentially undermining innovation capacity (Dellot et al., 2018).

Lastly, while manufacturing jobs were on the decline in the latter half of the 20th century, **service economy jobs** were growing immensely (Sassen, 1990). With stable economic growth, the GDP per capita grew tremendously, increasing overall health conditions and promoting consumerism (Hill et al., 2020). Though certainly empowering a great share of the working class, inequality has also increased (Sassen, 1990). This is evident in the housing market, where housing demand in urban areas from middle and high-income groups has raised the profitability of residential development, while affordability for low-income groups worsened (Sassen, 1990; Dewilde, 2017). Because of the profitability of developing residential projects, and manufacturing being seen as a weak land use (De Boeck & Ryckewaert, 2020), cities have been actively rezoning industrial land to meet this demand (Hill et al., 2020), furthering the difficulties of continuing business inside urban areas for manufacturers.

1.3 Manufacturing and Schiedam

Schiedam serves as an exemplary case of how the relationship between manufacturing and urban areas manifests spatially. Historically, the city has been a productive powerhouse. Especially from the 19th century onwards, Schiedam experienced significant economic growth when numerous **distilleries and glassworks** would settle within the city centre, resulting in a dense mixture of manufacturing and residential functions. This close proximity, however, came at a cost as the residents suffered severe health problems. Schiedam would also be described as a volcano spewing out soot from its chimneys that would cover façades and laundry hanging outside (Canon of the Netherlands, n.d.).

With the expansion of the **Port of Rotterdam**, Schiedam developed its first docks just after the beginning of the 20th century, marking the shift of heavy industry moving from the city centre southwards towards Meuse. Shipyards and other maritime-related industries established themselves there, some of which remain operational to this day.

Legend for the diagrams:
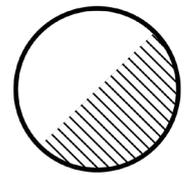○ Urban bounadries of Schiedam
⊘ Manufacturing

Figure 1.4: Production and housing in coexistence. Source: Municipal Archives of Schiedam, n.d.
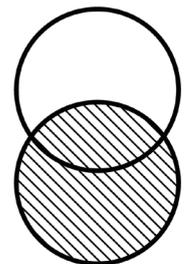
Figure 1.5: Production moves towards the harbour. Source: Municipal Archives of Schiedam, n.d.

During the 1930s, industrialisation around Schiedam accelerated once more with the development of the Merwehavens, located east of the city centre, and the **Spaanse Polder**, an industrial estate situated to the southeast. This period marked the definitive relocation of larger industrial and manufacturing activities beyond the urban boundaries of Schiedam, leaving only smaller workshops and repair services within the city.

Today, municipal ambitions to increase housing within and around the historic city centre have placed additional pressure on the remaining manufacturing functions (Municipality of Schiedam, n.d.). In recent years, manufacturing firms located in the northern part of the city centre have been displaced by new residential developments, as illustrated in Figure 1.7. Although manufacturing has not entirely disappeared, the continued demand for housing intensifies spatial pressures on the few firms that remain within the urban fabric. If this trend continues, Schiedam risks losing its long-standing connection to the productive activities that have historically defined its identity.

Figure 1.6: Production moves to inudstrial estates around the city. Source: Blok, 1956.

Figure 1.7: Production that is left makes place for housing. Source: Author, 2025.

Modernist planning ideals emerged partly because of the poor living conditions brought by industrialisation. It sought for a rational way of approaching urban design built on the separation of functions. These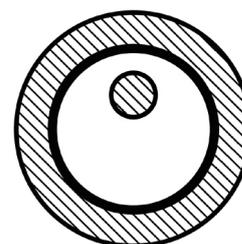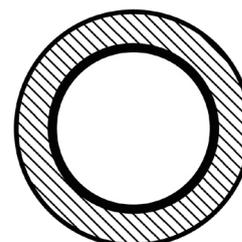 ideals shaped postwar urban development across Dutch cities as Schiedam, though their form evolved with changing interpretations.

1.4 The functional city

In response to the poor urban living conditions of many European city centres, the architectural movement CIAM (Congrès Internationaux d'Architecture Moderne) presented a new way of organising and designing cities. According to the movement, cities were in a chaotic state, and no longer able to meet the needs of its residents, which called for a more 'hygienic' view on cities (Van Es et al., 2014). To achieve this, a functionalist model of urban planning was proposed with a strict **separation between functions**, those being housing, working, recreation and traffic.

The ideas of the movement had a lot of influence on planning in Europe, and were widely implemented during the rebuilding and expansion of cities after the Second World War. Though the concepts introduced by CIAM were avant-garde for their time, they have become increasingly synonymous with a technocratic, profit-oriented and inhumane form of urban development (Van Es et al., 2014). Critique to this has taken form in contemporary development concepts such as the compact city where designing with multiple functions on a small grain is normalised again (Bibri et al., 2020; Korthals Altes & Tambach, 2008).

While these new concepts do challenge the strict functional separation advocated by CIAM, the reintegration of functions is still done rather selectively. Mixed-use planning often focuses on the combination of housing, offices and retail which have proven to be compatible and economically profitable (Meyer, 2023; Korthals Altes & Tambach, 2008). As manufacturing is seen as a weak land use, and regulations do not always allow it to be mixed with other functions, it continues to play a marginalised role in urban development nowadays (Hill et al., 2020). This raises the question whether contemporary cities are truly moving beyond the functionalist legacy of CIAM, or merely reproducing it in an altered form.

1.5 Postwar Schiedam

Modernist ideas also found their way into the urban planning of Schiedam. **Nieuwland** was developed as the first large-scale postwar expansion district of Schiedam. Constructed in phases between 1950 and 1965, the district embodied the principles of postwar ideals: functional, rational, and oriented toward mass housing production. Approximately 7.000 dwellings were built, primarily as medium-rise apartment blocks of four to five storeys, characterised by flat roofs, minimalist facades, and limited variation in floor plans. Due to its homogeneous built environment and aging housing stock, Nieuwland experienced socio-spatial decline starting in the 1980s, and plans to redevelop it were made soon after (Municipality of Schiedam, 2017).

Another neighbourhood built several years later under the same modernist ideas is **Groenoord**. Although Nieuwland and Groenoord share the same modernist ideas, their layout is vastly different. Where Nieuwland is designed with a relatively traditional layout consisting of semi-confined mid-rise blocks, Groenoord uses a different approach. The buildings do not confine any space and stand freely within it, surrounded by large green spaces and parking. The scale of the buildings is also considerably larger, with some reaching up to fourteen storeys. As a result, the spatial experience of Groenoord can at times feel alienating and detached from any human scale. Groenoord has undergone significant urban restructuring over the past decades, aimed at diversifying its housing stock.

Later expansions of Schiedam largely moved away from modernist planning principles, instead materialising as the characteristic bloemkoolwijken (cauliflower-neighbourhoods) and subsequently, VINEX-neighbourhoods.

Groenoord

Middelland

Historic city centre

Postwar expansion Schiedam ▶
1945 - 1969
1970 - 1989
1990 - 2010

0m   500m   1000m

Figure 1.8: Middelland just after construction completed. Source: Municipality of Schiedam, 1962.

Figure 1.9: Aerial photo of the flats in Groenoord. Source: Dijkstra, 1970.

Cities and manufacturing have grown apart, while it could play a vital role in addressing contemporary urban issues. A narrative for the integration of urban manufacturing is shaped through three lenses: space, people and flow.

1.6 Crossroads

The relationship between cities and manufacturing is ever changing. The marginalisation of manufacturing in contemporary urban planning is the result of shifts in economic, environmental and ideological transformations. As cities are confronted with challenges such as social inequality, resource scarcity and the need for more resilient economies, this marginalisation might be shortsighted as it is manufacturing that might be able to play a role in solving these issues due to their high adaptability (Ferm et al., 2021; Hill et al., 2020)

Cities are currently at a crossroads, where if not handled carefully their relationship with the manufacturing sector is fractured even more, thereby deepening existing divides and complicating efforts at future reintegration. It can therefore be helpful to create a narrative on what urban manufacturing can bring to show its necessity in urban contexts. This will be done through the lens of three different perspectives: space, people and flows (Tsui, 2023; Tjallingii, 1996). Although Tsui adopts the framework initially proposed by Tjallingii to specifically examine circular urban manufacturing, the perspectives it offers are applicable to urban manufacturing more generally, as will be outlined in the following paragraphs.

1.6.1 Space

While there is much public discussion about urban sprawl, **industrial sprawl** gets relatively little attention, even though it contributes significantly to the expansion of built up area in the Netherlands. Over the past two decades, urban sprawl (primarily in the form of housing developments) has accounted for 10.685 hectares, while industrial sprawl has covered 7.603 hectares (Endhoven et al., 2019). This expansion is tied to the difficulties that manufacturers have staying within cities, often leaving them with no other choice but to relocate to peripheral industrial estates (Stuyt, 2020). This puts pressure on the demand for space on these estates, and while the prevailing solution has been to simply develop more of them, in a spatially constrained country as the Netherlands this approach is becoming increasingly untenable.
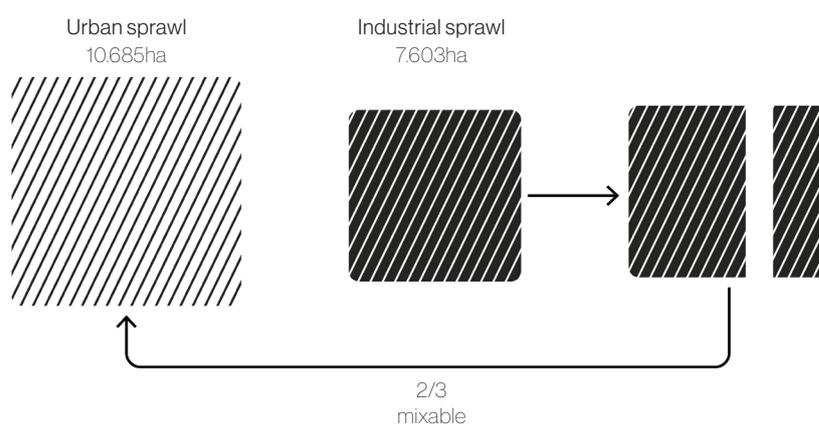
Figure 1.10: Urban and industrial sprawl in the Netherlands, and how much of it can be mixed.

As manufacturing has become cleaner, quieter, and smaller in scale over recent decades, it has become increasingly suitable for reintegration into urban environments (Tsui, 2023). New building technologies also allow for more integration as can be seen in newly developed mixed-use projects in London and Brussels. Currently, up to two-thirds of the businesses located on industrial estates could potentially be combined with residential functions (STEC Groep, n.d.). Meanwhile, the demand for space by businesses that do require separation from residential areas (such as recycling facilities) is expected to continue to grow (Rood & ▶

Evenhuis, 2023). To alleviate the pressure felt on the industrial estates, and making it possible for businesses that depend on spatial separation to locate themselves on these sites, businesses that are compatible with residential functions should be able to find appropriate and affordable spaces within cities. Cities that are not able to provide suitable space will likely result in paying higher prices or being unable to provide certain services such as repair or construction (Hausleitner et al., 2022). This asks for a new form of urban planning and designing, which would allow for a more efficient and equitable allocation of built up area in the Netherlands. Given the complexity of creating conditions that support a diversity of activities within the urban fabric (Tjallingii, 1996), the following chapters examine how to enable such integration.

Figure 1.11: Producing pressure gauges in a workshop in Spaanse Polder. Source: Breur, 1952.

1.6.2 People
The marginalisation of manufacturing in urban areas has significant implications not only for land use, but also for people. As manufacturing is increasingly excluded from the urban fabric, the everyday commutes of workers have grown longer, limiting access to local employment (Meyer, 2023). This distancing occurs all the while urban manufacturing relies on proximity to a large and diverse workforce, as well as access to educational facilities, making cities fundamentally attractive to manufacturers (Hill et al., 2020). Despite representing a relatively small share of the urban workforce (Warden, 2018), manufacturing remains one of the few sectors capable of offering well-paid, skilled jobs that do not require advanced academic credentials. Wages for blue-collar jobs, for instance, tend to outpace those in retail or hospitality: 12,3% of service workers earned incomes below the poverty line, compared to 7,6% of industrial workers (Phillips-Fein, 1998).

Moreover, manufacturing roles are generally less associated with exploitative working conditions such as zero-hour contracts, and often include pathways for progression into technical specialisation or management (Hill et al., 2020). This makes manufacturing not only a source of employment, but a mechanism for **upward mobility**. The economic ripple effects are substantial too: every 1.000 manufacturing jobs support an additional 777 jobs in other sectors of the economy, a multiplier effect significantly higher than in retail or business services (Curran, 2007).

Yet, many cities are facing a pronounced skills gap in technical professions, worsened by the declining visibility of manufacturing in the city, which contributes to the **deskilling of labour and the erosion of adequate technical training** (Hill et al., 2020). Reinvesting in urban manufacturing is therefore not only an economic act, it is also a social one. The value of skilled work lies not only in its output, but in the culture of care, knowledge-sharing and learning-by-doing that it fosters (Sennett, 2008). These qualities flourish through proximity (Ferm et al., 2021; Tsui, 2023; Hill et al., 2020). A renewed appreciation for urban manufacturing could thus play a key role in rebuilding more equitable and resilient local economies.

1.6.3 Flow

The density and diversity of stakeholders which allows for collaboration and the creation of networks makes cities major drivers of the transition to a **circular economy*** (Tsui et al., 2020; Hausleitner et al., 2022). Over the past years this realisation has led to multiple circular strategies for major municipalities in the Netherlands (Municipality of Rotterdam, 2023; Municipality of Amsterdam, 2020). Often these strategies see the potential of the makers movement to underpin the transition with its capabilities and skills to transform the way resources are being used (Hill et al., 2020). Urban manufacturing enables repair, remanufacturing and refurbishment of products and materials to extend its use life and reduce further consumption of raw materials (Hausleitner et al., 2022). Besides this, urban manufacturing has the potential to contribute to shorter supply chains, simultaneously lowering transportation emissions (Tsui et al., 2020).

Manufacturing located in the neighbourhood gives greater potential for turning local secondary or residual materials into resources (Tsui et al., 2020). It also increases the **traceability** of products and processes (Hill et al., 2020), potentially taking away the black box that production has become over the past decades. Besides this, it also allows for higher customisation, simplifies take back systems and creates feedback loops which all **help to reduce waste** generation (Hill et al., 2020). Companies can also become energy sources for local energy grids by providing power and heat or electricity by means of PV-panels on rooftops (Tsui et al., 2020). For production to be located closely to consumption though, cities have to provide enough space for bottom-up initiatives to emerge (Hausleitner et al., 2022). Important for this as well is for these initiatives to be able to scale up without having to move out of the city (Tsui et al., 2020). However, the current distancing of manufacturing from urban areas to peripheral industrial estates threatens these benefits, undermining the policies and ambitions aimed at fostering a circular economy.

*The circular economy oposes the currently prevailing linear take-make-waste model, and promotes reusing waste streams as a recourse (Furlan et al., 2022). For a more detailed explanation, see page 39.

1.7 Spatial quality and urban manufacturing

While it has become evident why manufacturing should return to urban contexts, the framework of space, people and flow fails to address how it could be spatially embedded. Much of what has been found through literature research focuses on why manufacturing needs to come back, but pays insufficient attention on how this can be done. If manufacturing really is to return to the urban fabric, several challenges must be addressed. This does not only include environmental concerns such as noise or odour, but also practical issues like accommodating large industrial buildings and meeting logistical requirements.

To truly reintegrate manufacturing into the urban fabric, typologies need to be reimagined as productive, adaptable, but also aesthetically pleasing components of the city. This comes with the task of ensuring coexistence between very different functions which means designing spatial conditions that are **liveable, safe and capable of interaction** without compromising the operational needs of manufacturing too much. If spatial quality (which could be embedded by urban design) is neglected with the reintegration of manufacturing, it could trigger conflict with other functions, risking its already weak position in the urban fabric and possibly leading to an everlasting marginalised position.
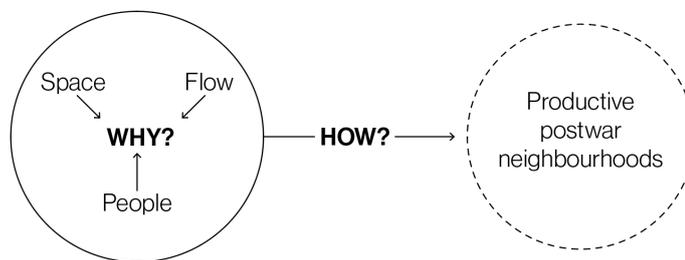
Figure 1.12: Why? is clear; *How?* poses a knowledge gap, which this thesis tries to fill.

1.8 Problem statement

Historical processes have progressively pushed manufacturing to peripheral zones, steadily weakening its position in the urban fabric. Although recent urban developments advocate for mixed-use, they often exclude manufacturing due to perceptions of its incompatibility with urban life, regulatory constraints, and real estate pressures. This has led to a disconnection between production and the urban fabric in three forms: spatially through the physical displacement of manufacturing, socially by weakening access to local employment and skill development, and in terms of flows by limiting circular processes that depend on the presence of local manufacturing. Despite growing recognition of manufacturing's value in cities, little attention has been given to how it can be spatially integrated into the urban fabric while ensuring spatial quality and liveability. Without thoughtful design that ensures coexistence with other urban functions, the desired reintegration risks reinforcing manufacturing's marginalisation. This leads to the **main question** that this thesis tries to answer: How can urban manufacturing be integrated in a way that contributes to the spatial quality and liveability of postwar neighbourhoods?

2
Methodology

This chapter introduces the sub-questions that support the main research question, outlines how they will be addressed, and explains the expected outcomes. Finally, these elements are synthesised into a diagram that brings them together and incorporates contextual information.
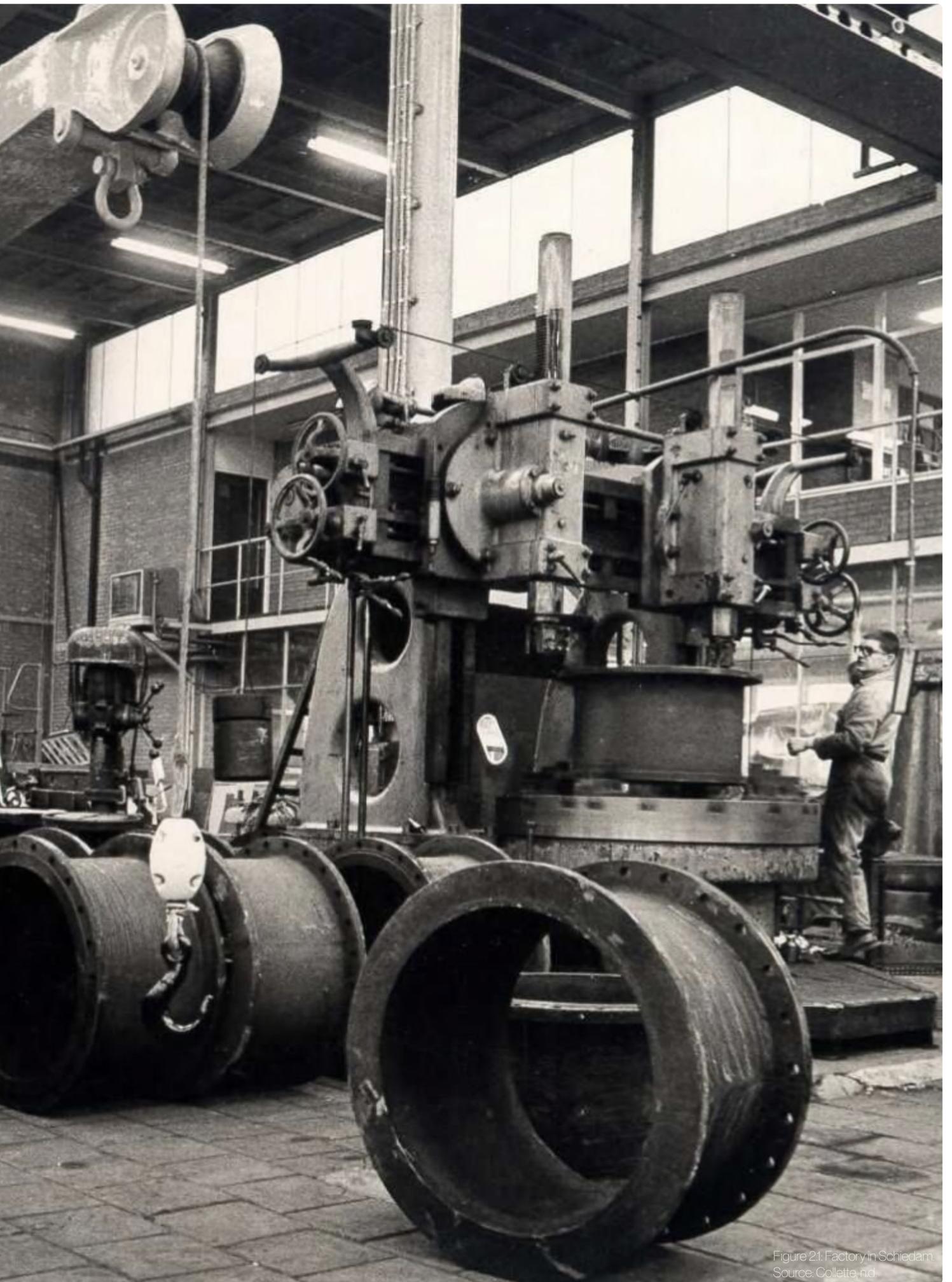
How can urban manufacturing be integrated in a way that contributes to the spatial quality and liveability of postwar neighbourhoods?

1. What defines urban manufacturing, and how can it be integrated to influence the spatial and operational logic of urban areas?
2. What typologies characterise postwar neighbourhoods, and how can liveability be identified and defined within them?
3. How can a pattern language inform the integration of urban manufacturing while preserving liveability and spatial quality?
4. How can the pattern language be spatialised into a design for a postwar neighbourhood?

2.1 Research aim

The aim of this research is to investigate how urban manufacturing can be integrated into postwar neighbourhoods in a way that enhances liveability and spatial quality. It challenges current models of mixed-use development, and argues for a broader, more inclusive interpretation of a functional mix. The spatial and structural characteristics of postwar neighbourhoods hold great potential to explore these new forms of functional integration. While these neighbourhoods face a range of challenges, solving these can serve as a catalyst for reimagining their future. By examining the potentials of postwar neighbourhoods alongside the spatial and functional requirements of urban manufacturing, this research aims to develop both strategic and site-specific design solutions to integrate the two.

2.2 Expected outcomes

This research will provide a comprehensive understanding of how urban manufacturing can be integrated into postwar neighbourhoods. The foundation of the study will be built on two analyses: first, an exploration of the requirements of various forms of urban manufacturing, including their compatibility with residential functions, and second, an analysis of postwar neighbourhoods, identifying its typologies as well as taking a dive into their liveability.

Building on this analysis, a pattern language will be developed that can guide the integration of urban manufacturing within neighbourhoods, including spatial interventions related to public space design, building typologies, and the interface between productive and residential uses. Finally, a design proposal will be developed for the Nolensbuurt. This proposal will illustrate how urban manufacturing can be integrated in a way that enhances liveability, fosters spatial quality, and supports a more inclusive urban mix.

2.3 Research approach

What defnes urban manufacturing, and how can it be integrated to influence the spatial and operational logic of urban areas?

Through an intertwined research approach, this question tries to answer what defines urban manufacturing, the great variety of businesses related to it, and how they can be integrated into urban areas. A **literature review** is done by drawing on books as Foundries of the Future (Hill et al., 2020) and relevant academic publications, gives the definition of urban manufacturing. This is complemented by a **case study** of four manufacturing businesses, which offers a more practical understanding of the sector.

Afterwards, zoning policies and related frameworks are examined to identify the mechanisms through which integration can be enabled. A second body of literature, including policy documents and academic sources, is used to define circularity and its connection to urban manufacturing. This leads to a **systematic analysis** of the prevailing consumption logic and how it might shift when productive functions are introduced into neighbourhoods.

What typologies characterise postwar neighbourhoods, and how can liveability be identified and defined within them?

A **spatial analysis** at the scale of the Metropolitan Region Rotterdam Den Haag (MRDH) is conducted to identify postwar neighbourhoods and outline their overarching characteristics. This is done by a typological analysis addressing neighbourhood form, block structure, building types, and dwelling types. Each type is evaluated for its potential to accommodate urban manufacturing by relating it to the insights derived from the preceding research.

Liveability is then defined by a **literature review**, using sources from well-established authors such as Leidelmeijer, Van Kamp, and Mandemakers. These works provide the basis for spatialising liveability through **GIS** data and examining how it manifests within postwar neighbourhoods, using Schiedam as a representative case study.

How can a pattern language inform the integration of urban manufacturing while preserving liveability and spatial quality?

A **pattern language** is developed through a combination of research methods from which the patterns are distilled. The process begins with a **case study** of four urban blocks in three different cities that integrate manufacturing, followed by **site visits** to relevant buildings, projects, and areas to extract additional design principles. Finally, **research by design** and a **literature review** is used to identify and address recurring spatial challenges.

These insights are synthesised into a pattern language. The interrelations between the patterns are mapped in a pattern field, which in turn clarifies how the various ambitions that were defined can be operationalised.

How can the pattern language be spatialised into a design for a postwar neighbourhood?

Research by design is used to develop a detailed proposal for the Nolensbuurt, in which an overarching framework functions as a zoning instrument and three blocks, along with the public space, are elaborated in greater detail. This development follows an iterative process of sketching, visualisation, and **site visits** informed by insights from earlier phases such as the analysis of postwar typologies and the application of the developed pattern language. Through this process, the design evolves into a context-specific proposal that demonstrates how urban manufacturing can be integrated while enhancing liveability and spatial quality.

2.4 Methods

All methods employed in this research are indicated in bold within the research approach. While these methods are relatively generic, their application is tailored to the specific objectives of each sub-question. For example, the literature review is not limited to academic publications but may also include policy documents where appropriate. An overview of the methods used, organised per sub-question, is provided in the diagram on the following page.

2.5 On the use of AI

Artificial intelligence tools (primarily ChatGPT) were used to support the writing process by refining phrasing and to develop or reflect on ideas. All AI-generated suggestions were critically evaluated and adjusted accordingly by the author, and nothing has been used without thorough verification and revision.

	Subquestions	**Aims**	**Define**
Foundation	What defines urban manu-facturing, and how can it be integrated to influence the spatial and operational logic of urban areas?	1. To define urban manufacturing 2. To define what functions are acceptable within the mixed-use neighbourhoods 3. To identify how consumption patterns shift	• Urban manufacturing • Mixed-use • Circularity
	What typologies charac-terise postwar neighbour-hoods, and how can liveability be identified and defined within them?	4. To analyse the characteristics of postwar neighbourhoods 5. To identify how liveability manifests itself within postwar neighbourhoods	• Spatial patterns and typologies of postwar neighbourhoods • Liveability
Synthesis	How can a pattern langua-ge inform the integration of urban manufacturing while preserving liveability and spatial quality?	6. To develop a pattern language for the integration of urban manufacturing	• Patterns for the integration of urban manufacturing
Design	How can the pattern language lead to the integration of urban manufacturing in a post-war neighbourhood?	7. To develop a design proposal that illustrates how the patterns are spatialised	

Outcomes

- Definition of urban manufacturing
- Decision-making tool mixable functions
- Systemic overview consumption patterns
- Spatial typologies of postwar neighbour-hoods
- Definition and spatialisation of liveability

- Pattern language
- Pattern field

- Framework on neigh-bourhood scale
- Zoom-in to block scale
- Public space design

Methods

Literature review
Case study
Spatial analysis
Systemic analysis
Site visit
Pattern language
Research by design
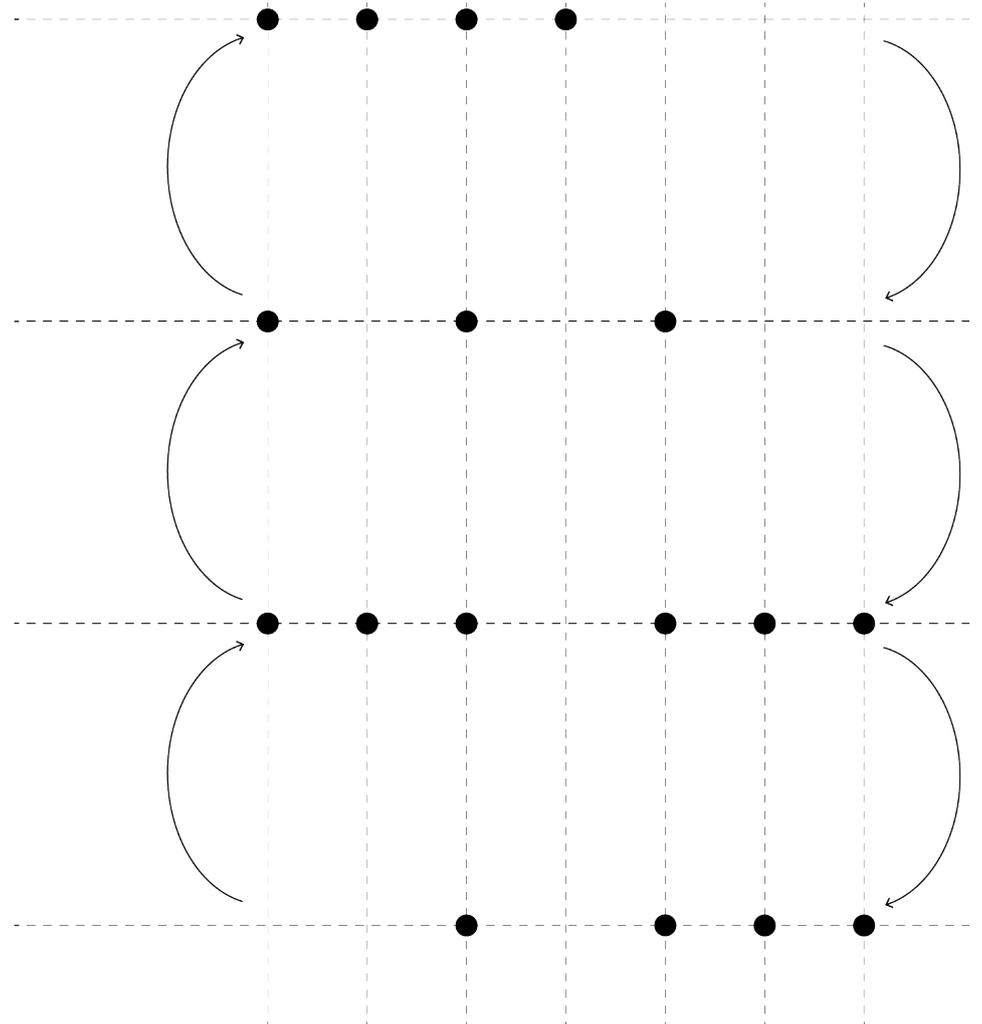
3
Urban manufacturing

This chapter seeks to establish a clearer understanding of what defines urban manufacturing. It begins by outlining a common definition and examining both business types and the building typologies in which they operate. Based on this foundation, four manufacturing businesses are analysed in detail.

The chapter then turns to the instruments that can support urban manufacturing, including zoning approaches and practical frameworks. This concludes with the Function Filter, a tool designed to help determine which businesses can be appropriately located in which areas.

Lastly, circularity is addressed and how urban manufacturing might contribute to this by showing how the consumption system shifts with the integration of productive functions within neighbourhoods.

Urban manufacturing is defined by its relience on or contribution to urban systems and comes in many different forms and sizes. It is hard to attach labels to them, but they do share some characteristics that distinguish them.

3.1 Defining urban manufacturing

Urban manufacturing refers to the production of physical goods that occurs within cities and is intrinsically linked to the urban context. Based on the general definition of manufacturing as the transformation of materials through labour, tools, and machinery into products at scale (Hill et al., 2020), urban manufacturing distinguishes itself by its reliance on and contribution to the distinct assets of cities such as labour, skills, technology, existing infrastructure and a local consumer base (Tsui et al., 2021; Green Leigh, 2013). Manufacturing that occurs in cities is tightly integrated within urban systems such as food production, waste management and healthcare customisation and so on (Hill et al., 2020)

Urban manufacturing is not defined just by the physical location of production within city boundaries, but by the extent to which manufacturing activities are oriented toward and embedded within the urban context (Hill et al., 2020). In this sense, it is the orientation of businesses toward the socio-economic, technological, and infrastructural characteristics of the city that distinguishes urban manufacturing. It can be understood as comprising two primary forms: those that depend on the city by drawing on its dense networks, and those that serve the city by providing services or products.

3.2 Types of businesses

Businesses that fall under this definition can be further categorised into four distinct types according to Tsui et al. (2021): **personal fabricators** who are hobbyists and create products primarily for personal use or their small business, **maker spaces** which provide shared workshop environments where individuals collaborate, access tools, and exchange ideas, **mini-factories** which refers to small- to medium-sized manufacturing businesses, and **traditional urban industry** that refers to large-scale manufacturers that remained within city boundaries. These forms of urban manufacturing persist in cities because their operations directly benefit from agglomeration economies, which enhance their adaptability and competitiveness (Jacobs 1961; Tsui et al. 2021). Businesses that could relocate to non-urban areas have already done so; those that remain do so because their presence in the city offers a clear strategic advantage (Ferm et al., 2021).

Although the four types of Tsui et al. (2021), give some direction it is still hard to generalise manufacturing businesses as it encompasses a wide variety of producers, each with distinct spatial and operational needs. This was for example observed in existing productive clusters in London, where spatial morphologies are far from uniform, but rather represent a "mix of mixes" in both function and form (Ferm et al., 2021). Defining urban manufacturing typologies by their scale might therefore be problematic, as it could suggest that this is the only characteristic defining them. A simple example illustrates this limitation: a small-scale workshop may generate far more nuisance for neighbouring functions than a larger but quiet facility. Relying on scale alone would therefore misrepresent the actual impact of different activities and additional factors must be considered to be able to differentiate businesses.

3.3 About mixed-use

While manufacturing businesses are difficult to classify into strict typologies, the buildings they occupy can be categorised more clearly. To do so, however, it is first important to understand the different forms of mixed use that can occur within buildings or areas. Jane Jacobs (1961) was one of the first to notice that a fine-grain mixing of diverse uses creates vibrant and successful neighbourhoods. Jacobs makes a distinction between mixed primary uses and mixed secondary uses, where primary uses such as residential or service functions produce the demand for secondary uses such as shops, bars and restaurants. Spatially, these functions are mixable through different dimensions: the shared premises dimension which refers to multifunctional use at a particular point (i.e. a building or dwelling), horizontal

dimension where different functions exist next to each other and the vertical dimension where different functions are stacked on top of each other (Hoppenbrouwer and Louw, 2005). Functions are not only mixable spatially, but also timewise which is why Hoppenbrouwer and Louw propose a fourth dimension: the time dimension. This dimension refers to the fulfilment of multiple functions within a certain time-period, where a longer time horizon correlates with a larger separation of functions. Hoppenbrouwer and Louw refined the mixed-use framework of Rowley (1996) where the four dimensions are related to different scales (varying from building to city) and urban texture (grain, density and interweaving) as can be seen on figure 3.2.
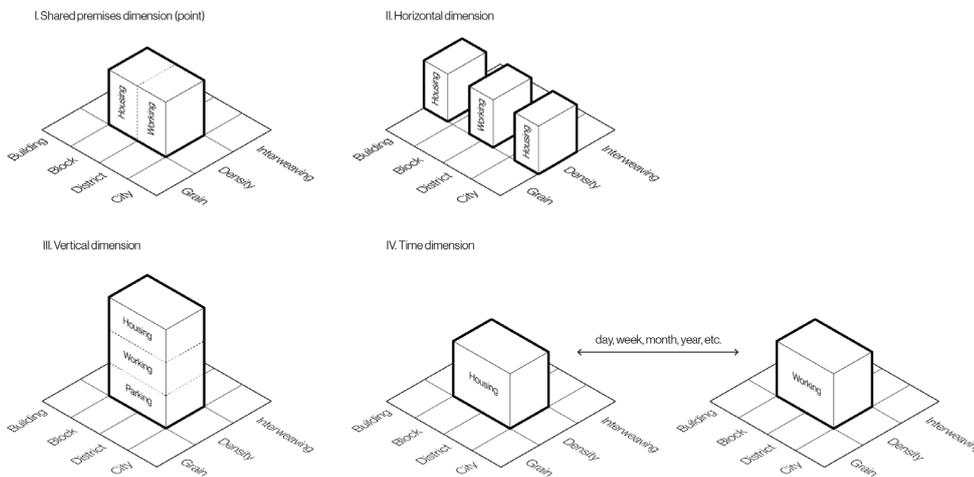
Figure 3.2: Different types of mixed-use. After Hoppenbrouwer and Louw, 2005.

Leinfelder and Pisman (2008) identified not only a space and time relationship between different functions, but also a relational dimension; functions can be either connecting or separating. This gives six different forms of mixed-use as can be seen on figure 3.3. As an example symbiosis could be reached when functions are not only related to each other but also use space very intensively such as nature development in a drinking water-collection area, overlap on the other hand is reached when there is a mutual tolerance of functions which can be combined in a more intensive use of space but without strengthening interrelations such as sports centres with common parking facilities (Leinfelder & Pisman, 2008).
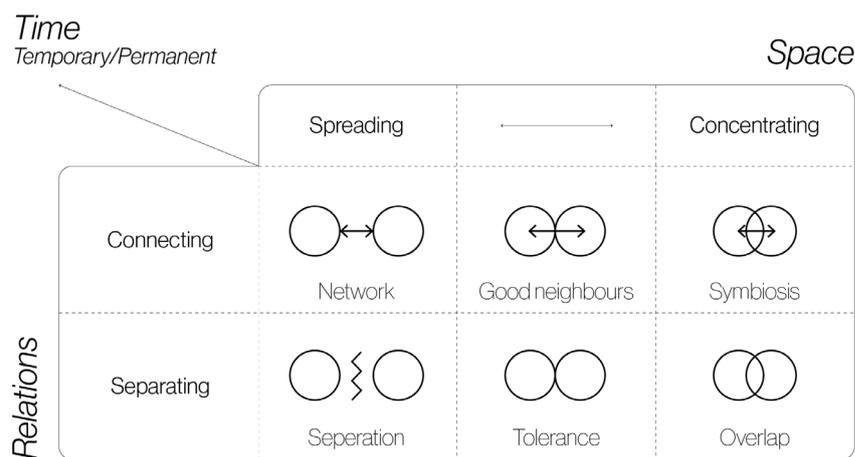
Figure 3.3: Relationships between functions. After Leinfelder & Pisman, 2008.

3.4 Building typologies

Following an analysis of various buildings in which living and working functions are combined, Geuting et al. (2019) classified eight distinct typologies. Although the scale of these typologies varies, they share fundamental similarities, and can be distilled into three basic types: the **live-work house**, the **live-work building**, and the **work building** (as can be seen on the figure 3.4 on the next page). These can be linked to the framework proposed by Hoppenbrouwer and Louw (2007), in which the live-work house corresponds to a form of shared premises mixed-use, the live-work building to vertical mixed-use, and the work building to horizontal mixed-use.

Figure 3.4: House A / Shop B.
Source: KimuraMatsumoto
architects office, n.d.

Live-work house
Shared premises

Live-work building
Vertical

Work building
Horizontal

Figure 3.5: Typologies of live-work buildings and work buildings

3.5 A closer look at four businesses

In the following pages, four different business types (more or less the same types as proposed by Tsui et al. (2020)) are analysed through examples abroad across several characteristics to demonstrate the diversity of urban manufacturing. The characteristics are adapted from classification tables developed by Atteveld 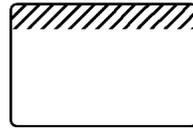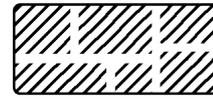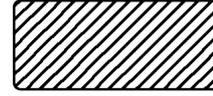e.a. (2021), which are used to define a wide range of business types. From these, the most relevant criteria for characterising urban manufacturing have been selected and applied as follows: Traffic intensity (deliveries, employees, and customers per week), size (footprint and height of the workplace), opening hours, employment (direct jobs generated by the business), spatial range (neighbourhood, city, regional, national, global), noise production (ranging from little to high), odour emissions (ranging from little to high), and vibrations generated (ranging from low to high). Due to not all data being available, certain assessments rely on informed estimations.

Building A / Shop B
Year: 2016
Architect: KimuraMatsumoto architects office
Usage: shop, workshop, cafe, house
Building typology: live-work house
Address: Japan, Kyoto, Kita Ward, Kamigamo, Aoinomoricho 7-19

Traffic intensity per week			*Size*		
(Un)Loading	*Employees*	*Customers*	*Footprint*	*Height*	*Opening hours*
1	0	120	15m²	3,5m	10:00 - 18:00

Employment	*Spatial range*	*Noise*	*Odour*	*Vibrations*
2	City	Little	Little	Little

This live-work house in northern Kyoto integrates four functions within a single building. It was designed for a couple, where the husband operates a small shop selling tools and hardware, along with an adjacent workshop where some of the products are made, while the wife runs a small cafe situated at the rear of the building. Their living space occupies the second floor. The open floor plan allows these functions to flow seamlessly into one another, and the building's transparent frontage extends this openness onto the street.

Dynamo Metal Workshop
Year: 2008
Architect: phalt Architekten
Usage: workshop
Typology: work building
Address: Switzerland, Zurich, Wasserwerkstrasse 15

	Traffic intensity per week		Size		
(Un)Loading	Employees	Customers	Footprint	Height	Opening hours
2	60	0	180m²	4,5m	10:00 - 18:00

Employment	Spatial range	Noise	Odour	Vibrations
25	City	High	Some	Little

This metal workshop forms part of a youth centre in Zurich. Its distinctive feature is the building's open design, which positions the workshop as an extension of the public realm. As a result, the noise associated with metalworking carries far beyond its immediate boundaries. For a large part this is accepted though, because neighbouring uses are part of the same community. The workshop also operates as a community space, offering metalworking courses in which residents can participate.

Figure 3.6. Small metal workshop in Zurich. Source: Phalt Architekten, n.d.

Mimasu CC
Year: 1957
Architect: -
Usage: factory, shop, office
Typology: work building
Address: Japan, Tokyo, Katsushika City, Nishishinkoiwa, 4 Chome-12-11

Traffic intensity per week			Size		
(Un)Loading	Employees	Customers	Footprint	Height	Opening hours
15	50	40	2.750m²	6m	08:00 - 17:00

Employment	Spatial range	Noise	Odour	Vibrations
8	National	Little	Some	Little

This factory, located in a residential neighbourhood in eastern Tokyo, primarily produces household cleaning products such as laundry detergents. Despite its close proximity to adjacent homes (some situated less than 1,5 metres from the exterior walls) the facility generates minimal nuisance outside of their workshop. A small store further contributes to neighbourhood interaction of the factory.

Freitag Factory Noerd
Year: 2010
Architect: Rothen Architektur
Usage: factory, shop, office
Typology: work building
Address: Switzerland, Zurich, Binzmühlestrasse 170

| Traffic intensity per week | | | Size | | |
(Un)Loading	Employees	Customers	Footprint	Height	Opening hours
20	225	405	6.000m²	12m	09:00 - 17:00

Employment	Spatial range	Noise	Odour	Vibrations
65	Global	Some	Little	Little

This building, located in a more peripheral area of Zurich, accommodates a range of compa-
nies. The ground floor houses a large workshop used by Freitag, a firm producing recycled
goods for a global market. The upper floors are occupied by smaller creative enterprises,
including architectural design firms and graphic design studios. As a relatively new and
well-insulated structure, the building generates minimal nuisance for its surroundings.
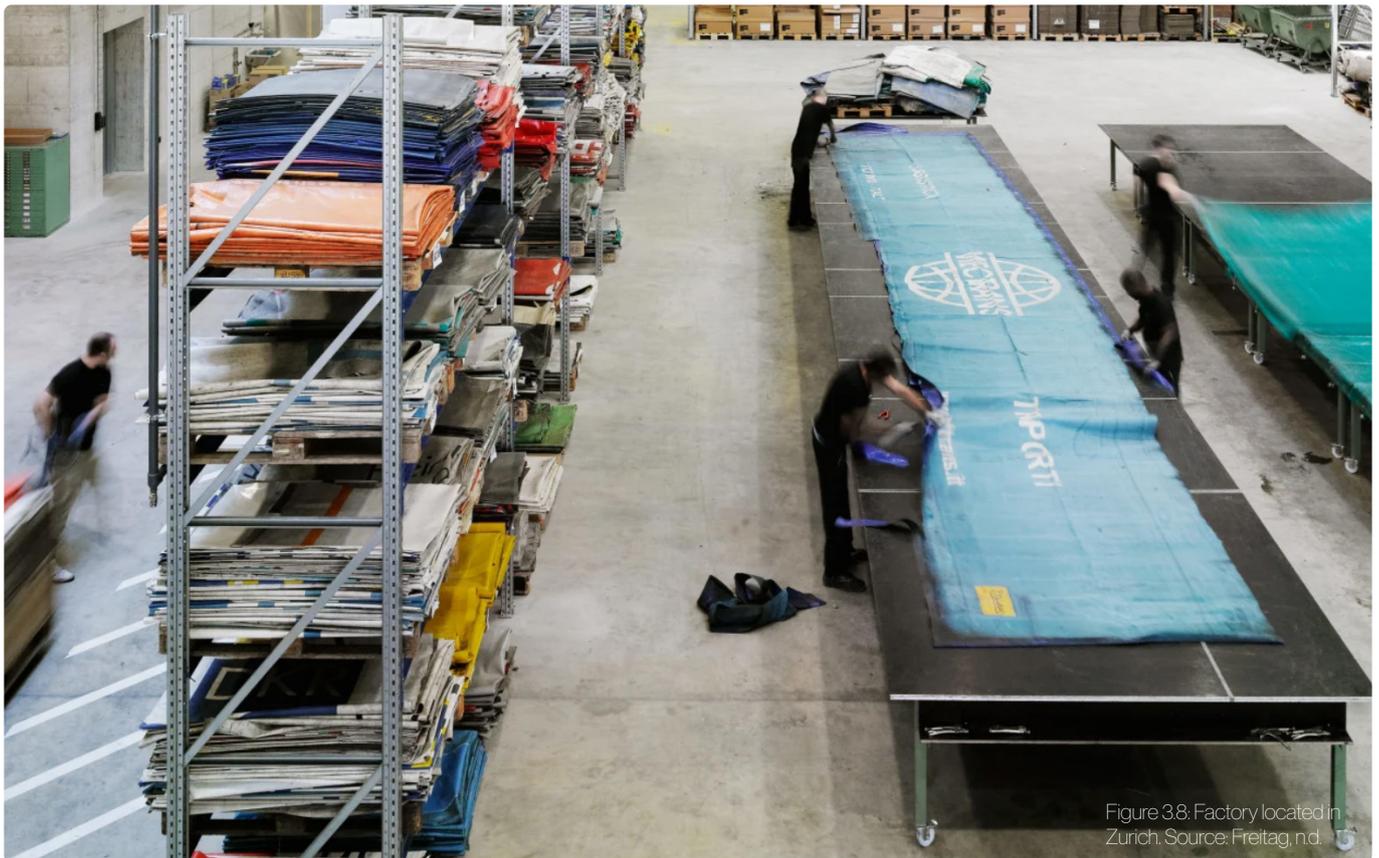
Figure 3.8: Factory located in
Zurich. Source: Freitag, n.d.

These four cases illustrate that no simple conclusion can be drawn from scale or sector
alone. While large businesses like the detergent factory in Tokyo or the Freitag Factory in
Zurich generate minimal disturbance, smaller workshops such as the metal workshop in
Zurich can be far more difficult to accommodate due to noise constraints. This undersco-
res the need to move beyond zoning based on specific business types and environmental
categories, and instead evaluate each business on its real prestations, using (some of) these
characteristics as the basis for classification.

Zoning must adapt to properly accommodate the wide variety of manufacturing businesses. The new Environment and Planning Act provides important tools for this transition, which are already being applied in practice through innovative zoning frameworks.

3.6 Zoning redone

The planning instrument that most directly affects manufacturers in the Netherlands is environmental zoning. For many years, this has been implemented through a system that classifies businesses into six environmental categories based on possible nuisance, each associated with a recommended minimum distance from sensitive functions such as residential areas (Meyer et al., 2018). The old approach, however, faced implementation issues (Bruinsma et al., 2024) and has been revised with the introduction of the Environment and Planning Act (Omgevingswet).

For industrial estates, the conventional practice of zoning outwards, where standard separation distances are imposed from industry toward sensitive functions, is no longer applied. Instead, it is replaced by **zoning inwards**, in which **transition zones** are generated around residential functions. These zones are defined by environmental criteria radiating from the sensitive function outwards, thereby determining which activities are permitted to locate within them (Bruinsma et al., 2024). Businesses are individually assessed to determine whether they fall within these criteria, rather than relying on general environmental categories (Bruinsma et al., 2024).

The new act also has implications for mixed-use neighbourhoods, making it possible to combine functions that were previously legally prohibited. It is now possible for activities that generate environmental nuisance to settle within these neighbourhoods, if the nuisance does not extend beyond the property or building itself (Bruinsma et al., 2024). This is made possible by new construction techniques that contain the environmental nuisance within the building (Hill et al., 2020; Zandbelt et al., 2019; Bruinsma & Barrois, 2019).
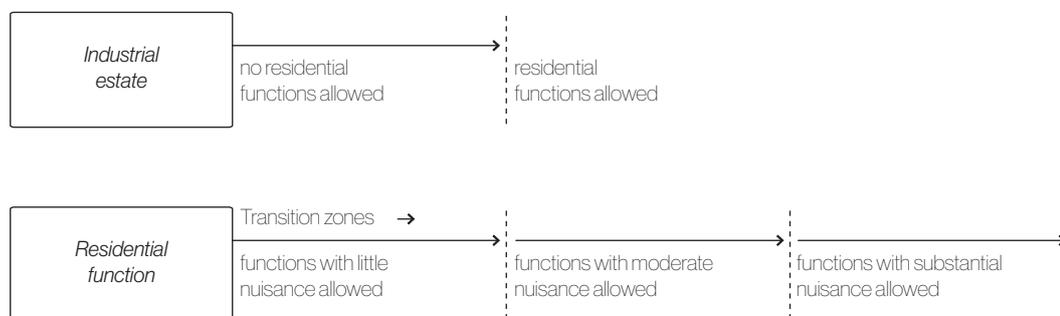
Figure 3.9: Difference between zoning outwards (above) and zoning inwards (down). Source: edited after Bruinsma et al., 2024.

3.7 The 5 *R's*

The practical application of this new approach to handling environmental nuisances is often implemented through a framework known as **Rust, Reuring, Ruis, Ruig, and Reus** (which roughly translates to Calm, Active, Noise, Rough, and Intense). These five categories (or the *5 R's*) are used as a zoning tool to indicate which functions are suitable for particular areas. Rust refers to mostly residential environments with minimal functional mixing, whereas Reus refers to industrial zones with large (and potentially polluting) industries. This five-part framework was first proposed by the urban design firm De Zwarte Hond in a study about mixed-use in Zuid-Holland in 2021. In this study, an analysis was conducted at the scale of the whole province, linking each *R* to specific types of spatial environments as commercial (zoned as reuring) or residential (zoned as rust) areas.

However, applying the complete framework at such a large scale undermines its effectiveness, as functions do not solely flourish by whether an area is primarily defined by commercial or residential functions. It depends a lot more spatial characteristics such as infrastructure or population density. Therefore, it is more effective to apply part of the framework based on the affordances of specific locations on a smaller scale, ensuring that functions are situated ▸

where they are most likely to thrive. In urban practice, this is already done in other projects by De Zwarte Hond or in the development plan for Schieoevers Noord in Delft by the firm marco.broekman (2019). Most often, the first 3 *R's* (Rust, Reuring and Ruis) are linked to specific types of infrastructure which allows for more careful transitions between functions and types of urban environments.

While the first three *R's* function most effectively when applied to specific urban conditions at the neighbourhood scale, the remaining two (Ruig and Reus) operate adequately at a regional scale. The functions situated within these zones do not require the fine-grained transitions that are necessary in mixed-use neighbourhoods, largely because sensitive functions are not permitted at the industrial estates they are located at. As a result, it is generally sufficient to classify existing industrial estates as Ruig or Reus on the basis of their current environmental categorisation (ranging from category 1 to 6). Maintaining these areas for activities that genuinely require distance from sensitive functions is crucial. If functions that could be integrated into neighbourhoods instead settle in Ruig or Reus zones, they place unnecessary pressure on the limited space available for high-impact functions that depend on separation from sensitive functions.

Zoning along the 5 R's

Rust/Reuring/Ruis (mixed-use neighbourhood)

Ruig (industrial estate with environmental category of 1-3)

Reus (industrial estate with environmental category of 4-6)

0km   5km   10km
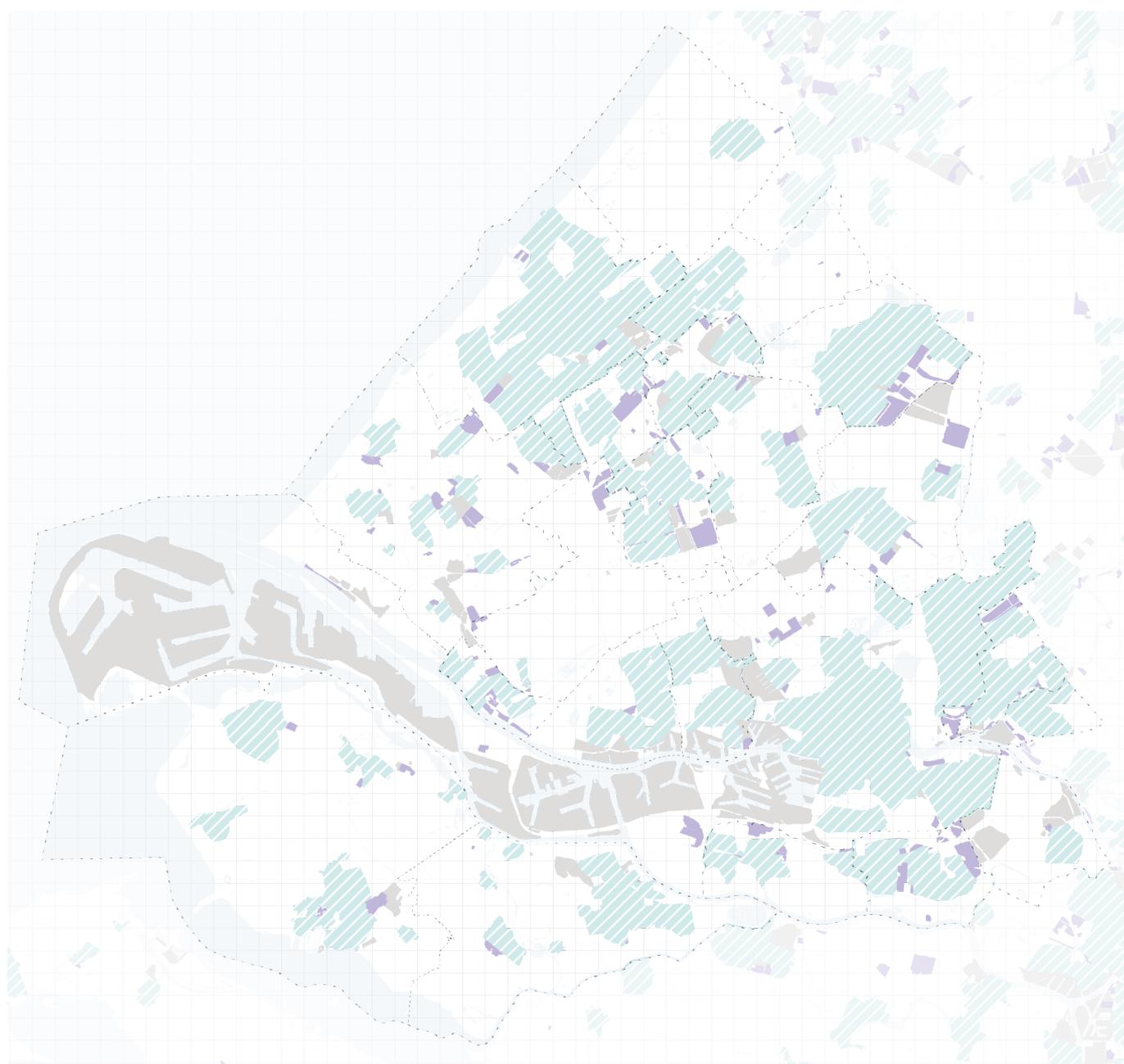
3.8 Function Filter

The next step in applying the *5R*-framework is determining which businesses can be accommodated within each category. As discussed earlier, defining fixed business typologies for manufacturing is not desirable, as such an approach would essentially replicate the logic of the old environmental zoning in the Netherlands. This would also leave little room to accommodate new types of business models that make use of new technologies.

What can be assessed, however, are the specific characteristics each manufacturing business exhibits as captured in the classification table developed for the four exemplary businesses These form the basis of the Function Filter which consists of **three deal-breakers** derived from current environmental regulations (Bruinsma et al., 2024) and design testing that explores the maximum permissible footprint of a building within postwar neighbourhood blocks in Schiedam (see appendix 2). The final step, the **Traffic Test**, evaluates the traffic intensity associated with the function in order to determine its appropriate position within the *5R*-framework.

As this thesis focusses on urban manufacturing, division between Ruig and Reus has not been made as the businesses located here are mostly not urban.

Does your business use hazardous materials or production processes?

No   Yes

Does your business produce nuisance outside of your building exceeding these values?
Noise: 45dB(A)
Odour: 0,5 ouE/m³

No   Yes

Does your business need a building bigger than 3.000m²?

No   Yes

See what situation applies best for your business.

My business recieves: a couple deliveries per week; a couple customers per week.	My business recieves: a couple deliveries per week; multiple customers per day.	My business recieves: some deliveries every day; a couple customers per week.	My business recieves: multiple deliveries every day; a couple customers per week.
Rust	Reuring	Ruis	Ruig / Reus

With this tool, any type of business can determine the location within the *5R*-framework that best aligns with its operational profile. In some cases, manufacturing firms may not immediately meet the requirements of their preferred zone. To address this, a curator or comparable facilitative actor can provide case-by-case guidance. For example, if a company exceeds acceptable noise levels, the facilitator can advise on appropriate architectural or technical mitigation measures that would enable the business to comply with the criteria of the desired location.

The diagrams below illustrate the process through which the Function Filter assesses and subsequently allocates businesses to appropriate zones.

Colours that represent the 5 *R*'s:
- Rust
- Reuring
- Ruis
- Ruig / Reus

Deal-breaker 1: Hazardous materials or production processes

Deal-breaker 2: Excessive nuisance levels

Deal-breaker 3: Building footprint

Traffic test

This filter makes it possible to identify which productive functions can be integrated into existing neighbourhoods. Examples of businesses that would be permitted include: bicycle repair workshop, tool and die workshop, metal fabrication workshop, prototyping studio, welding shop, clothing atelier, precision machining workshop, ceramics workshop, cable and wiring workshop, craft brewery, musical instrument workshop, office machinery manufacturing and repair, glass processing workshop, jewellery studio, furniture manufacturing workshop, upholstery factory, carpentry and joinery workshop, printing plant, bookbinding workshop, packaging production facility, textile processing plant, industrial laundry facility.

Integrating manufacturing into neighbourhoods strengthens urban circularity by making activities like repair and remanufacturing part of everyday life. Other circular processes such as recycle and recover also manifest themselves at specific locations within the city. Implementing this ultimately leads to different consumption patterns.

3.9 Defining circularity

Circularity has become an increasingly influential theme in policy agendas. Circularity is bound to the circular economy (CE) concept, which at its core sees any waste stream as a recourse that can be reused through several circular strategies like repair or recycle (Furlan et al., 2022). It opposes the currently prevailing linear **take-make-waste** model, where raw materials are extracted, produced into goods and eventually disposed of when considered unnecessary.

The most widely adopted conceptualisation of the CE stems from the Ellen MacArthur Foundation (2013), whose model distinguishes between two material cycles: a biological sphere, in which materials safely regenerate into the biosphere, and a technical sphere, in which products and materials circulate through a series of circular strategies. The operationalisation of this technical sphere is often articulated through the R-ladder, which proposes a hierarchy of circular strategies . These range from upstream actions as **refuse** (R1), **rethink** (R1) and **reduce** (R2) which narrow down the material flow, to midstream actions as **reuse** (R3), **repair** (R4), **refurbish** (R4), **remanufacture** (R4) which slow down the material flow, and finally downstream strategies as **recycle** (R5) and **recover** (R6) which close the material flow (Kishna & Prins, 2024).
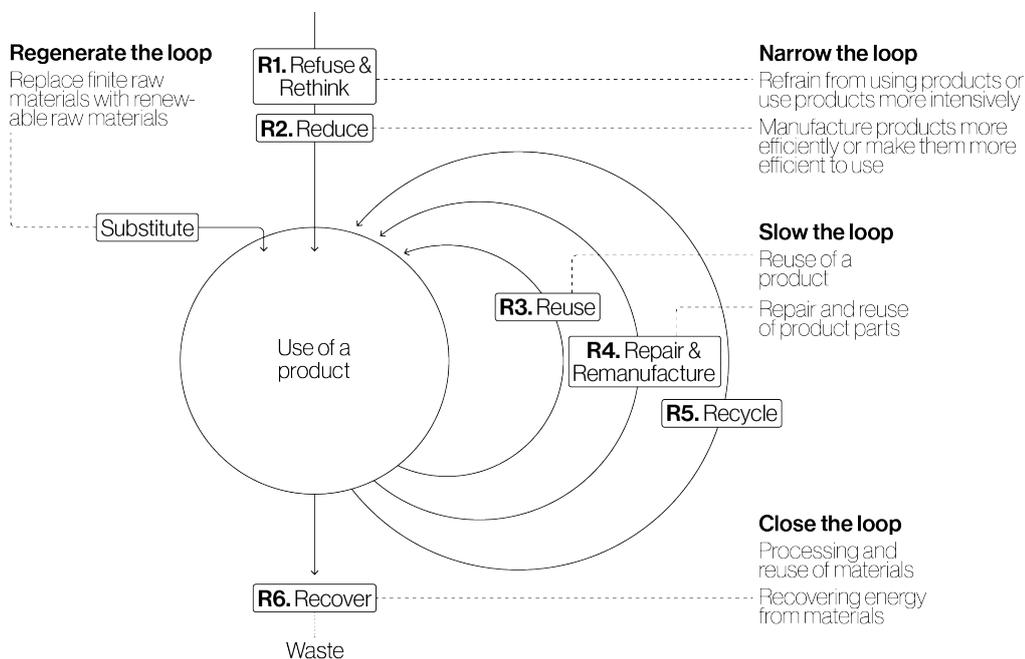

Figure 3.10: The R-ladder and the relation between the different circular strategies. After Kishna et al., 2019; Theye, 2025.

Recent scholarship suggests though, that the CE should be understood far more broadly than just looking at material flows. Calisto Friant et al. (2023), for example, propose a holistic framework of seven interdependent **socio-ecological cycles**:

1.   Biogeochemical cycles: circulation of biochemical cycles as water or carbon
2.   Ecosystem cycles: healthy and balanced ecosystem
3.   Resource cycles: sustainable management of materials and energy
4.   Political cycles: stable and fair democratic institutions
5.   Economic cycles: equally distributed wealth
6.   Knowledge cycles: open-source and transparent information and technology
7.   Social cycles of care: care as the cornerstone of society

These cycles together form the foundation of what they call a circular society. While it is important to recognise this integrated perspective, this thesis focuses primarily on the third cycle. The remaining cycles extend beyond the scope of this research and are therefore not addressed directly.
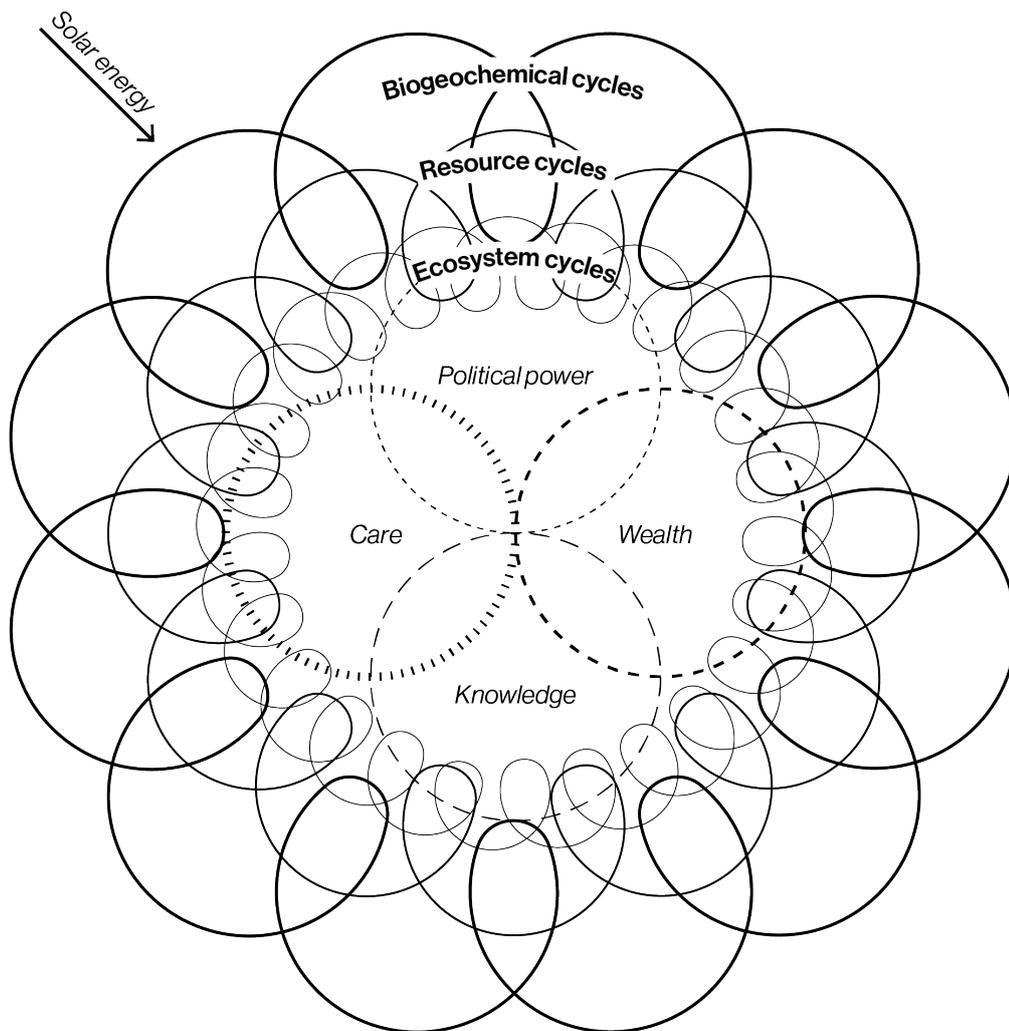

Figure 3.11: The seven socio-ecological cycles that form a circular society. After Calisto Friant et al., 2023.
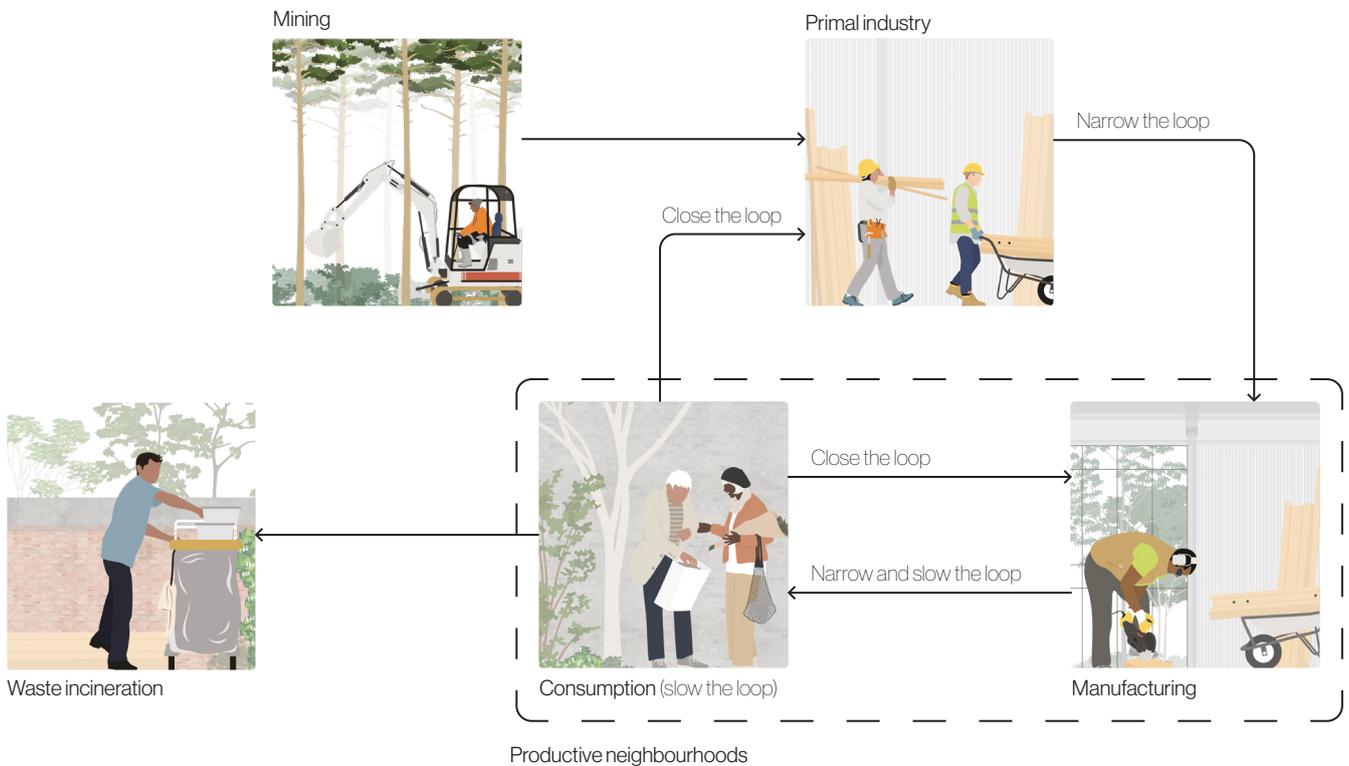
3.10 Circularity spatialised

When looking at the industrial system and flows related to them, Kishna & Prins (2024) argue that the different strategies manifest themselves within these material flows. This is however still a meta-way of looking at how the CE manifests itself spatially. This is underlined by Furlan et al. (2022) who argue that research on circular urban and territorial development demands more than merely upscaling industrial ecosystems diagrams.

By looking at the different circular strategies though, one can recognise a pattern in how they manifest themselves in particular parts of cities. Downstream activities such as recycling typically involve higher volumes of material flows and therefore require larger spatial footprints (STEC Groep, 2024). These activities often cluster in harbour zones and industrial areas. The spatial affordabilities for these businesses is largely determined by the materials being processed (Tsui, 2023). Businesses dealing with wood for example, generally function well on dry locations, whereas businesses processing textile, paper or building materials profit from a location accessible by transportation over water (STEC Groep, 2024). Midstream activities such as repair or refurbish benefit from being located within neighbourhoods close to consumers (Tsui et al., 2021). Meanwhile, service-oriented professions that support the circular economy indirectly, tend to concentrate in central urban areas (Gladek et al., 2018). It is difficult to claim that these supportive professions directly relate to the more upstream circular strategies though. As the diagram of Kishna & Prins (2024) illustrates, strategies aimed at narrowing material flows occur throughout the entire system. One could therefore argue that these strategies are not tied to a specific location but occur across the entirety of a city.

The terms upstream midstream and downstream have been derived from Theye, 2025.

Figure 3.12: Circular strategies and their relation to the industrial system. After Kishna & Prins, 2024.

Mining

Primal industry

Narrow the loop

Close the loop

Waste incineration

Consumption (slow the loop)

Close the loop

Narrow and slow the loop

Manufacturing

Productive neighbourhoods
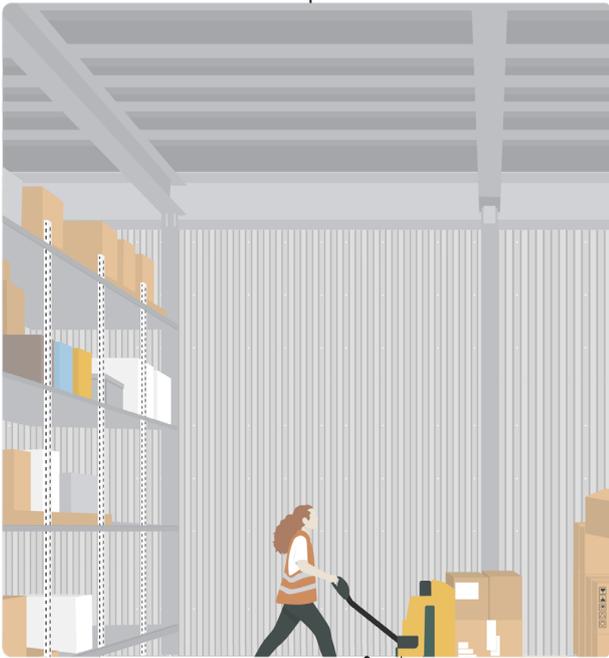
3.11 Current consumption logic

The diagram* below illustrates the current logic of how goods and materials flow toward consumers. At its core, this system is linear: raw materials are extracted, processed, and manufactured into consumer products, after which they are distributed and eventually discarded once they fall out of use. Production and distribution typically occur far from the consumer (often overseas or on peripheral industrial estates), rendering the origins, makers, and true value of the product largely unknown to those who purchase them.

The lack of accessible repair options further undermines the potential for circularity. Consumers must often go out of their way to repair goods, or they may simply be unaware of where such services exist. As a result, replacing a product for a new one becomes far easier than extending its lifespan, reinforcing the take–make–waste model.

*Each illustration in the diagram represents a specific actor within the system. The scales at which the actor mainly operates, as well as the typical location to which it is tied, is indicated alongside it. The size of each illustration represents the importance of the actor in the system. Line thickness corresponds to the relative volume of a particular flow. For each flow, the text alongside it specifies what is being moved, the mode of transport involved, and the types of infrastructure that enable it.

Processing
Global / Continental / National

Processed materials
Trucks
Regional & local roads

Processed materials
Cargo ships / Cargo trains / Trucks
Waterways / Rail / Regional roads

Raw materials
Cargo ships / Cargo trains / Trucks
Waterways / Rail / Regional roads

Mining
Global / Continental

Production
Global / Continental / National
Industrial estate

Distribution
National / Regional
Industrial estate

Products
Trucks
Regional & local roads

Shop
Regional / Local
Neighbourhood

Products
Car / Bike / Foot
Local roads

Products (online)
Vans
Regional & local roads

Products
Trucks
Regional roads

Products
Trucks
Regional roads

Products
Trucks / Vans
Regional & local roads

Products & services
Vans / Cargo bikes
Local roads

Consumers
Not bound by scale

Local manufacturing
Regional / Local
Industrial estate / Neighbourhood

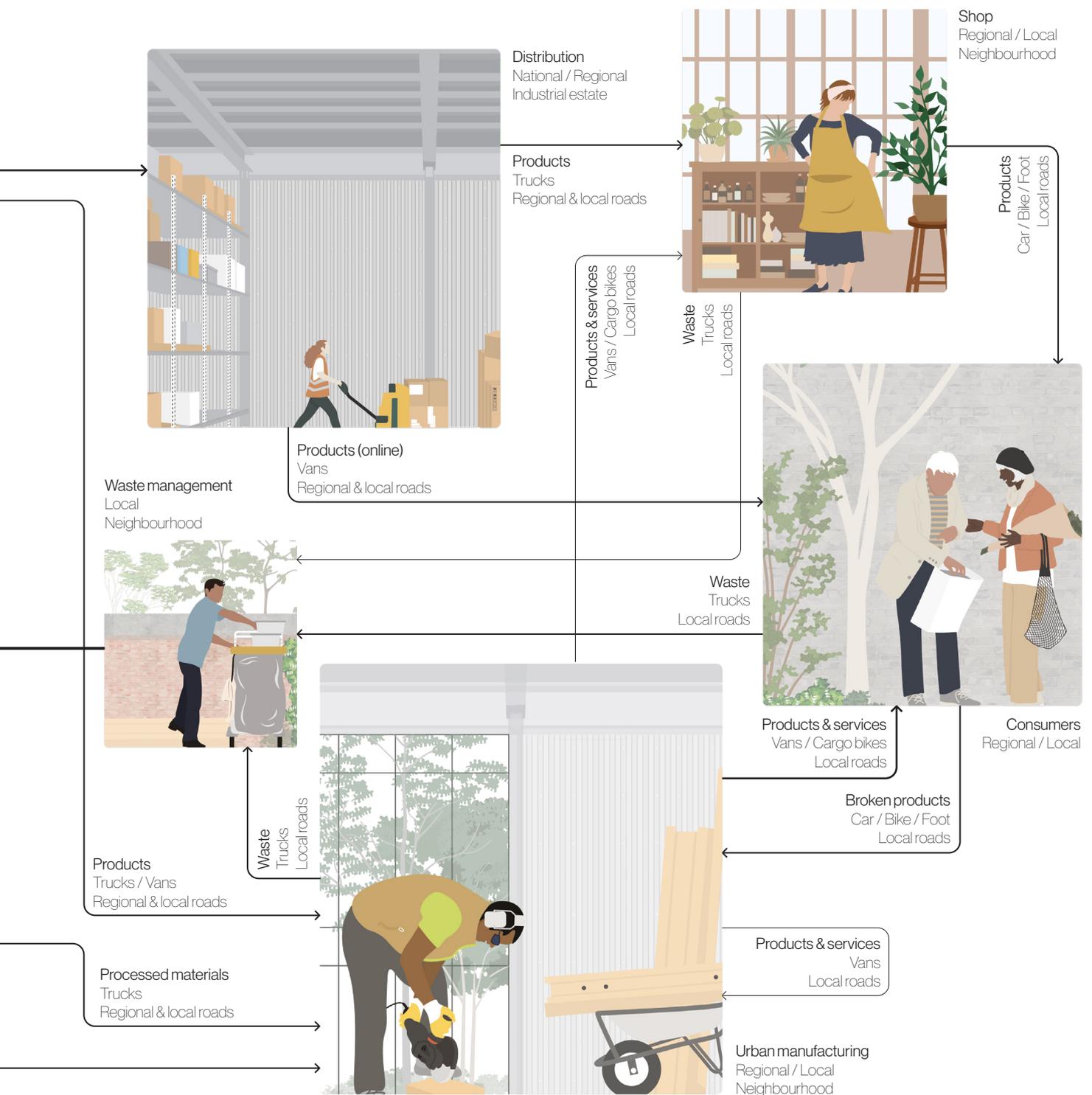**Products & services**
Vans
Local roads

3.12 The new logic

In the new logic, urban manufacturing gets to play a more prominent role, acting as a key facilitator of local circular activities. By locating manufacturers close to where people live, practices such as repair, refurbishment, and remanufacturing become more accessible, giving residents easier opportunities to extend the lifespan of their products. Local production also creates synergies with nearby shops and households, enabling services such as the installation or remodelling of interiors. With this in place, consumers have the choice to be more bound by scale than in the current system, and consume more locally.

Another essential component of the new logic is the integration of recycling and recovery facilities. These facilities play a central role in returning materials and disused products to the production cycle, enabling manufacturers to repurpose components or create new goods

Production
Continental / National
Industrial estate

Products
Trucks
Regional roads

Mining
Global / Continental

Processed materials
Cargo ships / Cargo trains / Trucks
Waterways / Rail / Regional roads

Processed materials
Cargo ships / Cargo trains / Trucks
Waterways / Rail / Regional roads

Raw materials
Cargo ships / Cargo trains / Trucks
Waterways / Rail / Regional roads

Processing
Global / Continental / National

Waste
Trucks
Regional & local roads

Recycle / Recover plant
Regional
Industrial estate

Processed materials
Trucks
Regional & local roads

from recycled materials. To support this, it is important to reserve space for recycling and recovery functions on industrial estates, and to maintain an accessible network of waste management facilities that makes separation and disposal straightforward for everyone. When such a system is in place (in which materials and products circulate far longer than in the current linear model) the demand for raw material extraction and primary processing is reduced, thereby lowering dependencies on resources from outside Europe.

Distribution
National / Regional
Industrial estate

Products
Trucks
Regional & local roads

Shop
Regional / Local
Neighbourhood

Products
Car / Bike / Foot
Local roads

Products & services
Vans / Cargo bikes
Local roads

Waste
Trucks
Local roads

Products (online)
Vans
Regional & local roads

Waste management
Local
Neighbourhood

Waste
Trucks
Local roads

Products & services
Vans / Cargo bikes
Local roads

Consumers
Regional / Local

Waste
Trucks
Local roads

Broken products
Car / Bike / Foot
Local roads

Products
Trucks / Vans
Regional & local roads

Products & services
Vans
Local roads

Processed materials
Trucks
Regional & local roads

Urban manufacturing
Regional / Local
Neighbourhood

4
Postwar neighbourhoods

This chapter examines postwar neighbour-
hoods by identifying and defining typologies
across multiple spatial scales. Each typology
is assessed for its potential to accommodate
or integrate urban manufacturing.

The chapter concludes by defining the
concept of liveability, followed by a focused
analysis where again Schiedam is used as
an exemplary city to show how liveability is
spatialised and what factors come in play.

Figure 4.1: Groenoord during construction. Source: Dijkstra, 1970.

Five neighbourhood types shaped the post-war expansion of Dutch cities From these, garden city high-rise neighbourhoods hold the greatest potential for accommodating productive functions. Therefore, these neighbourhoods are further analysed to define typologies across multiple scales.

## 4.1 Postwar neighbourhood typologies

The decades following the Second World War were a highly dynamic period in Dutch urban planning, during which a wide range of ideas (and their corresponding spatial expressions) emerged in succession. Despite this diversity, postwar urban development can broadly be grouped into **five main categories**: early postwar expansion (1945–1950), garden city low-rise (1950–1970), garden city high-rise (1950–1970), bloemkoolwijk (1970–1990), and VINEX neighbourhoods (1995–2005). Although additional types can be identified, such as high-rise districts or restructured neighbourhood (Kluck et al., 2023), these typically build upon existing urban structures and therefore lack the consistency required for a more generalised analysis. For this reason, they are not included in this analysis.

Postwar neighbourhoods in the MRDH. Source: Kluck et al., 2023.

- Early postwar expansion
- Garden city low-rise
- Garden city high-rise
- Bloemkoolwijk
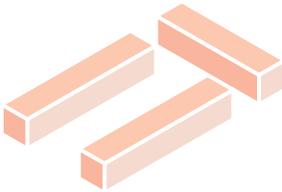- VINEX neighbourhood

0km   5km   10km
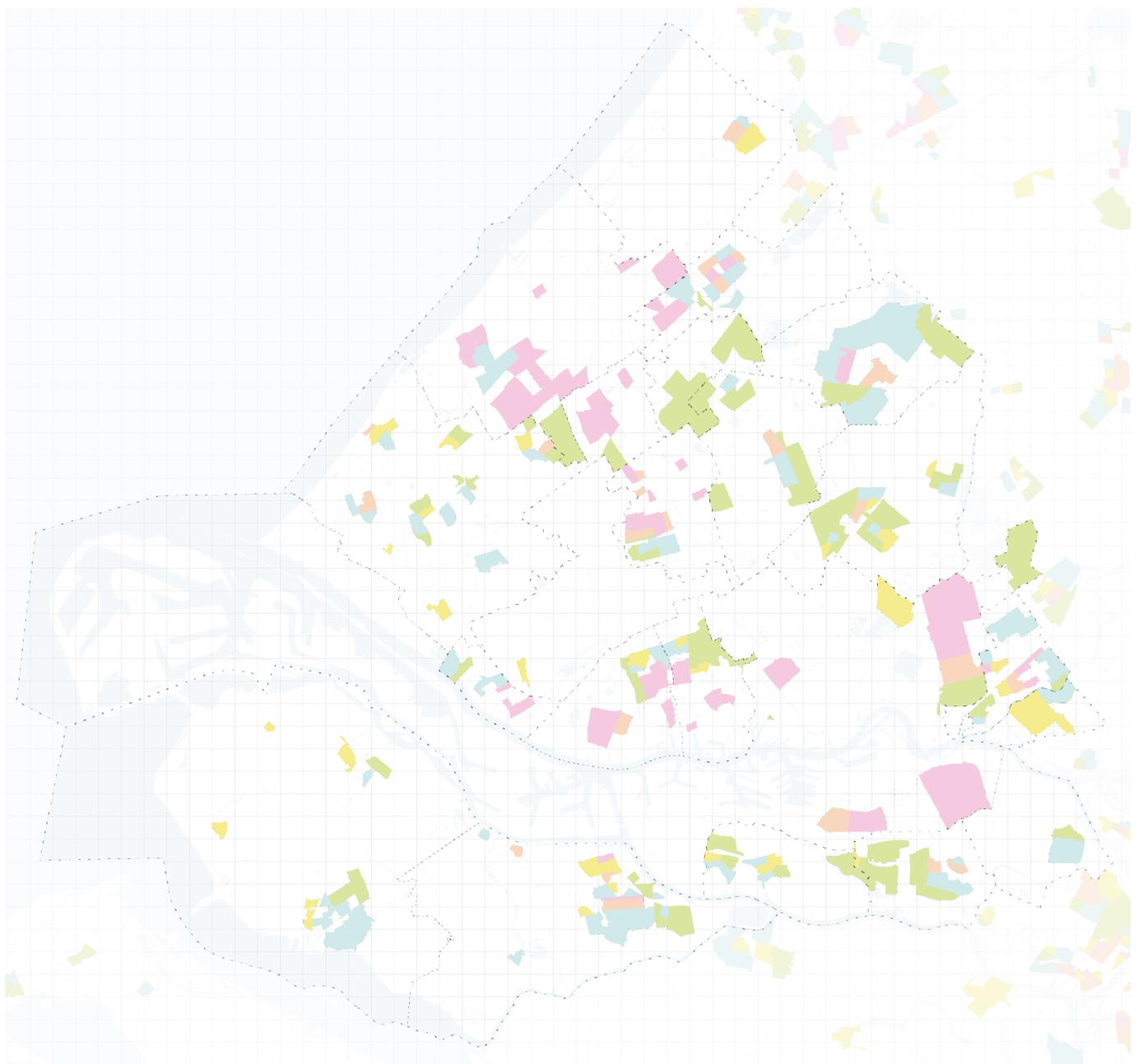
Early postwar expansion
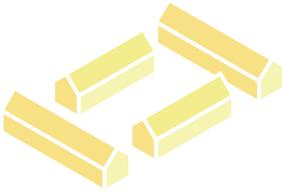
Characterised by two-storey terraced houses with pitched roofs, typically accompanied by both front and back gardens. The streets are relatively wide and often dominated by paved surfaces to accommodate parking.

|	
Prevailing building type:	terraced house
Prevailing block type:	semi-open
Average GSI:	0,273
Average FSI:	0,578

Garden city lowrise

These neighbourhoods are characterised by predominantly open building blocks composed of terraced houses set within generous public green space. The homes have private back gardens and are oriented towards the street.

|	
Prevailing building type:	terraced house
Prevailing block type:	open
Average GSI:	0,232
Average FSI:	0,560

Garden city highrise
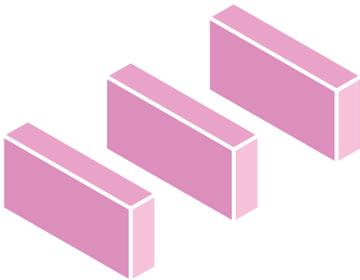
Defined by open building blocks, containing buildings ranging from four to sometimes over fourteen storeys. The ground level is primarily organised for parking or as public green space in the form of grass fields.

Prevailing building type:	walk-up flat / deck-acces flat
Prevailing block type:	open
Average GSI:	0,139
Average FSI:	0,418

Bloemkoolwijk
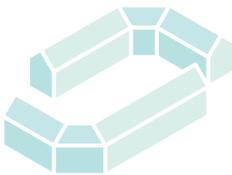
Bloemkoolwijken (cauliflower-neighbourhoods) are characterised by winding streets leading to blocks primarily composed of terraced houses. Green–blue structures form the underlying framework of these neighbourhoods, while the streetscape itself remains largely paved.

Prevailing building type:	terraced house
Prevailing block type:	semi-open
Average GSI:	0,257
Average FSI:	0,600

VINEX-neighbourhood

These neighbourhoods comprise a wide variety of housing types arranged in diverse urban configurations. Dwellings typically have generous back gardens, and the streets are wide, with lots of space for parking.

Prevailing building type:	varied
Prevailing block type:	varied
Average GSI:	0,215
Average FSI:	0,511

Neighbourhood characteristics based on Kluck et al., 2023.

GSI and FSI calculations based on data from Harbers et al., 2024.

4.2 Transformation possibilities based on GSI

The Ground Space Index (GSI) provides a quantitative indication of the spatial density of urban fabrics, describing the proportion of built footprint relative to total surface area. A low GSI typically reflects a loose urban structure with generous open space, while a high GSI indicates compactness.

When comparing different post-war neighbourhoods typologies, the **Garden City high-rise** neighbourhoods demonstrate an exceptionally low **average GSI of 0,139**. This difference can be attributed to the urban form of widely spaced slab blocks and extensive green or residual publicly owned spaces between buildings. Originally designed this way to provide light, air, and space, it now mainly results in an underutilised ground plane.

From the perspective of transformability, this provides opportunities, as the abundance of open space and low ground coverage create opportunities to introduce extensions or new volumes. Compared to denser neighbourhoods, where transformation often implies replacement or vertical intensification, the garden city high-rise neighbourhoods* offer a spatially generous and structured organisation that can serve as a testing ground for the co-existence of productive and residential functions. The following pages examine these neighbourhoods and evaluate their potential for accommodating urban manufacturing.

GSI in the MRDH (with garden city high-rise neighbourhoods outlined). Source: Harbers et al., 2024.

- 0,0 - 0,2
- 0,2 - 0,4
- 0,4 - 0,6
- 0,6 - 0,8
- 0,8 - 1,0
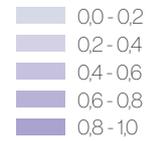
*For ease of reference, the garden city high-rise neighbourhoods will be simply refered to as postwar neighbourhoods from now on, as is already mostly done within Dutch contexts.

0km   5km   10km
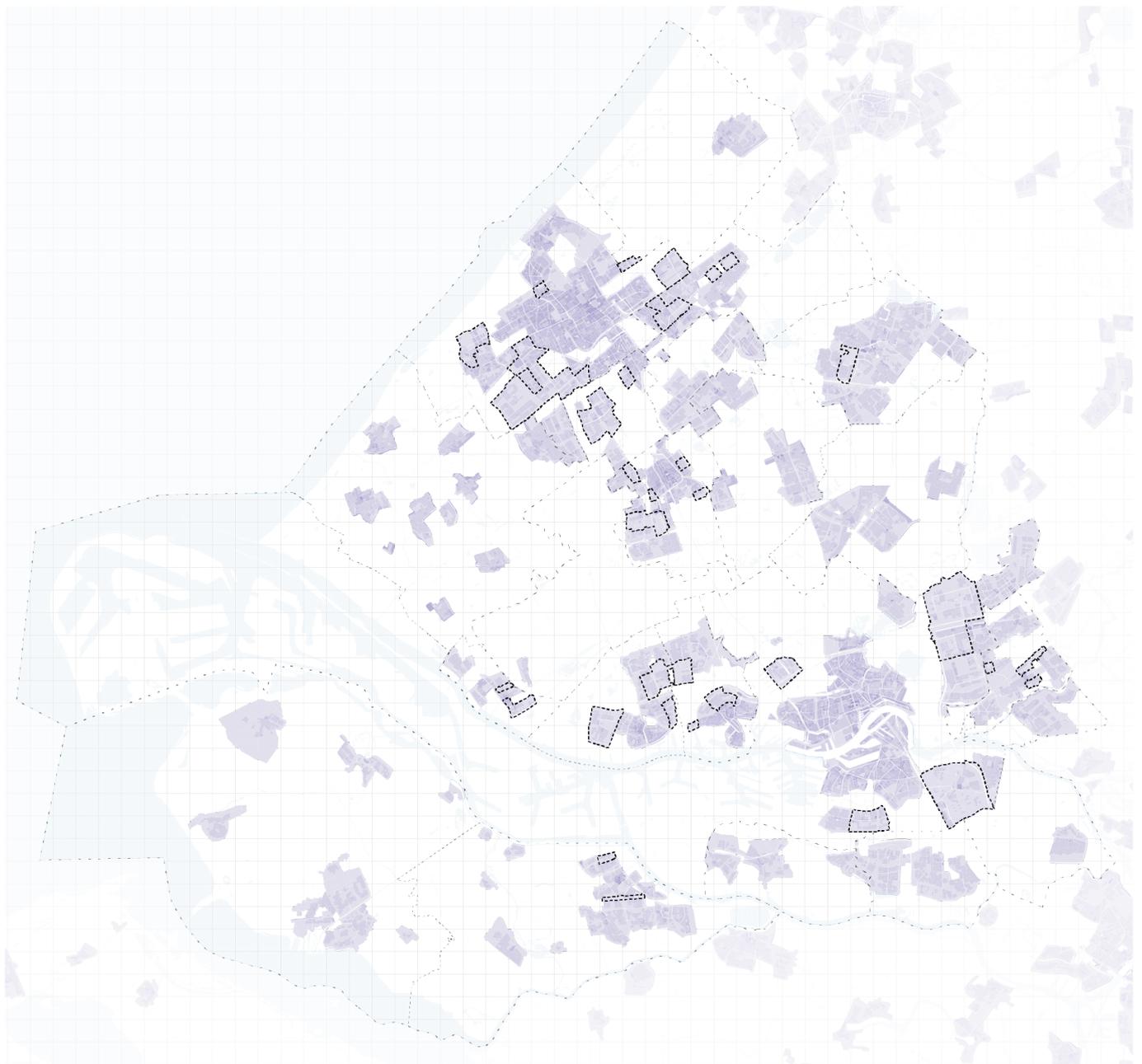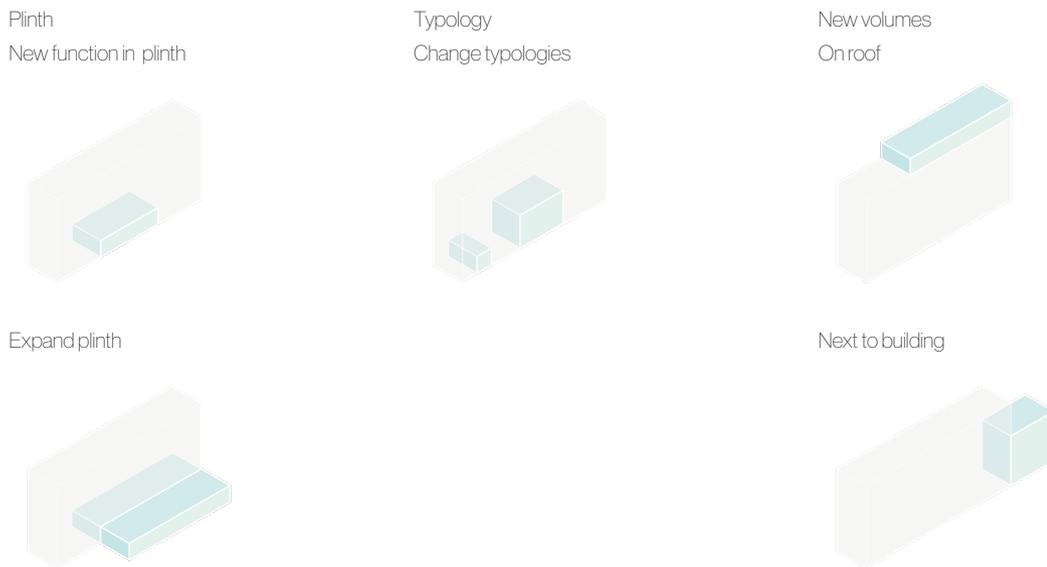
4.3 Postwar building typologies

Within postwar neighbourhoods three predominant residential building types can be distinguished: **ground-access terraced houses**, **walk-up apartments**, and **deck-access apartments**. The ground-access rowhouse type, with its individual entrance on the ground floor and being relatively large in size, offers the greatest potential for internal mixed-use, allowing for small-scale production on the ground floor or through extensions toward the garden. In contrast, the walk-up and deck-access types, characterised by shared circulation and elevated living levels, present more limited possibilities at the dwelling scale. However, their ground-floor zones that are often occupied by storage spaces, hold potential for repurposing into productive spaces.

Ground-access terraced house

Walk-up apartments

Deck-access apartments

Dwelling

Storage

Entrance

Structure
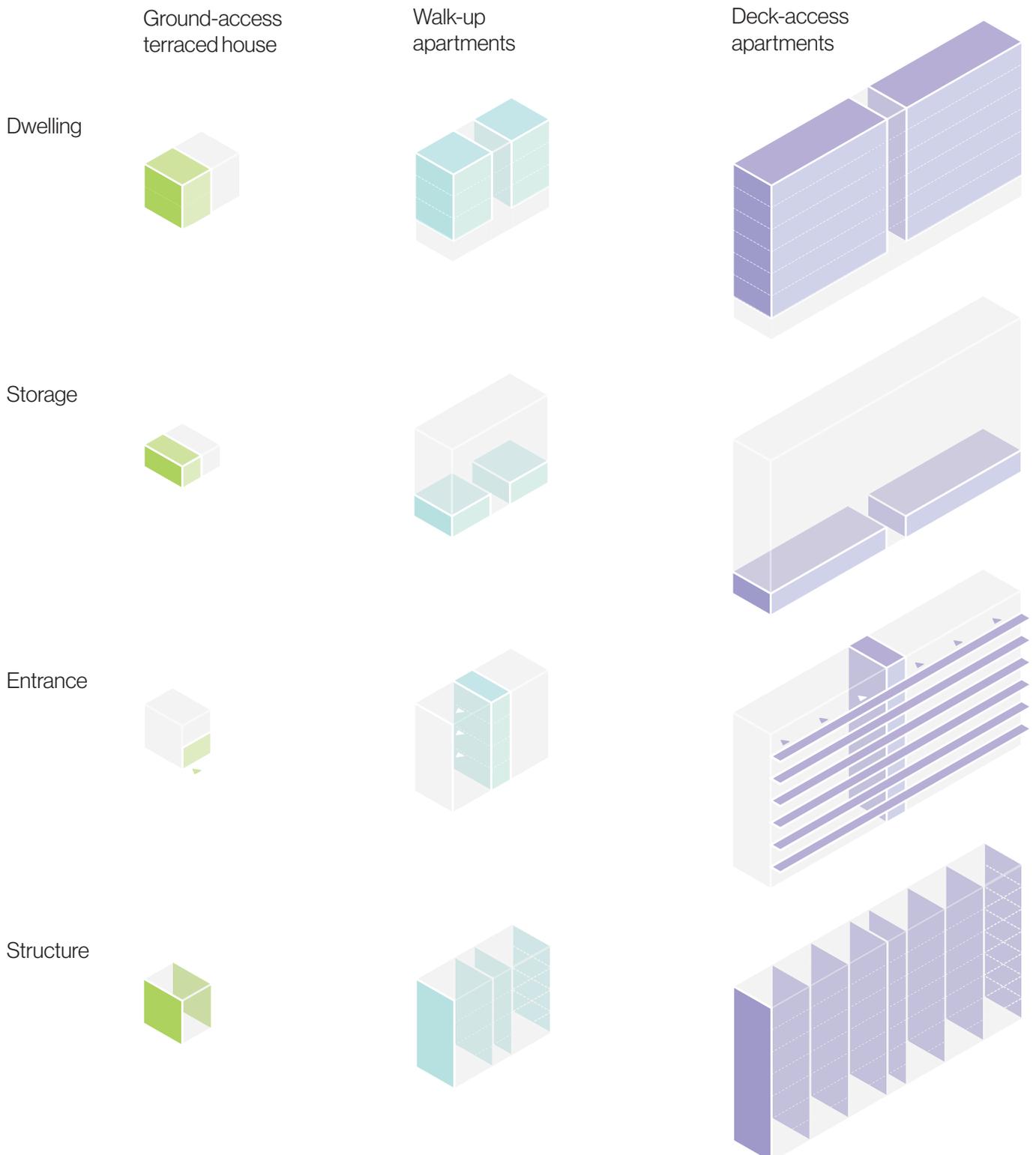
To understand the possibilities of transformation in postwar neighbourhoods, two reference studies of deck-access apartment buildings have been conducted, in which working formed part of the new programme.

4.4 Reconfiguring postwar buildings

A design study by Otto Paans and Ralf Pasel (2014) on the post-war neighbourhood of Overvecht in Utrecht explored several strategies for accommodating new programmes within these areas, primarily by adapting and reconfiguring the existing building stock.

Plinth
New function in plinth

Typology
Change typologies

New volumes
On roof

Expand plinth

Next to building

4.4.1 De Boel

This building was renovated by Hans van Heeswijk Architects, who expanded the existing work programme by adding additional office space in the plinth and first floor. This intervention significantly improves the building's relationship with the street. The existing dwellings were renovated, as well as adding ten new units on the roof, which also hosts a shared rooftop garden.

Added functions after renovation
- Rooftop usage
- Work-programme
- Residential-programme
- Parking garage

Common rooftop garden

New housing on top of the roof

Additional office space in plinth and first floor
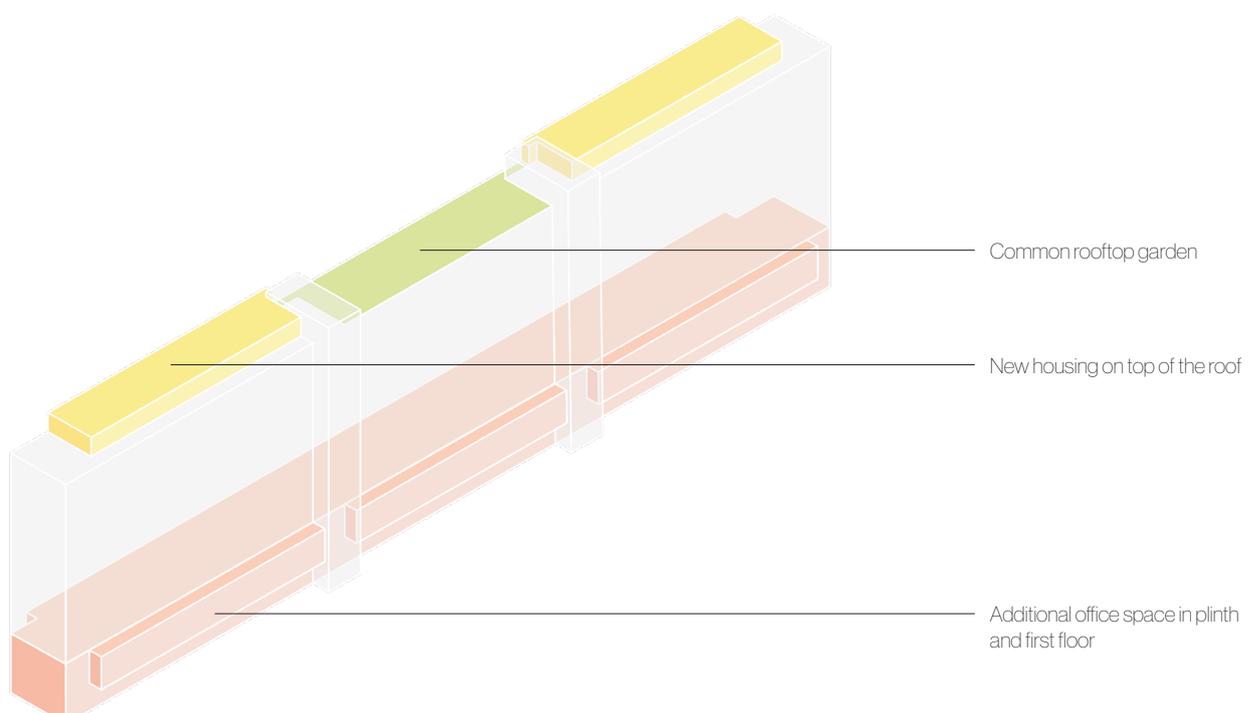
4.4.2 Kruitbergflat

One of the remaining original Bijlmer flats was upgraded by KOVOS Architects. The plinth was expanded, creating space for functions such as a GP practice on the metro-facing side, while also allowing several new ground-floor dwellings to be added along the courtyard. The expansion additionally included a new parking garage, removing cars from the streetscape. A new rooftop structure was added as well, together with PV panels.

PV-panels

New housing in plinth with ground-floor access

New structure on rooftop

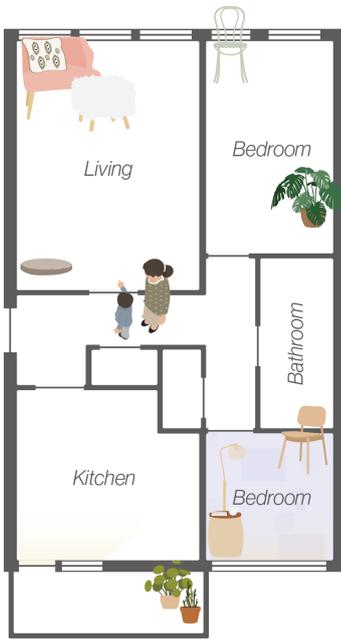New parking garage

New functions in plinth
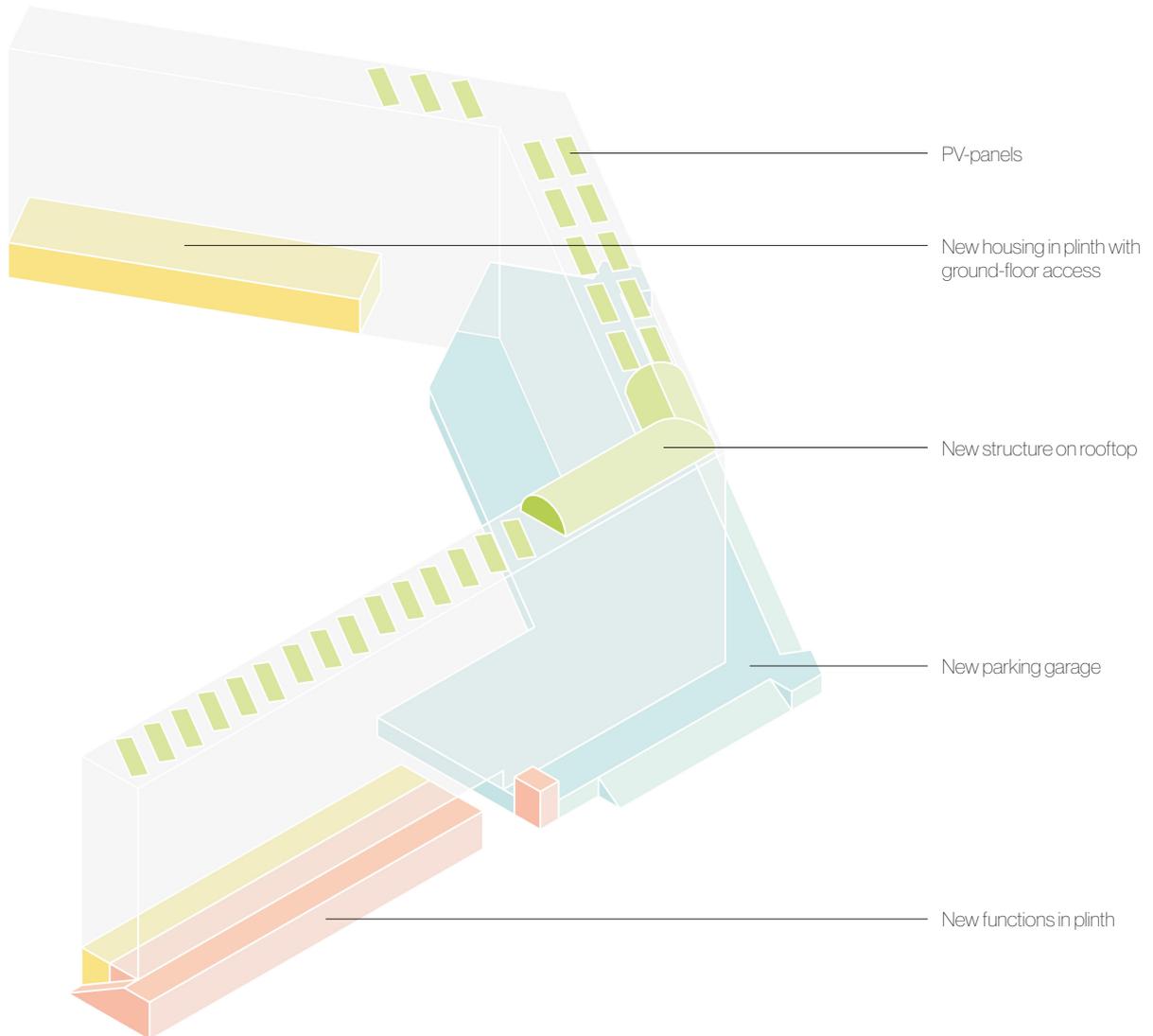
4.5 Postwar dwelling typologies

Dwellings with **ground-floor access** (ground-access terraced house, as well as some walk-up apartments as can be seen below) demonstrate the highest potential for domestic productive activity, as their direct connection to the street and larger footprint enable home-based workshops or studios with ease of access for clients or deliveries. In multi-storey walk-up and deck-access dwellings, these opportunities are more limited, although **surplus rooms** such as secondary bedrooms may serve as small hobby or workspaces. Meanwhile, **disused storage units and garages**, though modest in size, provide opportunities for hosting small-scale manufacturing, simultaneously activating adjacent public space.

Transformation potential
A lot of potential
Some potential

Walk-up apartment, 70m²

Walk-up apartment, 100m² (ground floor + first floor)

Living

Bedroom

Bathroom

Kitchen

Bedroom

Living

Bathroom

Bedroom

Bedroom

Garden

Bedroom

Kitchen

Deck-access apartment, 67m²

Deck-access apartment, 100m²

Living

Bedroom

Bath-room

Bedroom

Kitchen

Bedroom

Bedroom

Kitchen

Bathroom

Bedroom

Living
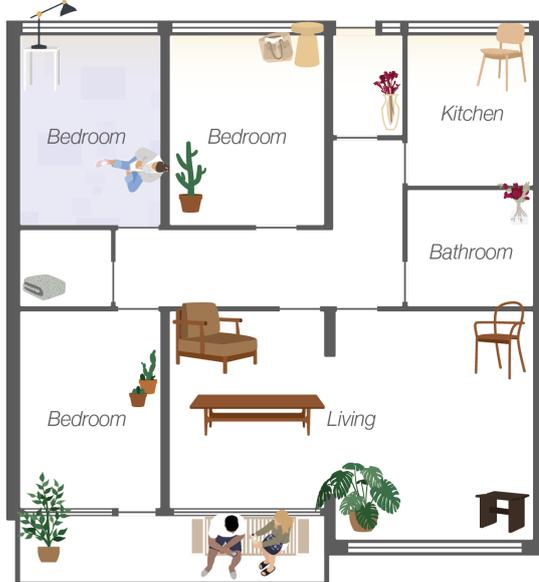
0m   2,5m   5m

Terraced house, 100m² (ground floor + first floor)

Storage

Entrance

Kitchen

Living

Garden

Bedroom

Bathroom

Bedroom

Bedroom

Garage, 32m²

Garage

Storage, 12,5m²

Storage

4.5.1 Time zones

Domestic spaces generally follow time zones of activity throughout the day. By mapping these temporal patterns, it becomes possible to compare the rhythms of domestic life with those of urban manufacturing, which typically operates between 08:00 and 18:00. Spaces such as the kitchen and bathroom are most intensively used in the morning and evening hours, while the living room becomes active during the late afternoon and evening thus having little overlap with standard working hours. Bedrooms also remain largely inactive during operation hours of productive functions.

Most domestic spaces are thus active at different times than productive functions, which would suggest a degree of compatibility between the two. However, the emergence of home offices and the presence of lifestyles with higher daytime occupancy (due to household composition, care responsibilities, or unemployment) complicate this relationship. Therefore, residential environments will always retain a certain sensitivity to nuisance. These time zones, however, can inform architectural interventions that help mitigate this.

Temporal patterns

■ Domestic timezone
■ Productive timezone
▨ Overlap

Kitchen

Living

Kitchen/Living

Storage

Bathroom

Home office

Bedroom

4.5.2 Nuisance sensitivity

A more precise understanding of the relationship between housing and urban manufacturing can be made by considering the nuisance sensitivity of different domestic spaces instead of just their temporal characteristics. While time-based overlaps indicate moments of potential conflict, it is ultimately the degree to which spaces can tolerate external nuisances that determines their compatibility with productive functions. Evaluating the different rooms based on their sensitivity to nuisance exposes a gradient of tolerance, ranging from highly sensitive spaces such as bedrooms and living rooms, to more tolerant spaces such as bathrooms, kitchens, and storage spaces.

Bedroom   Kitchen/Living   Living   Home office   Kitchen   Bathroom   Storage

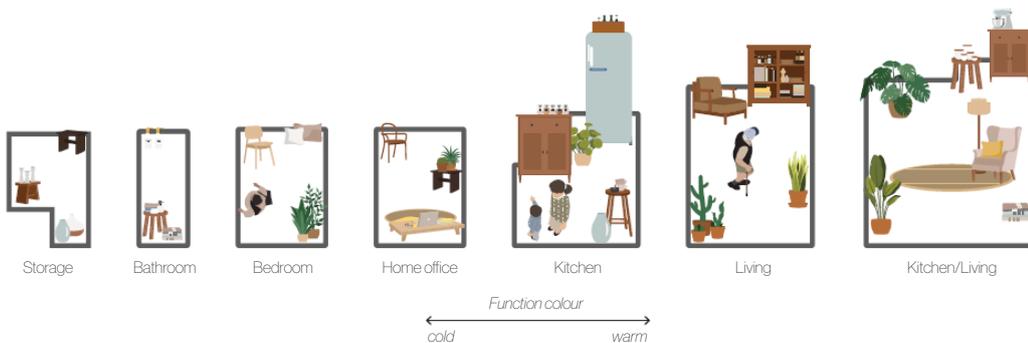*Nuisance sensitivity*

a lot ← → *little*
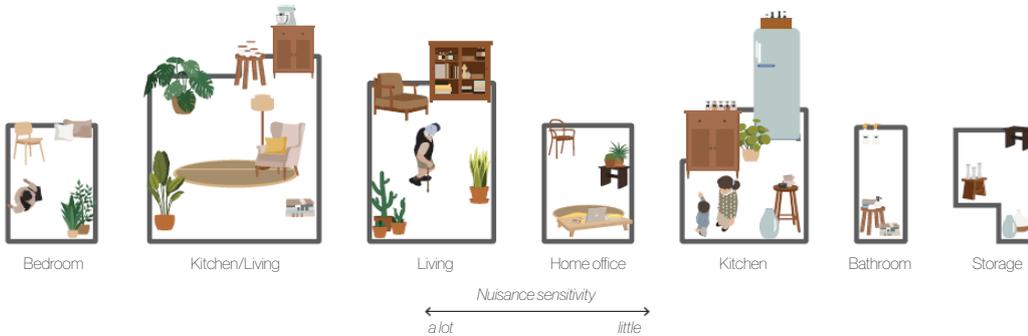
This hierarchy of sensitivity can serve as a spatial guideline when designing or adapting dwellings in proximity to urban manufacturing. Spaces with a higher tolerance for nuisance, such as storage spaces or bathrooms, could be strategically positioned along façades adjacent to productive functions, acting as buffers between manufacturing and quieter rooms located on the calmer sides of buildings. In this way, careful internal organisation can mediate potential conflicts between living and production.

4.5.3 Programmatic temperature

A similar analysis can be made by focusing on the programmatic role of each room, differentiating between more active (**warm**) and more passive and private (**cold**) spaces. Spaces such as storage areas and bathrooms can be seen as cold rooms, contributing little to the liveliness of the street due to their inward orientation and limited visual or spatial engagement with the public realm. In contrast, warm rooms such as living rooms and kitchens generate more activity, and interaction, playing a greater role in activating the street. This distinction is particularly relevant in post-war housing, with an abundance of disconnected or 'dead' plinths. Considering the temperature of rooms when adapting existing structures could therefore enhance the interaction between buildings and the public domain.

Interestingly, this relationship is quite the opposite with the gradient of nuisance sensitivity: rooms that are most sensitive to external disturbances such as living rooms often correspond to the warm end of the spectrum, while the more tolerant, cold rooms are typically those that contribute least to street-level liveliness.

Storage   Bathroom   Bedroom   Home office   Kitchen   Living   Kitchen/Living

Function colour

cold ← → *warm*

4.6 Postwar stamp typologies

All postwar neighbourhoods in Zuid-Holland were analysed to identify their underlying block typologies. Six recurring types emerge: open, semi-open, comb, parallel slabs, L-shaped, and walls. Some of the analysed blocks could not be assigned to an existing type and instead were defined as urban ensembles, forming a type of their own.
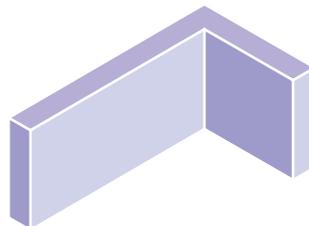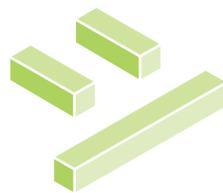
Most stamp typologies can be further differentiated by scale: S, M, L, and XL. The opportunities for transformation largely lie within these scales: a large-footprint building will rarely work within an S-sized block but may fit comfortably in one of the larger ones.

Open Semi-open Comb

S

M

L

XL
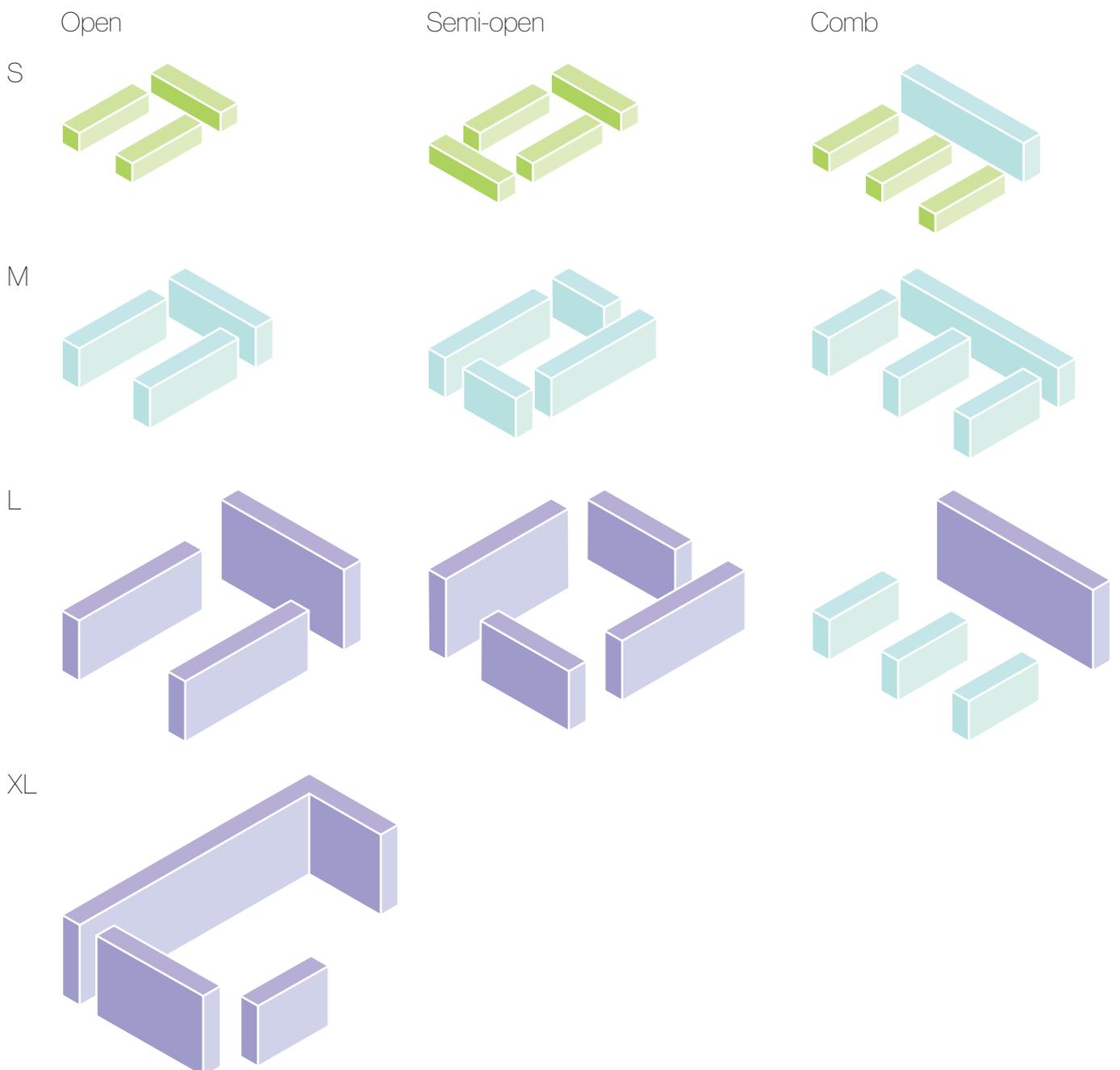
Parallel slabs
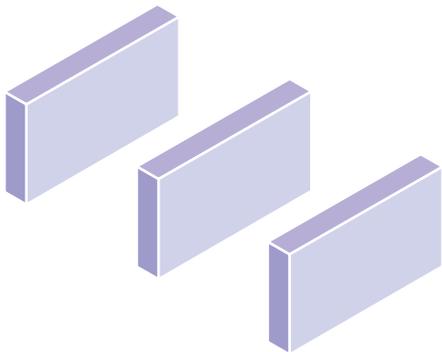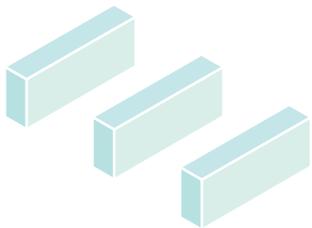
L-shaped

Wall
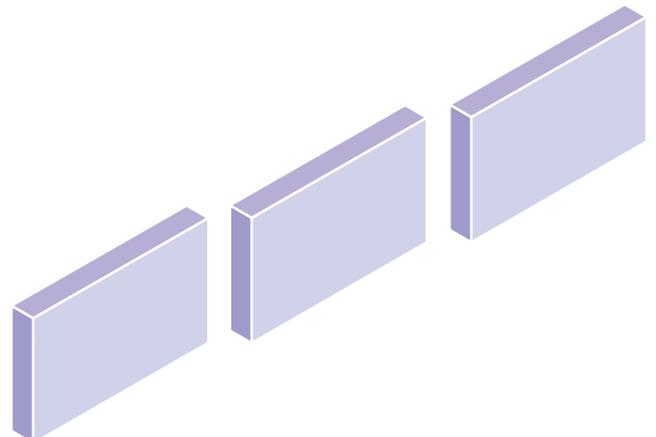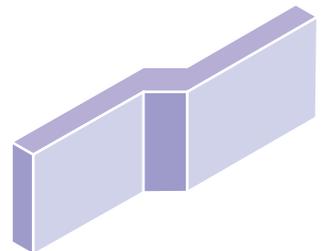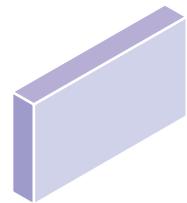
4.7 Postwar infrastructural typologies

An analysis of various postwar neighbourhoods in the MRDH has revealed a set of infra-structural typologies:
- Traffic artery
- Local artery
- Residential street
- Shopping street
- Service alley

For each type, a section examines its spatial characteristics, followed by an assessment of its potentials and limitations in relation to urban manufacturing. This evaluation is subsequently related to Rust, Reuring, or Ruis to identify the range of functions that each type is capable of accommodating.

| 2 m. | 4 m. | 4 m. |
| Pedestrian path | Bike lane | Car lane |

0m   5m   10m

4.7.1 Traffic artery

The traffic artery is designed to facilitate the efficient movement of large traffic volumes. Characterised by its wide cross-section, it typically accommodates one or two lanes for motorised vehicles per direction, alongside dedicated lanes for cyclists and pedestrians. These traffic flows are physically separated from one another through median strips, reflecting the modernist planning principles of segregation by transport mode. Direct building access is generally absent along traffic arteries, resulting in limited street-level interaction and a predominantly transit-oriented streetscape.

Because traffic arteries are associated with relatively intense traffic and the noise it comes with, it aligns with **Ruis** best. Because of their accessibility and detachment from residential functions, traffic arteries can accommodate productive uses with greater logistical intensity. Moreover, their width allows for design interventions that can accommodate these functions such as buildings with large footprints.

4 m.	3 m.	2 m.
Car lane	Bike lane	Pedestrian path

4.7.2 Local artery

The local artery functions as an intermediary infrastructural type, connecting residential areas to larger traffic arteries. It typically features a relatively wide cross-section (often 25 metres or more) and accommodates mixed traffic flows, where motorised traffic and cyclists share the same carriageway. On-street parking is commonly integrated along the side, while pedestrian paths are spatially separated from the carriageway by verges.

Residential buildings situated along local arteries are generally accessed directly from these pedestrian paths. The intensity of both motorised and pedestrian traffic along these streets is moderate, allowing for certain degrees of public activities. The residential context, however, imposes some limits on functions that produce more nuisance, rely on heavy logistics, or have extended operating hours. The local artery requires a more case-by-case approach when deciding between **Rust**, **Reuring**, or **Ruis**, as it covers a wide range of urban environments.

4.7.3 Residential street

With cross-sections up to around 20 metres, the carriageway of residential streets is shared by both motorised vehicles and cyclists, with limited through traffic. On-street parking dominates the visual and spatial character, with parking often provided along both sides. Pedestrian paths mostly line either side of the street, providing direct access to housing frontages.

Traffic intensity on residential streets is thus generally limited to local residents and visitors, making these streets relatively calm. The introduction of other functions within these settings (if done at all) requires careful consideration, as the residential character constrains functions that generate any type of nuisance. Therefore, residential streets are most closely associated with **Rust**.

1 m.	2,8 m.	5,5 m.	2,8 m.	5 m.
Pedestrian path	Parking	Carriageway	Parking	Pedestrian path

From top to bottom: local artery and residential street

2,3 m.	5 m.	2 m.	2 m.
Pedestrian path	Carriageway	Parking	Pedestrian path
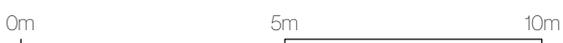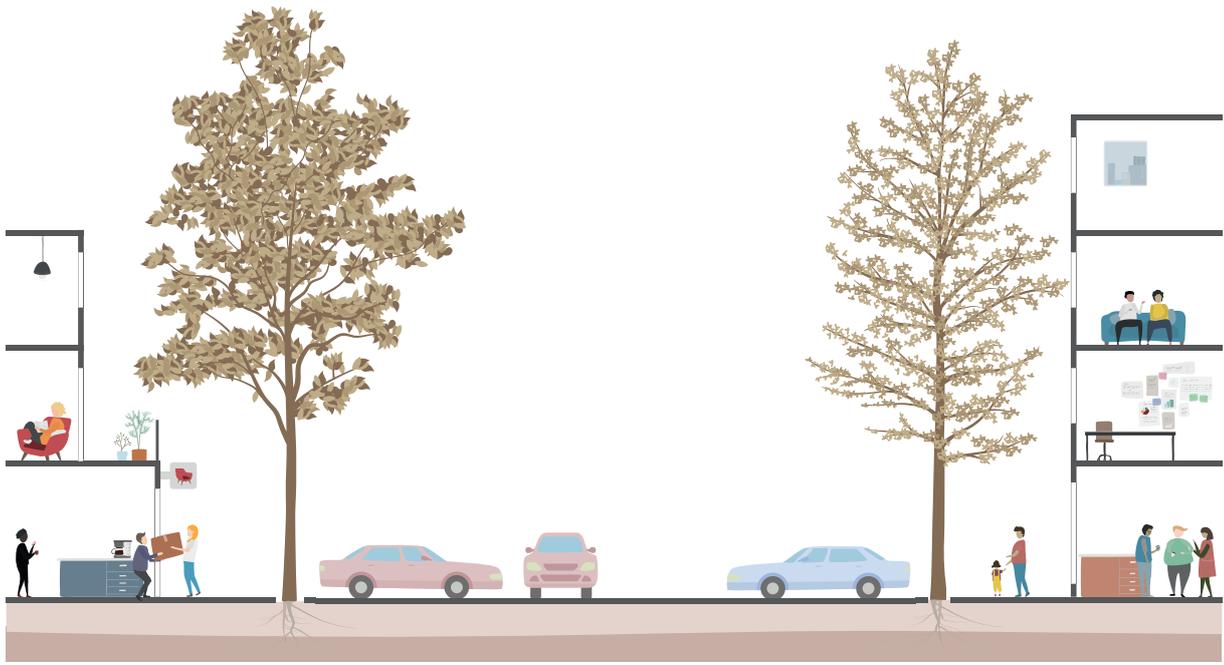
0m   5m   10m

3 m.
Pedestrian path

5 m.
Parking

5,5 m.
Carriageway

5 m.
Parking

3 m.
Pedestrian path

12 m.
Pedestrianised street

2,5 m.
Pedestrian path

6,5 m.
Carriageway

From top to bottom: shopping street with car access, pedestrianised shopping street, and service alley

0m   5m   10m

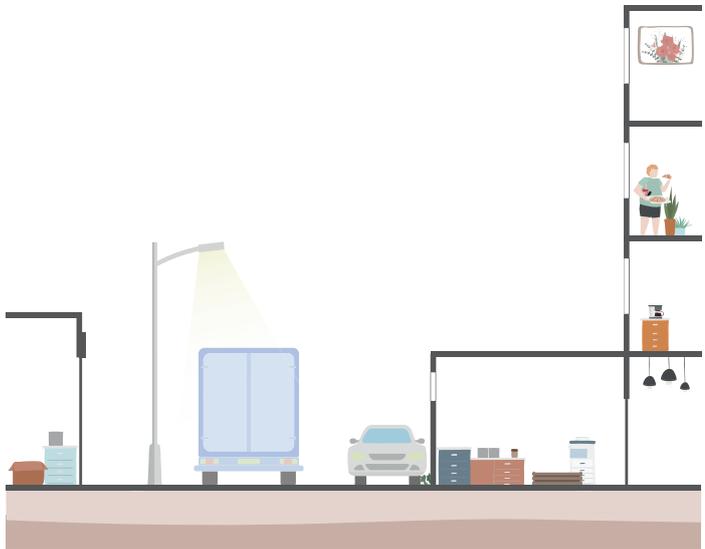### 4.7.4 Shopping street

The shopping street typology can be further divided into two subtypes, with the first one representing a cross-section more commonly seen in post-war neighbourhoods. It features a carriageway shared by motorised traffic and cyclists, with on-street parking along both sides and pedestrian paths running behind it. Shops occupying the plinth at ground level are directly accessible from these pedestrian paths, with residential units situated above. The second subtype comprises pedestrian-only streets, typically around 10 metres wide. These streets are often defined by single-storey buildings hosting retail functions.

Although primarily designed for shopping, these streets also offer opportunities for urban manufacturing that relies on foot traffic and a visible storefront. Streets without residential uses in particular could accommodate slightly more intensive production, given the absence of domestic constraints. Within the RRR-framework, shopping streets align most closely with **Reuring**.

4.7.5 Service alley

The usually narrow service alley forms the logistical backbone behind shopping streets, functioning as an access route for the loading and unloading of goods. Their use is largely limited to delivery traffic and maintenance activities, which often results in a visually disordered character, with bins or disused materials occupying parts of the public space. Occasionally these alleys host small-scale uses, such as repair workshops or dance studios, which take advantage of the back-of-house conditions.

Service alleys align most closely with **Ruis**, reflecting their noisy, active, and production-oriented nature. Given their existing tolerance for logistical and material activity, these spaces hold potential for a diverse range of urban manufacturing.

4.6.6 Transformation possibilities of typologies

By analysing the qualities and limitations of infrastructural typologies and relating it back to the 3 *R's*, the compatibility of the different types with urban manufacturing is assessed.

Traffic arteries and service alleys are currently characterised by heavy traffic and noise. Their existing tolerance for nuisance renders them particularly suitable for production-oriented activities. Local arteries, due to their traffic dynamics, demonstrate potential for integrating functions beyond residential use. Similarly, shopping streets present opportunities to accommodate production activities that benefit from a visible storefront. However, the presence of residential functions in these types imposes stricter constraints on acceptable nuisance levels compared to the aforementioned traffic arteries and service alleys.

In contrast, residential streets exhibit limited potential for the integration of productive functions due to their vulnerability to nuisance. Urban manufacturing in these areas is therefore largely restricted to low-impact or home-based activities that can coexist within the tranquil character of this typology.

Liveability gains meaning from both subjective and objective components of people's daily lives. Postwar neighbourhoods are renowned for having below-average liveability. Schiedam serves as an illustrative case to show how this manifests spatially.
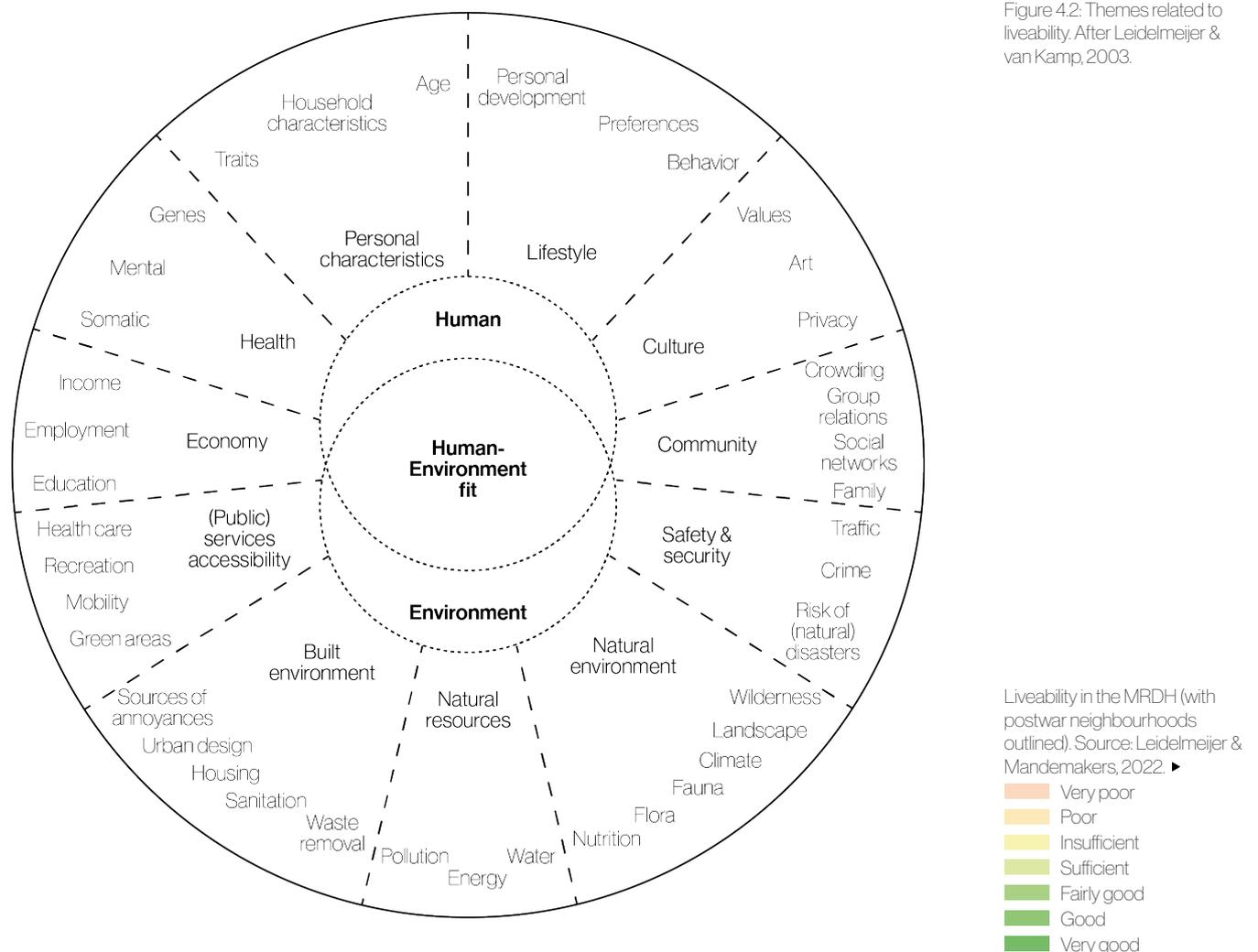
4.8 Defining Liveability

Liveability refers to the environment as the object, evaluated from the human perspective, whereby the environment gains meaning based on the extent to which it meets human needs and preferences (Leidelmeijer & Van Kamp, 2003). Perceptions of liveability vary across individuals, as people's spatial boundaries that are shaped by lifestyle, mobility, and daily routines differ significantly (Michalos, 1996; Kitchin, 1996). This also means that liveability can be seen as something dynamic, as individuals continuously assess and seek environments that align with their needs and desires (Leidelmeijer & van Kamp, 2003).

To truly understand the relationship between humans and their environment though, not only subjective, but also objective dimensions are essential (Szalai, 1980; Lawrence, 1996). To do this it is important to look at the environmental quality of life, which in contrast to liveability the human being is taken as the object and views their well-being from the perspective of the environment (Cicherchia, 1996). Both environmental quality of life and liveability are inherently abstract concepts that cannot be directly observed but must be measured through indicators, for which the main aspects are visible on figure 4.2 (Leidelmeijer & Van Kamp, 2003).

It is important to note that a singular project (like this thesis) cannot address every single aspect evenly or at all. Redesigning a neighbourhood to fit urban manufacturing for example, clearly addresses aspects as community, built environment and economy but less so for aspects as natural environment or health.

Figure 4.2: Themes related to liveability. After Leidelmeijer & van Kamp, 2003.

Liveability in the MRDH (with postwar neighbourhoods outlined). Source: Leidelmeijer & Mandemakers, 2022. ▶

Very poor
Poor
Insufficient
Sufficient
Fairly good
Good
Very good

4.9 Liveability spatialised

Leidelmeijer and Mandemakers (2022) developed a tool to spatialise liveability, which is used here to project liveability within the MRDH. Overall, the urban areas in the region tend to score adequate or higher. However, several neighbourhoods in The Hague and in and around Rotterdam stand out for scoring moderate or even insufficient. These neighbourhoods are often areas that have struggled with low liveability for a longer period of time. Importantly, these low scores cannot be consistently linked to any specific neighbourhood type. This becomes evident when zooming in on the postwar neighbourhoods themselves (marked on the map): while some have a sufficient score, others are among the worst-performing in the entire MRDH.

What can be stated in general terms is that neighbourhoods in large municipalities tend to score lower than those in smaller or non-urban municipalities. The only dimension on which these neighbourhoods consistently perform well is the availability of amenities; on all other dimensions, they score below average (Leidelmeijer & Mandemakers, 2022).

0km   5km   10km
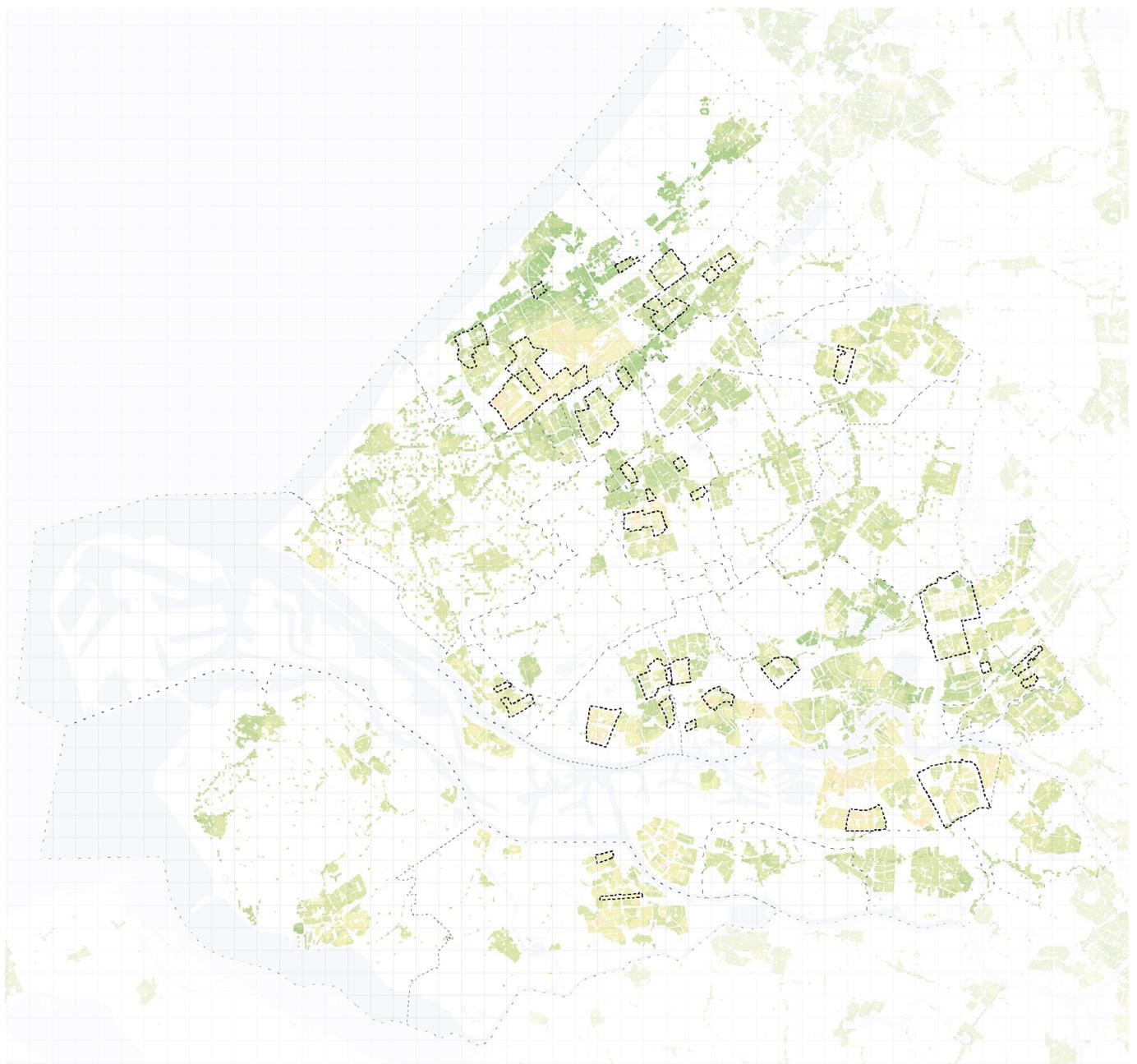
4.10 Liveability in Schiedam

Schiedam has been performing relatively poorly in terms of liveability. Although it has historically ranked among the lower-scoring cities in the Netherlands, its performance was once comparable to cities such as Nijmegen or Lelystad. While many Dutch cities have shown a steady improvement in liveability over recent decades, Schiedam has experienced a prolonged decline. Despite modest improvements in recent years, its liveability levels are roughly equivalent to those of twenty years ago, placing Schiedam among the lowest-scoring cities in the country today.

The neighbourhoods with the weakest performance are the prewar districts of Schiedam Oost and Schiedam Zuid, as well as the restructured areas of the inner city. However, the postwar neighbourhoods of Groenoord and Middelland perform notably worse than all others, with some parts even falling into the poor category.
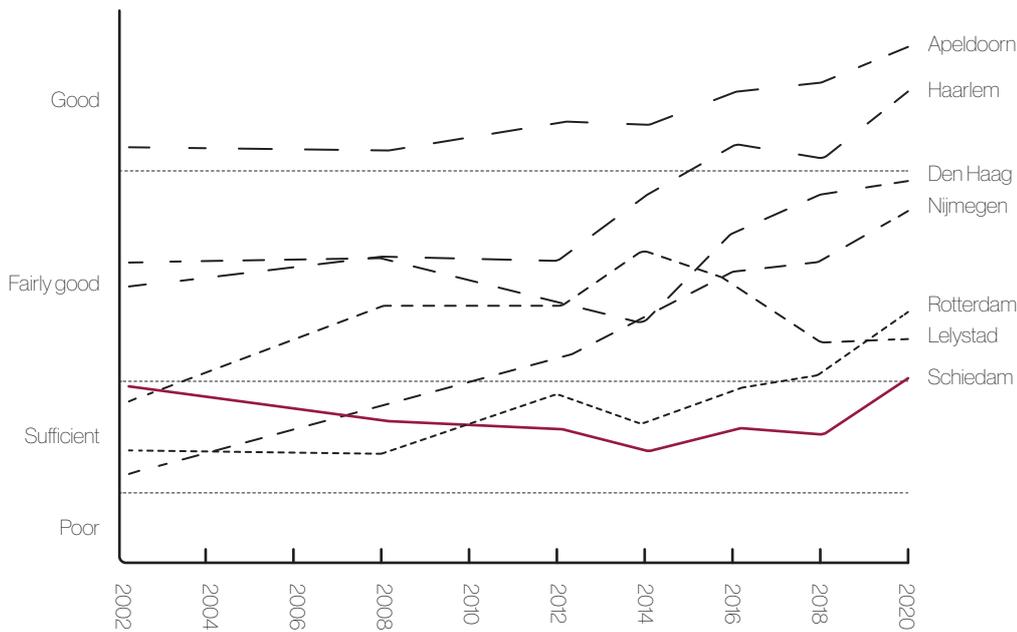
Figure 4.3: Development of liveability across Dutch cities. After Leidelmeijer & Mandemakers, 2022.

Groenoord —————————

Middelland —————————

4.11 Liveability in postwar Schiedam

Zooming in on one of these postwar neighbourhoods, Middelland reveals a familiar pattern seen in many larger Dutch cities: the neighbourhood scores very well on amenities, yet performs below average across nearly all other themes. Its performance is particularly weak in the category of safety. Urban design alone cannot address all underlying causes of these issues, but it can play a role in enabling a more liveable neighbourhood with certain interventions such as facilitating more eyes on the street.

Historic city centre —————————
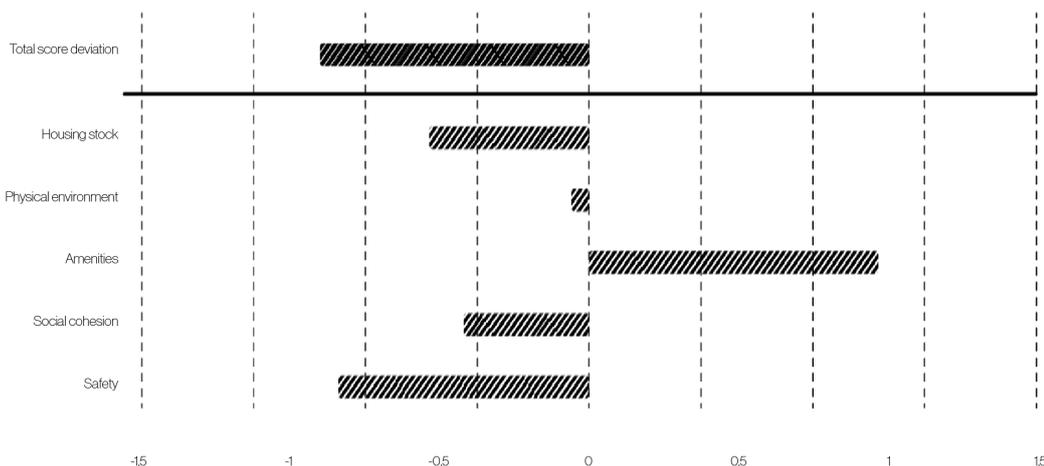
Figure 4.4: Liveability score of Middelland. After Leidelmeijer & Mandemakers, 2022.

Liveability in postwar Schiedam. Source: Leidelmeijer & Mandemakers, 2022. ▶

- Very poor
- Poor
- Insufficient
- Sufficient
- Fairly good
- Good
- Very good

0m   500m   1000m

5
Developing patterns
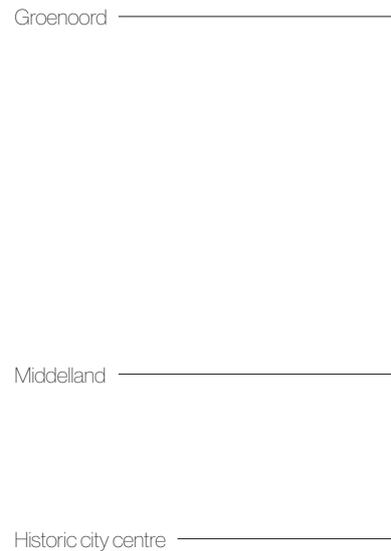
This chapter focuses on developing a pattern language for integrating urban manufacturing into neighbourhoods while preserving liveability and spatial quality. To support this, a reference study was conducted in which blocks and buildings from both the Netherlands and abroad were analysed, whereafter principles were distilled from them.

These principles, combined with knowledge gained from design testing and literature reviews, were then combined into a pattern language, which is elaborated upon through a series of diagrams illustrating the interrelations between the patterns.

Manufacturing within cities happens all around the world. An analysis of four blocks in three cities, and a personal exploration of manufacturing around cities in Europe has led to patterns that support the integration of manufacturing in urban areas.

5.1 Learning from making abroad

To understand how manufacturing and residential functions can coexist spatially, four urban blocks in three different cities were analysed. The blocks were ide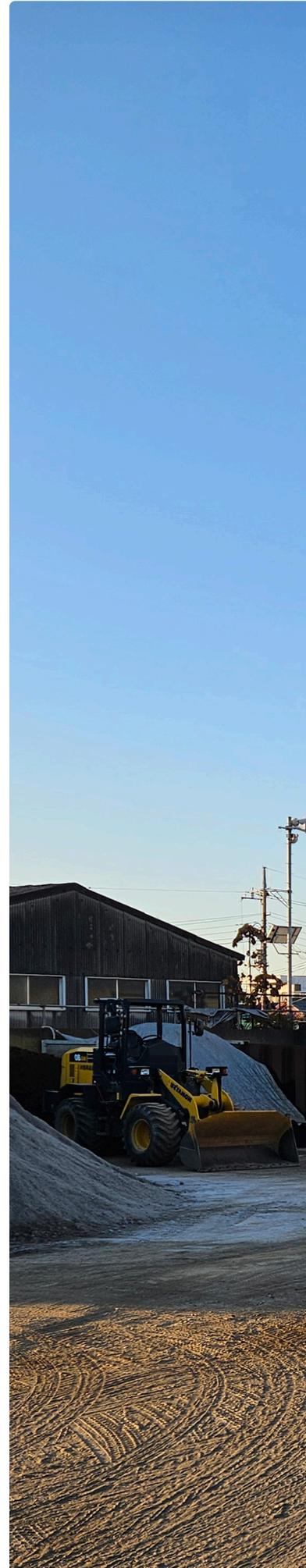ntified through relevant literature highlighting cities and neighbourhoods where these functions coexist on a fine grain. The selection subsequently focused on neighbourhoods within Brussels, Osaka, and Nantes. Within these cities, representative blocks with differing spatial configurations were selected to capture a broad range of design principles. Each block was analysed in terms of its composition, its position within the urban fabric, and the spatial relationships between productive and residential uses. By comparing how these functions relate to and coexist with one another, spatial strategies and design principles were distilled, forming the basis for the development of the pattern language.

Brussels, Osaka and Nantes. The city centres are hatched, and the analysed blocks are indicated by dots.
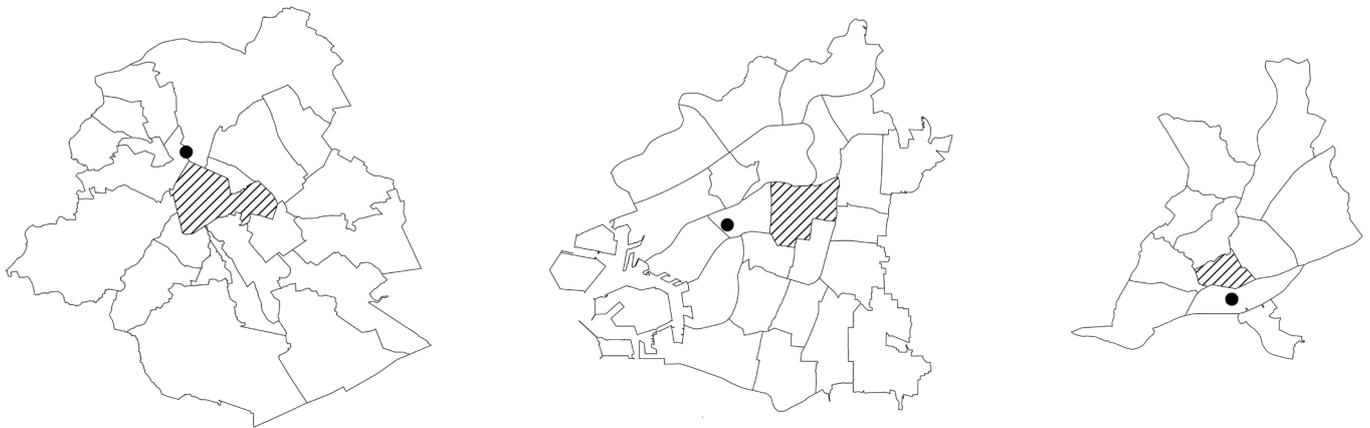
5.1.1 Brussels

Brussels has long maintained a substantial presence of productive functions within its urban fabric. Despite increasing pressure from population growth and the demand for housing, policy and zoning efforts continue to safeguard these activities (Borret e.a., 2018). While many productive functions cluster along the canal running through the city, manufacturing has also persisted within the blocks of older neighbourhoods.

The analysed block is located in Molenbeek, on the western side of Brussels. It is predominantly residential, with several large halls extending deep into the interior of the block. Some of these halls still accommodate manufacturing, while others have been repurposed for functions such as furniture stores. Nevertheless, the underlying design principles that allow these buildings to integrate successfully into the block still remain valid.

Functions in the block
Residential
Manufacturing
Supportive (office/shop)
Other

Messy backside
The interior of the block is very utilitarian and somewhat chaotic. Here, there is no need for architectural refinement as the buildings are purely functional.
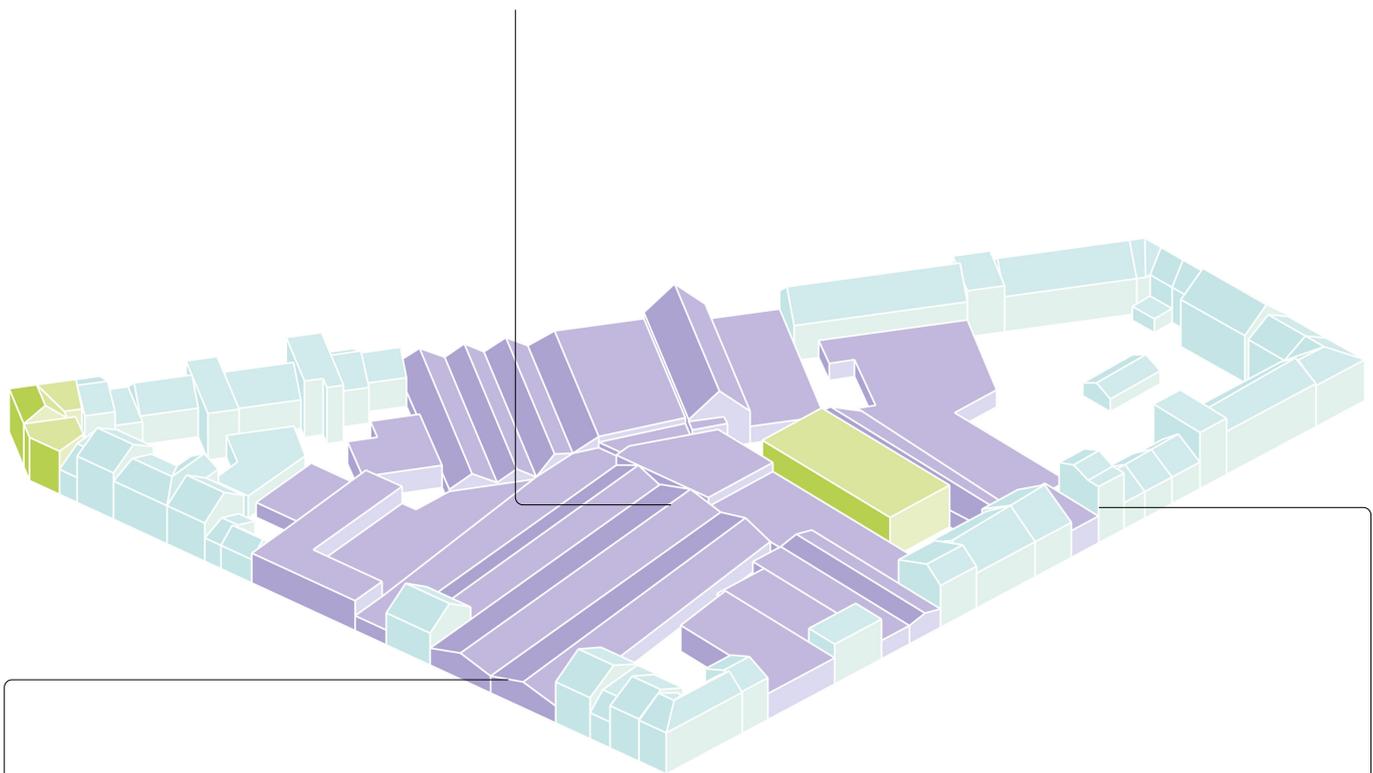
Public frontage
The street-facing façades generally present a representable appearance (with the occasional exception). The fine-grained plot structure results in multiple entrances on all sides of the block, contributing to an active streetscape.

Touching walls
Buildings sit directly against one another with no gaps, even between residential and manufacturing structures. This is typical for densely built neighbourhoods like this one. When a building has a blind façade, this principle can also be applied, provided that sufficient architectural and technical measures are taken to prevent nuisance.

5.1.2 Osaka

A wide variety of functions coexist in many Japanese neighbourhoods, partly due to the country's highly flexible zoning laws (Japanese Ministry of Land, Infrastructure and Transport, 2003). It is therefore not unusual to find a factory directly adjacent to a residential building when walking through a neighbourhood in a Japanese city. The machi-kōba (neighbourhood factories) play an important role locally: they provide jobs, keep eyes on the street, and pass on knowledge by for example welcoming elementary school classes for hands-on visits (Kakuda, 2019).

The two analysed blocks are located in the Kujo Ward in western Osaka, an area where small and medium-sized manufacturers have been mixed with housing for decades (Kakuda, 2019). Unlike many Western cities, where manufacturing has largely been pushed to the periphery, it continues to play an active and visible role here and in many other Japanese urban areas.

Functions in the block
- Residential
- Manufacturing
- Supportive (office/shop)
- Other
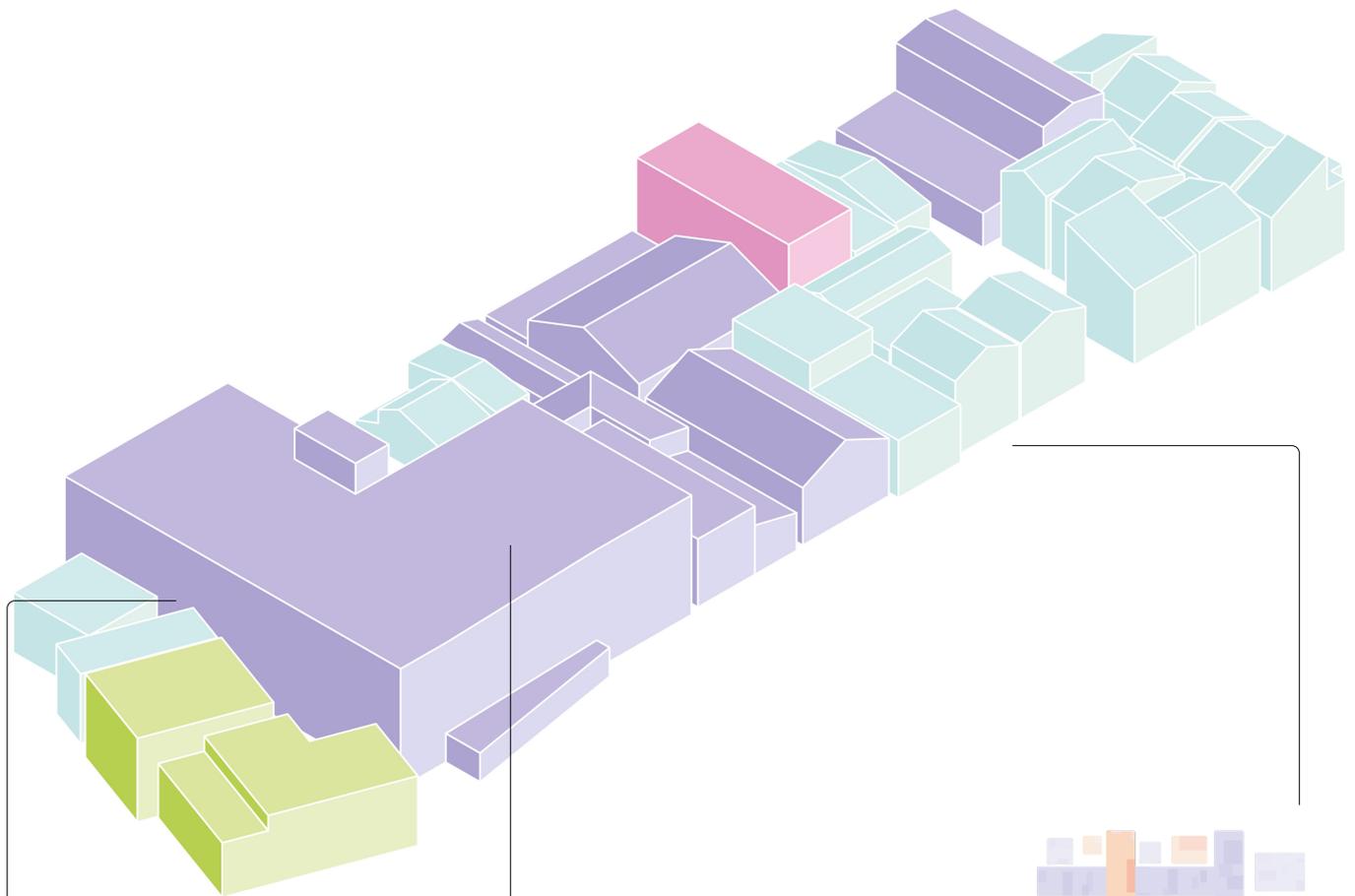
Size diversity
The factory buildings themselves also vary greatly in scale, allowing space for different types of businesses.

XL
Some buildings in the block are no larger than 40 m², while the biggest one is more than twenty times that size. This larger building has wide street-facing openings that facilitate easy loading and unloading.
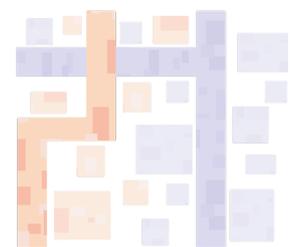
Zoning along infrastructure
The different functions are located in distinct areas, creating a clear division. The street at the back of the block functions as a residential street, while the front faces a busier street that accommodates more commercial activities.
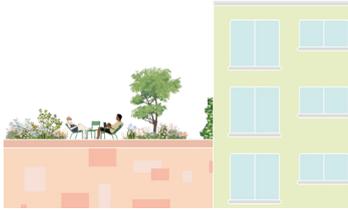
Rooftop garden
A residential building's garden is located on the roof of the adjacent factory.

Transitional functions
Within the block, the offices of the factories are found in two locations. These spaces act as a buffer zone between the noisier functions and the nearby dwellings, which benefit from reduced disturbance.

Public frontage
Because one of the offices is placed between the street and the factory, it creates a more public-facing function than if the factory itself had fronted the street.
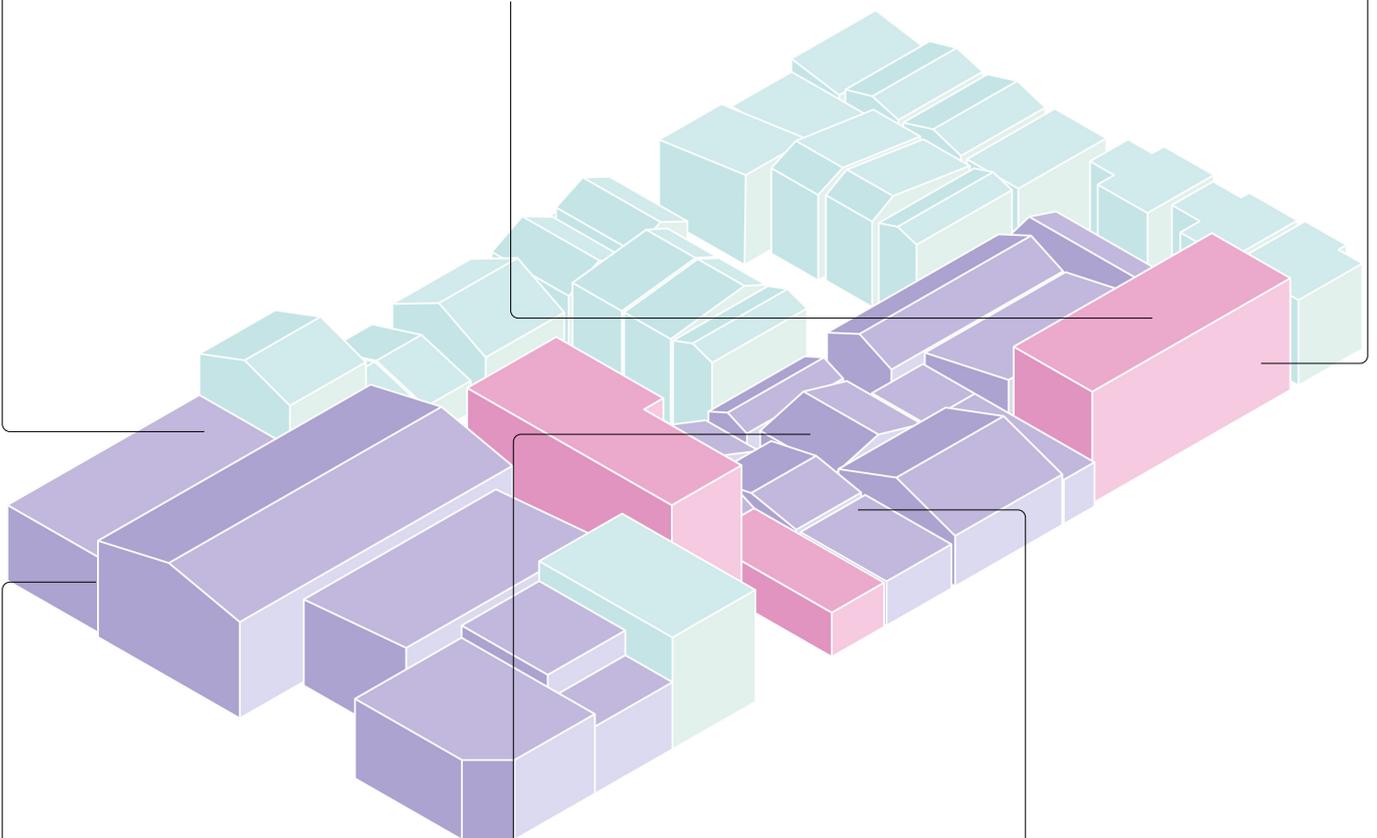
Small gap
A defining feature of Japanese urban landscapes is their extremely dense built fabric. In many places, buildings stand no more than a metre apart. While such proximity could be applied in highly urban areas, it requires careful consideration to ensure adequate daylight for spaces that depend on it.

Messy backside
The interior of the block is quite irregular, with various volumes added and attached over the years, while the exterior presents a much more orderly edge built neatly along the street line.

Modularity
Although the buildings themselves are not necessarily modular, the block's varied plot sizes and the rapid turnover of buildings in Japan create opportunities for expansion. This is also how many factories in the area have grown over the years, adding new parts one piece at a time.

5.1.3 Nantes

The block analysed in Nantes is located on the Île de Nantes, historically one of the city's main industrial districts. In recent years the area has undergone major redevelopment, with much of the heavy industry relocating and large amounts of new housing added. While most large manufacturers have left, a number of smaller, craft-based producers remain in the old buildings. As a result, today's blocks combine newly built residential buildings with fragments of the historic industrial fabric providing space for other functions.

Functions in the block
- Residential
- Manufacturing
- Supportive (office/shop)
- Other
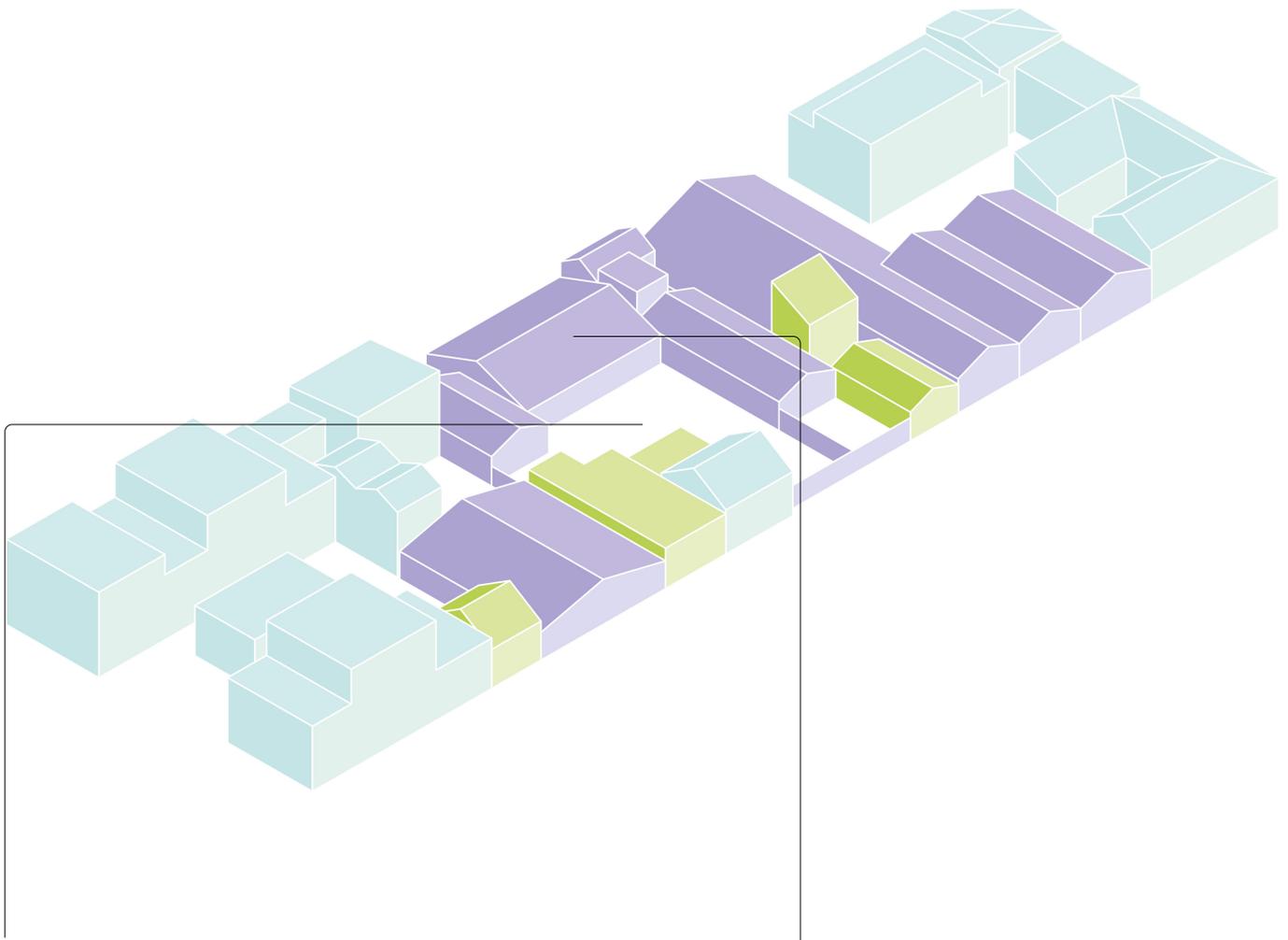
Messy backside
In Île de Nantes, the interiors of the blocks are also messy. This is visible not only in the buildings themselves but also in the yards between them, often used for storage or outdoor workspaces. In contrast, the street-facing sides feature a neatly aligned building frontage.

New ideas need old buildings
The old buildings on Île de Nantes are occupied by a wide range of new businesses. These buildings often have lower monthly costs compared to new construction, while preserving the character of the historic area.

Pocket park
In another block on Île de Nantes, a pocket park (or some other form of green space) is used as a buffer between productive and residential functions. This buffer is 8 metres wide.

5.2 On-site exploration

Over the summer, several relevant buildings and areas were visited in Zurich, Munich, and Delft to observe how manufacturing is embedded in different urban contexts. These visits provided concrete insights into how manufacturing can be integrated within the urban fabric, and offered a practical foundation for shaping some patterns.

Zurich, Munich and Delft. The city centres are hatched, and the areas and buildings visited are indicated by dots.
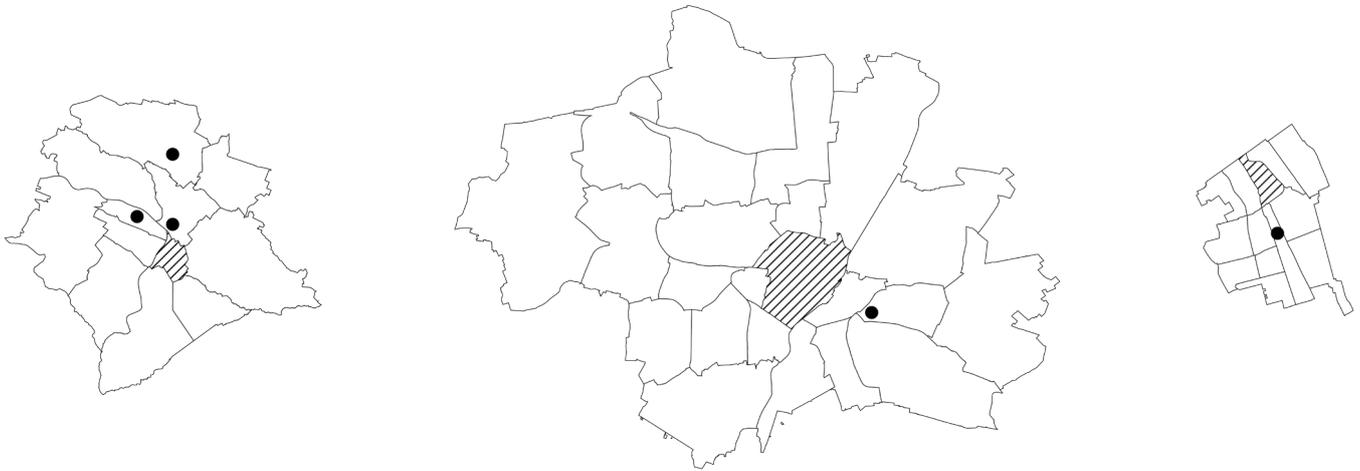
5.2.1 Zurich

The visit to Zurich revealed how a wide range of urban functions can be seamlessly combined at a fine-grained scale. Manufacturing has long played a visible role in Zurich's streetscape and continues to be actively supported through the development of new mixed-use neighbourhoods and small-scale workshops throughout the city. Notably, these contemporary productive spaces are characterised by a consistently high level of architectural quality, indicating a deliberate effort to integrate manufacturing as a valued component of the urban environment.

Figure 5.2: A messy frontage in Oerlikon, a neighbourhood in the norhtern part of Zurich. Source: Author, 2025.

Productive pavement

Some companies in Oerlikon had a few meters of space in front of their entrance, serving as a transition zone between the business and the public, where activities like loading and unloading took place.

Transparency

The Zurich power plant, located in the middle of the city, features an open façade that makes the processes taking place inside visible from the outside.

Green strip

One of the factories in Oerlikon is separated from the street by a small park with seating elements, a few metres wide.

Building a community
As part of the Dynamo youth centre, the metal workshop plays an important role in the local community, supporting social interaction, and offering public workshops that connect it to the city.

Sharing is caring
The metal workshop is used by a variety of people, all of whom share the available tools.

5.2.2 Munich

Werksviertel is a recent development in the eastern part of Munich, where a former industrial site is being redeveloped into a mixed-use neighbourhood. Although residential, office, and commercial functions dominate, some productive functions are still present in the area. It was particularly interesting to observe how these activities are integrated in a district undergoing gentrification and extensive new construction.

Productive pavement

In Munich, a form of productive pavement was also present, where businesses used the space between their building and the street for storage and work. This connects the function more closely to the street and adds vibrancy.

Noise allows for noise

In Munich's Werksviertel, manufacturing was located directly next to a concert venue. This works because both functions generate some disturbance, so they do not significantly conflict with each other.

Figure 5.5: Representable architecture and art for buildings that host manufacturing. Source: Author, 2025.

Vertical sports

One of the tallest buildings in the area featured a climbing wall, demonstrating a way to give a function to otherwise blank façades.

Mural

Art was applied to otherwise unused walls to give them a more appealing appearance.

5.2.3 Delft

A former cable factory now accommodates a diverse mix of functions. It houses a bouldering hall, padel courts, and offices, but the majority of the space is occupied by manufacturing firms. Many small businesses have their own workspace, often separated by self-constructed structures within the larger hall. The building also provides workshops for students of the Technical University of Delft. In a few years, this ecosystem will make place for the development of a new mixed-use neighbourhood (which also includes space for manufacturing).

Figure 5.6: Inside the building of the Kabeldistrict. Source: Author, 2025.

Temporary usage
Since the building hosting the Kabeldistrict will be redeveloped soon, all usage within it is temporary. The current users of the building prevent it from becoming a void within the city, instead turning it into a vibrant place.

Co-location
Some of the bigger halls within the building are used by several firms and individuals who thus share the same space with each other.

Flexible spaces
Since their usage is temporary, workplaces are constructed using scrap materials, which they can expand or shrink as needed, thanks to the generous space provided by the overarching structure.

Affordable workspace
All these factors ensure that the firms and individuals in the building have access to affordable workspace.

5.3 Design testing

Building on the previously developed principles, a design study was conducted to test volumetric interventions within a postwar neighbourhood block (see Appendix 3). During this process, two recurring challenges emerged: the presence of spatial voids created by large manufacturing buildings (such as extensive roof surfaces and blank façades facing the street) and the need for careful transitions between productive and residential functions, at both the building and street levels. These observations informed the development of an additional set of patterns aimed at mitigating these challenges of which a couple are shown here.

Activating voids
Large walls, rooftops, and overlooked spaces associated with manufacturing buildings pose a challenge, as they can create dead spots within the urban fabric. By giving these areas purpose, they stay active and engaging.

Good transitions
Where seemingly conflicting functions, such as residential and manufacturing, meet, thoughtful design can help reduce any frictions that might exist between them.

Quality urban environment
Manufacturing traffic can conflict with other street users, requiring street redesigns that improve safety while also enhancing spatial and architectural quality.
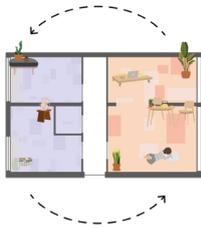
Interior flip
Ensure that disturbance-sensitive spaces, such as bedrooms, are not oriented toward noisy functions, while less sensitive spaces like bathrooms or storage rooms can occupy these locations.

Green wall
When buildings are designed accordingly, adjoining residents can be given the opportunity to extend their gardens onto the roof.

Internal infrastructure as a buffer
Supporting programmes such as internal infrastructure (for example a corridor) can be used as a buffer between disruptive functions and housing.

5.4 Literature review

The pattern language was also built up through a targeted review of relevant literature. Mainly, sources were selected for their focus on design challenges related to urban manufacturing and mixed-use building blocks, particularly those that formulate explicit design principles or pattern-based approaches. These were adapted to fit the pattern language of this thesis and include Foundries of the Future (Hill et al., 2020), Inspiratieboek voor een kwalitatieve functiemix (De Zwarte Hond, 2021), Superplinten Handboek (Atteveld et al., 2021), and Metro Mix (Zandbelt et al., 2019).

Additionally, insights were drawn from design studies and reference projects such as Schieoevers Noord (marco.broekman, 2019), Kabeldistrict (Mei Architects, 2022), and Zuid-Holland Bedrijventerreinen (Rademacher & De Vries, n.d.). Moreover, sources not directly focused on design were used, including Ruimte voor de economie van morgen (Boegheim et al., 2017) and The Death and Life of Great American Cities (Jacobs, 1961).

A pattern language helps to break complex topics down into bite-sized bits of knowledge (patterns). The concept sees every pattern as a part of a larger network through different scales and fields. The pattern language for urban manufacturing in postwar neighbourhoods was developed through an iterative process using many types of resources, ultimately meant to be used to guide design processes operating within this context.

5.5 Pattern language explained

The concept of a pattern language was first introduced by Christopher Alexander and colleagues in 1977. It attempted to create a "language" for addressing recurrent problems in the built environment by formulating a set of generic solutions. This systemic approach breaks down complex topics into comprehensible bits of knowledge. Patterns operate across multiple scales and fields, forming a network of interdependent elements. Unlike general design principles, which tend to be used as independent solutions, patterns derive their meaning from these **interconnections**, enabling a more coherent design approach.

The patterns developed for Productive Postwar Neighbourhoods were distilled from a range of sources, including literature, the analysis of relevant case studies, and design explorations. The relationship between the patterns emerged through an iterative process in which the categorisation, hierarchy, and interrelations of patterns were continuously examined and refined. Ultimately, this process produced a pattern language consisting of approximately 50 patterns. Rather than a fixed instrument, the language should be understood as an evolving framework that will continue to develop as it is applied in practice and as new patterns or connections come to light. It is also important to note that this pattern language is designed to integrate manufacturing in ways that enhance neighbourhood liveability and spatial quality. Other aspects related to urban manufacturing, such as circularity, are acknowledged but play a secondary role within the patterns.

5.6 Application and user groups

This pattern language has been developed primarily to support design processes concerning urban manufacturing, and it can serve as a tool for both **co-creation and co-development**. The pattern language can be used within design offices and municipal planning departments, where professionals can draw on the patterns to form a design. It can also be used during participatory sessions with a broader public. This is possible because many of the patterns convey relatively clear spatial implications, which makes them accessible to non-experts and thus suitable for collaborative settings.

*When engaging in co-creation or co-development with a general public, it is necessary for a facilitator to guide other co-creators in the process and select relevant patterns to work with. The facilitator preferably comes as an urban designer or planner as they need to be able to translate patterns and ideas into spatial interventions.

The workflow begins with collectively establishing the set of patterns to be used. The facilitator prepares an initial selection, which is then discussed and refined with the co-creators. Once the selection is agreed upon, the site is analysed to assess the applicability of the chosen patterns, identify missing elements, and understand local opportunities and constraints. Based on this set, the facilitator spatialises the patterns, producing initial design concepts and, if necessary, initiating another cycle of pattern selection and refinement.

Besides of co-creation and co-development, the pattern language can also function as a source of inspiration for urban designers, planners, and others interested in realising productive neighbourhoods. While the patterns have been developed with postwar neighbourhoods in mind, many of them are sufficiently general to be applied in other urban contexts. In such cases, a more specified initial pattern selection and the addition of context-specific patterns may be required to tailor the language to the particular spatial conditions of the project.

*The proposed workflow has been derived from the pattern language and related workflows developed by Cities of Making (Hill et al, 2020).

5.7 The patterns explained

As mentioned, the patterns form a network through different scales and fields. This is represented in different ways on the patterns. First of all, there are **three types of patterns**: ambition, zoning, and practical patterns. Ambition patterns are the most important principles that should be taken into account when considering to implement urban manufacturing within an existing neighbourhood. These patterns are derived from a combination of the most important findings from literature review and design experimentation. The five ambition patterns are: Socially embed manufacturing (A.1), Activating voids (A.2), Good transitions (A.3), Quality urban environment (A.4), and Enable manufacturing (A.5). These patterns are connected to many other patterns and have different ways of achieving them. The other two pattern types are zoning patterns (Z.1-Z.9), which represent more abstract measures, and practical patterns (P.1-P.35), which represent more concrete measures.

Secondly, every pattern performs best at a certain scale. Within the pattern language, **four scales** have been identified: building, block/street, neighbourhood, and trans-scalar. Also, patterns are connected to each other in different ways. Within the network there are **five types of connections** to be distinguished:

- Connected: The patterns complement each other or work towards a similar goal
- Conditional: The patterns can only be used together
- Preconditioning: Another pattern can only be realised with this pattern
- Preconditioned by: This pattern can only be realised with another pattern
- Alternative: The pattern forms an alternative for solving the same problem

Thirdly, it is important to note that the way sources are represented in the patterns does not indicate any form of ranking or scoring. For example, a pattern based on a reference study (represented by one point) is not weaker or less valid than one based on literature (represented by three points). The structure of an individual pattern is demonstrated below and the following page presents all patterns ordered by code.

P.29
Sharing is caring

When nearby manufacturers share machinery and materials, they can lower costs. This can be realised by allocating an easy-to-reach common space which simultaneously encourages collaboration and mutual support.

Connected to: A.1 / A.5 / =P.14 / +P.20 / --P.33

Code
The letter represents the type of pattern (**A for ambition**, **Z for zoning**, **P for practical patterns**). The numbers do not represent a particular order but are there to enable cross-referencing.

Title

Illustration
Represents the practical implication of the pattern.

Hypothesis
Brief explanation of what this pattern represents.

Scale
- Building
- Block / Street
- Neighbourhood
- Transscalar

Source
- Reference study
- Design testing
- Literature review

Connections
Indicates the relation to other patterns. The symbols represent in what way they are connected (**+ for connected**, **= for conditional**, **- for preconditioning, -- for being preconditioned by**, *** for alternative**).

A.1
Socially embed manufacturing

Manufacturing that plays an integral part within the neighbourhood strengthens the community and creates mutual acceptance. By having a transparent and accessible production process, the neighbourhood can engage with it, learn from it, and benefit from its services and products.

Connected to: Z.3 / P.2 / P.3 / P.4 / P.5 / P.10 / P.14 / P.19 / P.27 / P.29 / P.33

A.2
Activating voids

Large walls, rooftops, and overlooked spaces associated with manufacturing buildings pose a challenge, as they can create dead spots within the urban fabric. By giving these areas purpose they stay active and engaging.

Connected to: Z.1 / P.2 / P.5 / P.6 / P.7 / P.9 / P.10 / P.11 / P.12 / P.13 / P.19 / P.20 / P.21 / P.22 / P.27 / P.34

A.3
Good transitions

Where seemingly conflicting functions, such as residential and manufacturing, meet, thoughtful design can help reduce any frictions that might exist between them.

Connected to: Z.4 / Z.6 / Z. 7 / P.9 / P.8 / P.17 / P.18 / P.23 / P.24 / P.25 / P.26 / P.30 / P.34

A.4
Quality urban environment

Heavy traffic from manufacturing can conflict with other street users such as cyclists and children. Streets should be redesigned to safely integrate manufacturing, which brings opportunities to also improve spatial quality. Not only public space design, but also architectural quality can elevate the perception of the urban environment.

Connected to: Z.1 / Z.9 / P.30 / P.32 / P.34 / P.8 / P.17 / P.18 / P.19

A.5
Enable manufacturing

For manufacturing to thrive within neighbourhoods, a couple conditions must be in place. Beyond their spatial affordances and needs, supportive planning tools and institutions are essential to make urban manufacturing possible and sustainable.

Connected to: Z.2 / Z.3 / Z.4 / Z.5 / Z.6 / Z.8 / Z.9 / P.4 / P.9 / P.4 / P.5 / P.6 / P.17 / P.8 / P.9 / P.22 / P.25 / P.29 / P.30 / P.31 / P.32 / P.33

Z.1
80/20

If one function dominates a street, it can leave the street empty for much of the day. Limiting a single function to around 80% and leaving 20% for others brings variety and attracts different people at different times.

Connected to: A.2 / A.4 / +Z.8 / −P.10 / +P.13 / +P.32

Z.2
Guaranteed space

Makers benefit from a secure, fixed location so they can invest in buildings and equipment. By for instance defining how much of the site area or gross floor area in each block is reserved for manufacturing, this permanency is ensured. This can also lead to new typologies of live-work buildings.

Connected to: A.5 / -Z.4 / -P.3 / +P.31

Z.3
Making along shopping streets

Some manufacturers benefit from a public front where they can sell products and services to a wider audience. High streets are ideal for this, bringing more traffic and visibility.

Connected to: A.1 / A.5 / −Z.4 / +P.3 / −P.10 / +P.22 / -P.27 / P.32 / +P.33

Z.4
Infrastructure defines zoning

Different types of streets and infrastructure suit different functions. Busy streets can support a wide variety of uses, while residential streets are best kept for quieter, compatible activities.

Connected to: A.3 / A.5 / -Z.2 / +Z.5 / +Z.6 / +P.30 / -P.32

Z.5
Noise allows for noise

A function with some form of nuisance makes it easier for other slightly disruptive functions to establish nearby, such as a club or night shop.

Connected to: A.5 / +Z.4 / +P.28 / +P.32

Z.6
Zone based on prestation

Instead of zoning businesses by predefined categories, assess each business by its actual impact or nuisance. This helps find the best place for them and allows new types of businesses to establish.

Connected to: A.3 / +Z.4 / +P.1

Z.7
Transitional functions

Less sensitive functions can be placed between disruptive activities and residential buildings to create a buffer. Examples of these transitional functions include offices, shops, but also parking garages

Connected to: A.3 / +P.8 / +P.24 / +P.26

Z.8
Size diversity

When an area offers buildings of different sizes, it allows different types of businesses to settle and gives companies the chance to grow without leaving the area.

Connected to: A.5 / =Z.1 / +P.15 / +P.16 / +P.35

Z.9
Window times

Setting specific time windows for trucks and other heavy vehicles helps keep streets safer. By aligning window times with quieter periods (and avoiding busy moments like when children travel to and from school) traffic can be better managed and the risk of accidents reduced.

Connected to: A.3 / A.4 / A.5 / +P.30 / +P.32

P.1
Home-based business

Allowing people to start small businesses from their homes lowers the threshold for entrepreneurship and brings more activity into residential areas. Possible disturbances for neighbours should be carefully considered, and be kept to a minimum.

Connected to: A.5 / +Z.6 / +P.31

P.2
After office hours

When workshops stand empty after the workday ends, they can be used for other activities such community events or sports sessions (organised by or in consultation with the owner of the place). By opening these spaces up in the evening, buildings stay active for longer and contribute more to the life of the neighbourhood.

Connected to: A.1 / A.2 / −P.15 / +P.33

P.3
Repair closeby

Repair and refurbishment businesses located close to where people live makes it easier to fix and reuse products. This helps extend their lifespan, resulting in less waste and thus contributing to circular economy goals.

Connected to: A.1 / −Z.2 / +Z.3

P.4
Practical education

A school that specialises in teaching practical skills can work hand in hand with urban manufacturing located nearby. Knowledge and experience can be exchanged between the school and local entrepreneurs through lectures, workshops and internships.
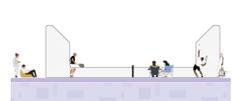
Connected to: A.1 / A.5 / +P.33

P.5
Community garden

A roof can be transformed into a shared garden, providing a communal space for residents to grow their own plants and interact. It works best when located close to where people live, with clear ownership and easy access from the ground level.

Connected to: A.1 / A.2 / *P.6 / +P.20 / −P.21

P.6
Sports at a high level

Large roofs can host sports like basketball or tennis, as well as providing for more informal activities made possible by playgrounds or outdoor gyms. This works best when located relatively close to where people live and when accessible from the ground level.

Connected to: A.2 / *P.5 / *P.16 / +P.21 / +P.33

P.7
Rooftop garden

When a residential building sits right next to a building with a large roof, openings can be created in the building to give residents access, allowing them to use it as their own rooftop back garden.

Connected to: A.2 / *P.20 / −P.21 / −P.25

P.8
Pocket park

When manufacturing and residential functions sit next to each other, a pocket park can help separate them. Vegetation reduces the impact of manufacturing on residents and adds public greenery to the neighbourhood. Back gardens can also serve this purpose.

Connected to: A.3 / A.4 / +Z.7 / +P.11

P.9
Temporary usage

Allowing manufacturers to use spaces temporarily, like in buildings planned for demolition or temporal structures, provides affordable opportunities to run their workshops. This approach also activates locations that would otherwise remain unused.

Connected to: A.2 / A.5 / +P.15 / +P.22 / +P.31 / +P.35

P.10
Public frontage

Functions that benefit from street activity can integrate a storefront or public entrance into their building. This is most effective on streets with high traffic, connecting businesses to the neighbourhood and increasing their visibility

Connected to: A.1 / A.2 / −Z.1 / −Z.3 / +P.19 / +P.27 / +P.28 / +P.33

P.11
Green wall

A green wall can be realised relatively simply with climbing plants, providing benefits like cooling the street. Especially suitable for walls of buildings that do not benefit from much interaction with the street.

Connected to: A.2 / A.4 / +P.8 / *P.12 / +P.34

P.12
Mural

A large wall can be used for a mural, adding character and identity to the place. Works best for walls of buildings that have little interaction with the street.

Connected to: K.2 / *P.11 / *P.13

P.13
Vertical sports

Walls that would otherwise be unused can host sports like climbing activities such as bouldering, but also wall-based games like squash. Benefits most from being located close to residential functions for easy access.

Connected to: A.2 / +Z.1 / *P.12 / –P.16 / +P.33

P.14
Co-location

When several businesses share one building, it can lower costs and create a community. Working close together makes it easier to exchange ideas and share the costs of expensive equipment.

Connected to: A.1 / A.5 / +P.15 / –P.29 / +P.31 / +P.33

P.15
Flexible spaces

Entrepreneurs located in urban areas often face challenges when expanding their businesses. Providing flexible spaces allows them to adjust the amount of room they use, so their workspace can evolve along with their needs and ambitions.

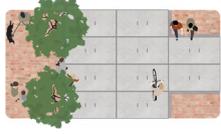Connected to: K.5 / –Z.8 / –P.2 / +P.9 / –P.14 / –P.16 / +P.31 / +P.35

P.16
XL

Some manufacturers handle big materials and products, so they need big spaces. This does not only mean high ceilings, and wide floors, but also large openings to make it easy to move goods in and out.

Connected to: A.5 / –Z.8 / –P.6 / –P.13 / +P.15

P.17
Different pavement!

Using different types of pavement for each traffic flow helps people become more aware of their surroundings. When the ground surface changes, it signals that one enters another domain where extra attention is needed for other users. Useful on streets used by heavy traffic and pedestrians or cyclists.

Connected to: A.3 / A.4 / A.5 / *P.18 / +P.19 / +P.30 / +P.32

P.18
Divided traffic flows
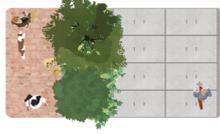
Separating different types of traffic, for example with a strip of greenery, helps all street users move safely without getting in each other's way. This is especially beneficial on streets shared by heavy traffic and slower forms of traffic.

Connected to: A.2 / A.3 / A.4 / A.5 / *P.18 / P.30 / +P.32 / +P.34

P.19
Productive pavement

The pavement directly in front of a manufacturing business can be used as an extension of the workspace. Within a few metres, it can host small outdoor tasks or loading and unloading activities. When makers use the public space in this way, their work adds life to the street and blurs the line between inside and outside.

Connected to: A.1 / A.4 / A.5 / +P.10 / +P.17 / +P.32 / +P.33

P.20
Energy roof

Large rooftops can generate energy for the business itself, but also for the surrounding community, creating shared benefits. This works best on roofs that are not highly visible to neighbours or on roofs that do not benefit from an active use such as sports.

Connected to: A.2 / *P.5 / *P.6 / *P.7 / +P.21 / +P.29

P.21
Green roof

A green roof offers nearby residents a more pleasant view than technical roofscapes (PV-panels or installations), simultaneously supporting biodiversity in the area.

Connected to: A.2 / –P.5 / –P.7 / *P.20 / +P.23

P.22
New ideas need old buildings

Adapting disused buildings creates new opportunities. It provides affordable space for businesses while bringing life back to forgotten parts of a neighbourhood. Buildings like old schools or garages often hold lots of potential and should be reused whenever possible instead of being demolished.

Connected to: A.2 / A.5 / +Z.3 / +P.9 / +P.31

P.23
Small gap

In high density areas, buildings can grow close together, leaving little space between them. In this situation, care should be taken to provide enough sunlight for rooms that need it and to avoid placing rooms sensitive to nuisance directly next to a disturbive function.

Connected to: A.3 / +P.21 / +P.24 / –P.26

P.24
Internal infrastructure as buffer

Shared infrastructure like stairwells or decks in residential buildings can act as a buffer between disruptive functions, keeping noise, vibrations, and other disturbances away from dwellings.

Connected to: A.3 / +Z.7 / +P.23 / +P.25 / +P.26

P.25
Touching walls

When a building has a windowless façade, another building can be placed right next to it without disturbing the existing structure too much, creating a more dense urban fabric. This is possible as long as measures are taken to prevent transferring nuisance to the neighbouring building.

Connected to: A.3 / –P.7 / +P.24 / +P.26

P.26
Interior flip

When a disturbing function is added next to a residential building, it can be redesigned so that sensitive rooms, like bedrooms, face away from it. Less sensitive rooms, such as bathrooms or storage, can be placed toward the disturbance.

Connected to: A.3 / +Z.7 / +P.23 / +P.24 / +P.25 / +P.28

P.27
Transparency

When a building used by manufacturers has façades with lots of transparent materials, the walls feel less oppressive and allow passersby to see the activities inside, connecting it more with the street.

Connected to: A.1 / A.2 / –Z.3 / –P.10 / +P.33

P.28
Messy backside

The backside of manufacturing can be more practical and less representable. This space can be used as a service yard where loading and unloading, waste storage, or small production tasks can take place, provided that there is enough space reserved for it.

Connected to: A.5 / +Z.5 / +P.10 / +P.26 / +P.32

P.29
Sharing is caring

When nearby manufacturers share machinery and materials, they can lower costs. This can be realised by allocating an easy-to-reach common space which simultaneously encourages collaboration and mutual support.

Connected to: A.1 / A.5 / +P.14 / +P.20 / +P.33

P.30
Safe street design

Neighbourhoods with productive functions bring heavy traffic, which can conflict with other users such as pedestrians and cyclists, so streets should be designed to allow everyone to move around safely.

Connected to: A.3 / A.4 / +Z.4 / +Z.9 / +P.17 / +P.18 / –P.32

P.31
Affordable workspace

Keep spaces for manufacturing affordable so small and emerging businesses can start, grow, and stay in the neighbourhood. This supports a diverse local economy and keeps makers embedded in the community.

Connected to: A.5 / +Z.2 / +P.1 / +P.9 / +P.14 / +P.15 / +P.22 / +P.35

P.32
Service alley

Service alleys usually run parallel to shopping streets or through a block and provide space for loading and unloading goods without disrupting other traffic flows. Their rough and functional character makes them well suited for activities that are a bit messier.

Connected to: A.4 / +Z.1 / –Z.3 / –Z.4 / +Z.5 / +Z.9 / +P.17 / +P.18 / +P.19 / +P.28 / –P.30

P.33
Building a community

Residents can connect with makers (or makers with other makers) in semi-public spaces like bars or community centres, or by transparent production processes made possible by open days, transparent façades, and public entrances. This builds familiarity, reduces anonymity, and encourages mutual acceptance.

Connected to: A.1 / A.5 / +P.6 / +P.13 / +P.14 / +P.19 / +P.27 / –P.29

P.34
Green strip

When a wall cannot be activated, a green strip can serve as a buffer between the street and the building, simultaneously contributing to a greener neighbourhood.

Connected to: A.2 / A.3 / +P.11 / +P.18

P.35
Modularity

Modular buildings can adapt to changing needs by allowing their size and shape to be adjusted over time. This flexibility requires reserving space for future expansion beyond the original footprint and height. Systematic building systems make such adaptations easier and more affordable.

Connected to: –Z.8 / +P.9 / +P.15 / +P.31

5.8 Pattern field

The relationships between the patterns are visualised in the pattern field, where they are organised along two axes. The x-axis represents scale, ranging from the building level to the neighbourhood scale. The y-axis reflects the degree of abstraction, moving from concrete to abstract patterns. Two transscalar patterns, which do not fit neatly within this framework, are positioned outside the main graph.

A distinct distribution becomes visible where the more concrete patterns tend to operate at smaller scales, while the more abstract patterns largely address the neighbourhood scale. Moreover, most alternative connections appear around the concrete, small-scale patterns.

Connections of the pattern field:
— Connected
⟷ Conditional
⟶ Precondition
----- Alternative

Abstraction (concrete - abstract) →

Scale (building - neighbourhood) →
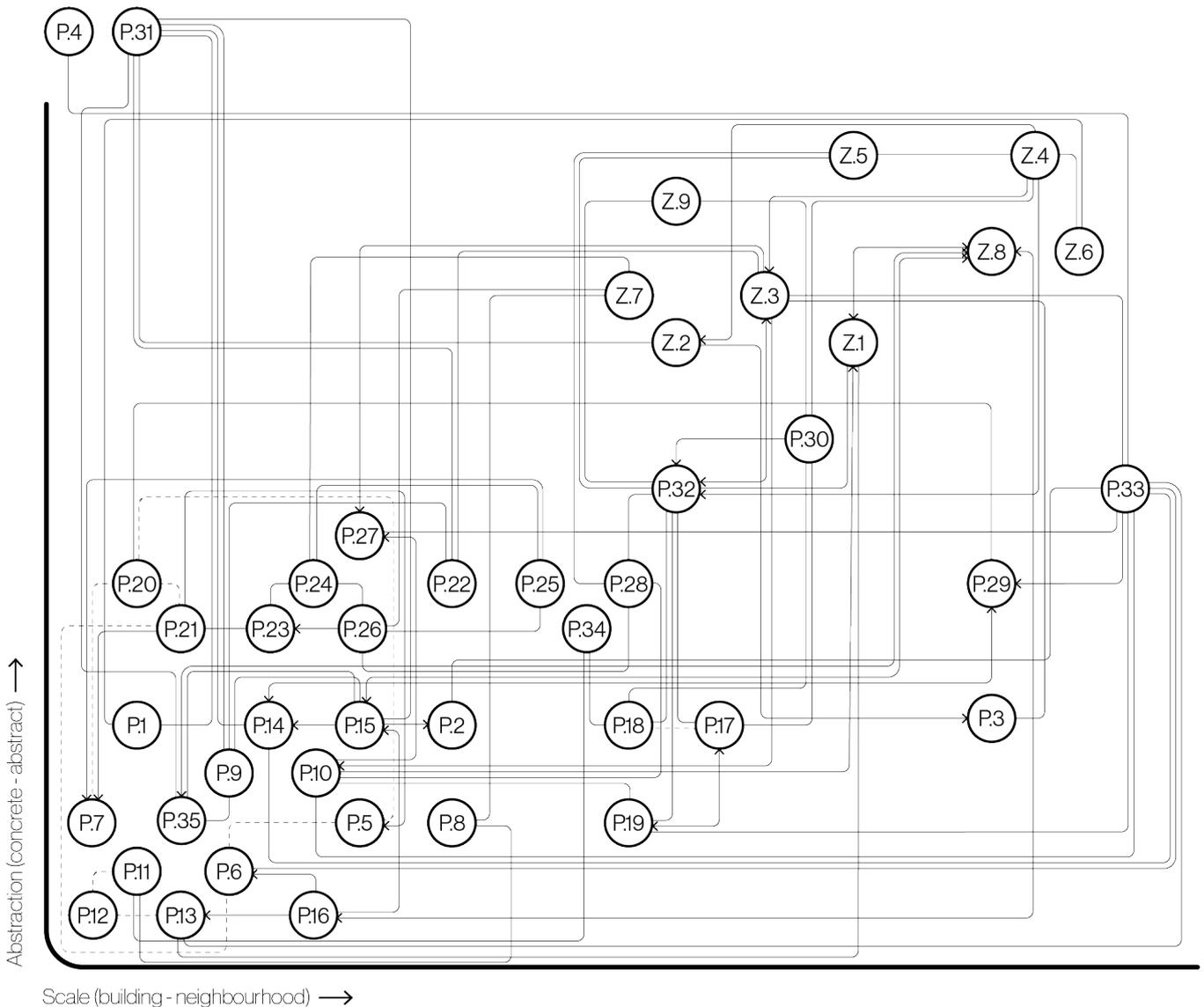
5.9 Realising ambition patterns

By highlighting the patterns related to the five ambitions (Socially embed manufacturing (A.1), Activating voids (A.2), Good transitions (A.3), Quality urban environment (A.4), and Enable manufacturing (A.5)), the domains in which they can be realised come to light*. While patterns A.1, A.3, and A.5 can only be achieved through patterns across scales and abstraction levels, ambition patterns A.2 and A.4 clearly show a tendency towards a small scale and block/street level approach respectively.

Another insight emerging from these domains concerns the **actors** required to realise the associated ambitions. When ambitions are linked to zoning patterns (Z.1-Z.9), their feasibility depends largely on governmental actors, who influence development through regulatory instruments, planning, and policy. However, ambitions grounded in more concrete, small-scale patterns, such as A.2, present a more complex governance challenge. While several actors, including housing corporations, local entrepreneurs, community organisations, or developers could in principle contribute to such interventions, none is structurally positioned to undertake them independently. Residents often lack the means, developers act largely within mandated frameworks, and for housing corporations some patterns might fall outside their field of operation. As a result, the responsibility for implementing these patterns is dispersed, underscoring the need for coordinated governance mechanisms such as a curator (Hill, et al., 2020).
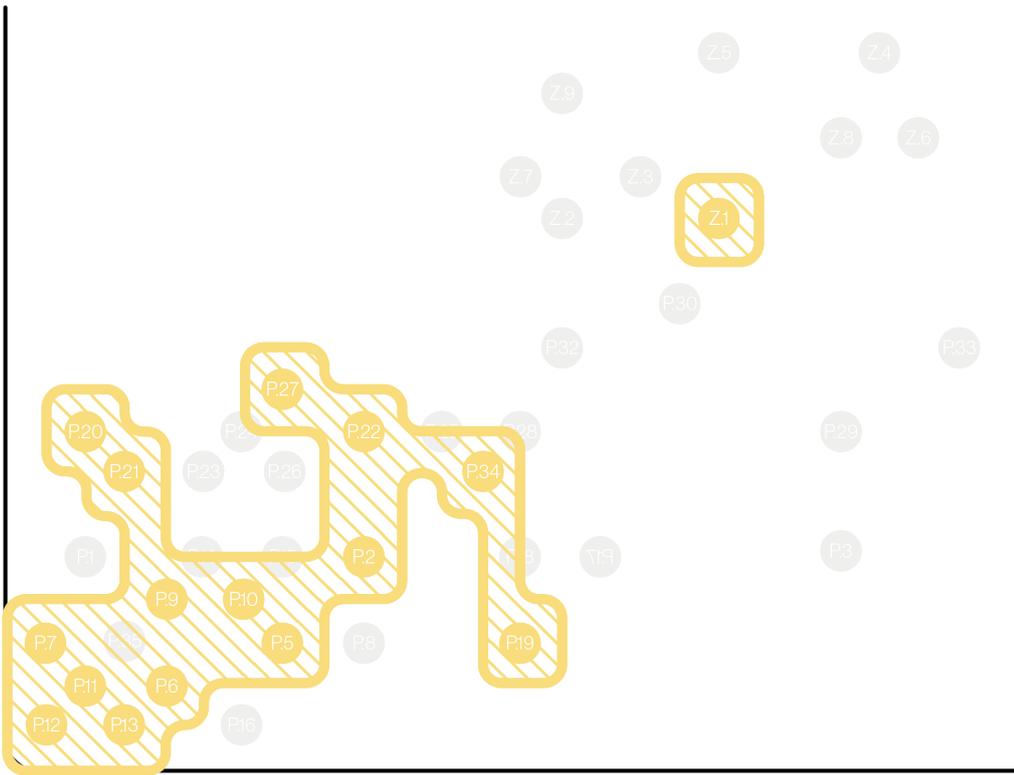
*See next page for the domains for A.2, A.3, A.4, and A.5
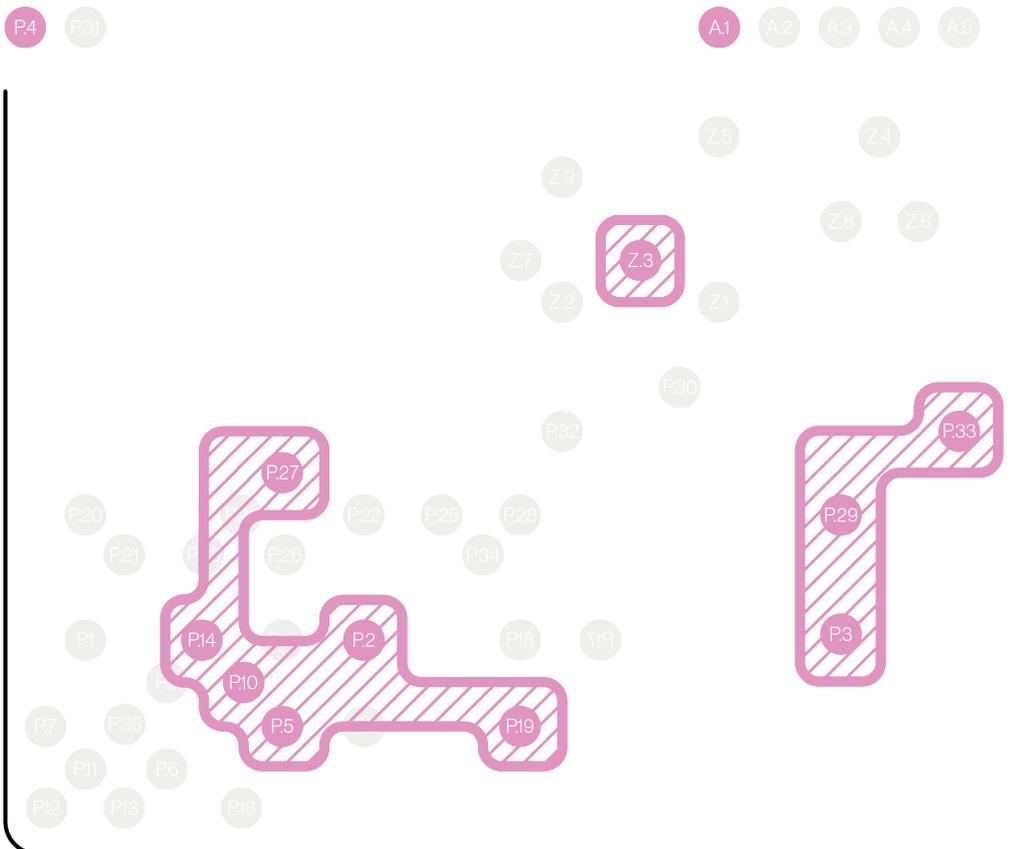
Domain of A.1: Socially embed manufacturing

Domain of A.4: Quality urban environment

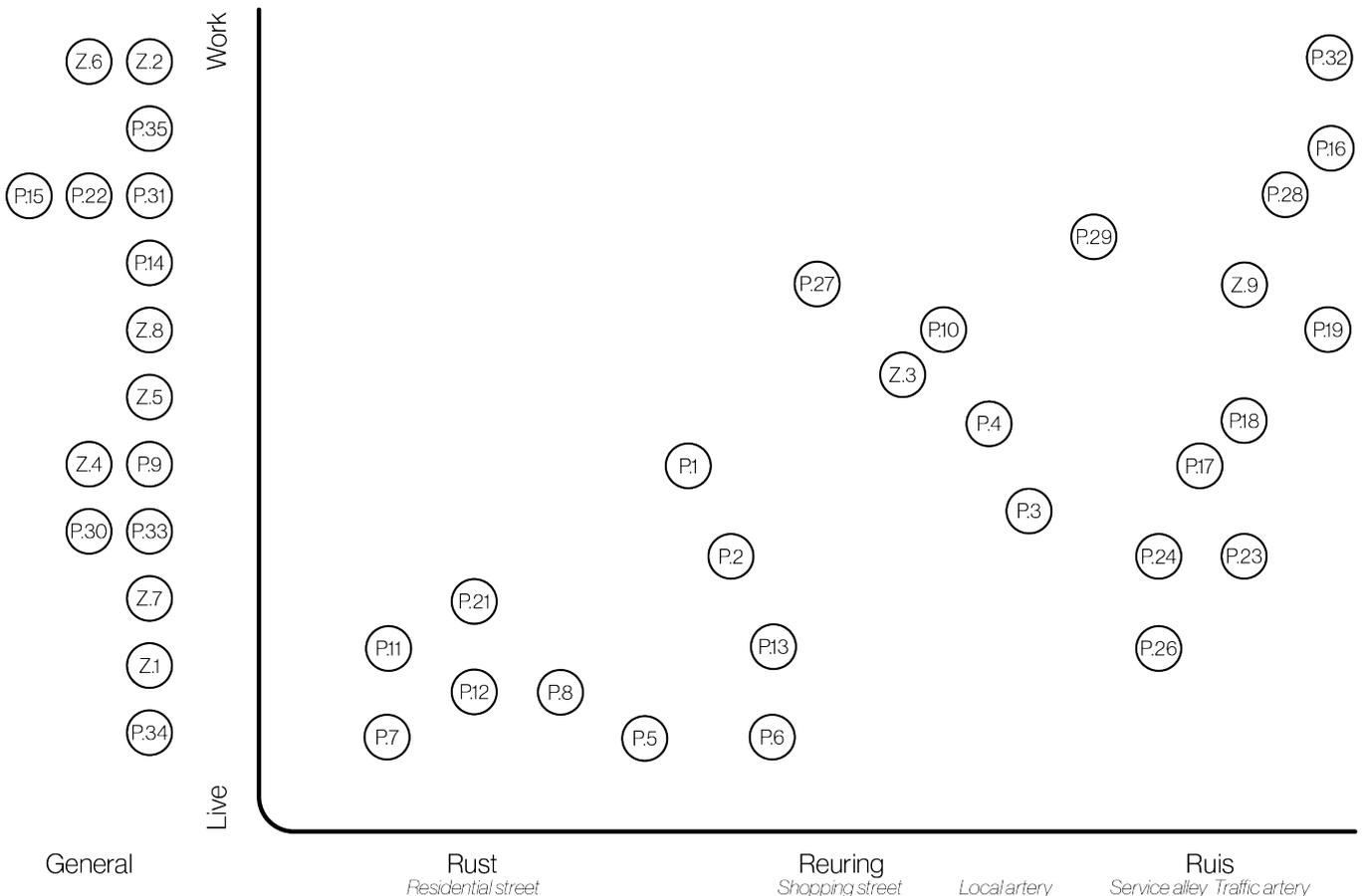

Domain of A.5: Enable manufacturing
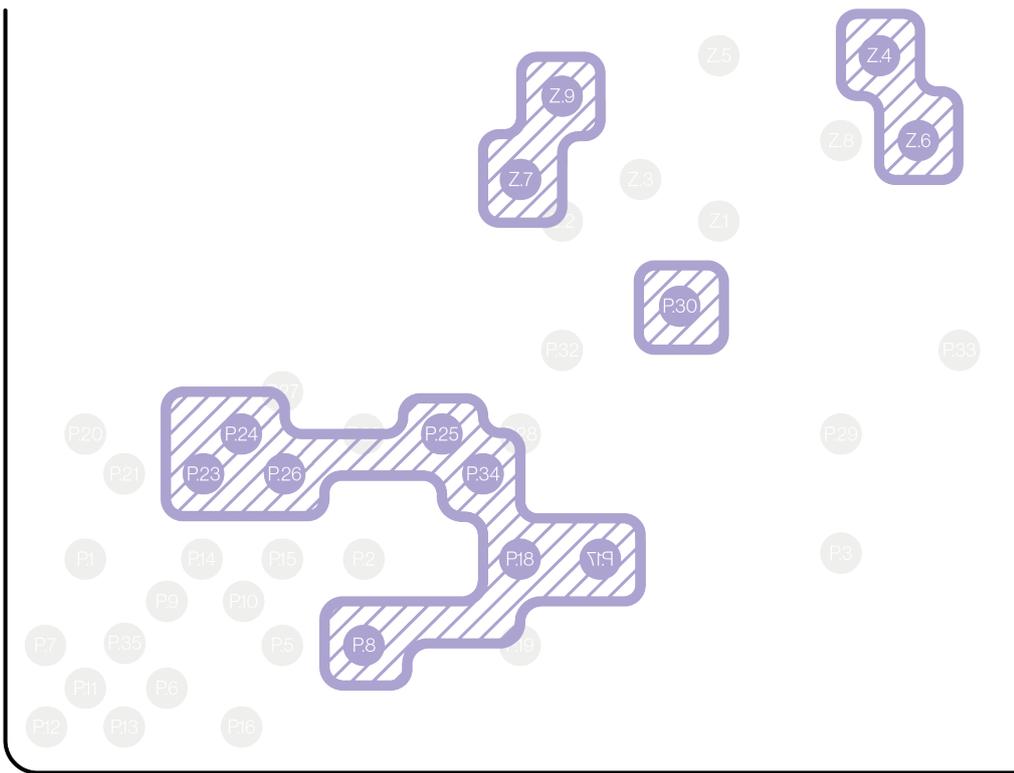
5.10 Live-work-patterns

The pattern language was developed with the idea of bringing together two seemingly conflicting functions: manufacturing and residential. This resulted in patterns that primarily support either living or working, as well as a set that addresses both. This is reflected in the diagram, where **the y-axis ranges from live to work**, indicating the extent to which individual patterns primarily support one function or the other.

The x-axis represents the RRR-framework and its associated infrastructural typologies, positioning patterns according to the type of spatial or infrastructural environment they relate to. By combining these two axes, patterns oriented toward residential life generally cluster on the Rust side, while those addressing productive or manufacturing needs gravitate toward the Ruis side. This graph may therefore assist users of the language in identifying where particular patterns might be most suitable.

Some patterns, however, do not lend themselves to clear placement along the x-axis because their relevance is not tied to the RRR-framework or a specific infrastructural typology. These have therefore been positioned solely according to their live–work orientation on the y-axis. Two patterns, Energy roof (P.20) and Touching walls (P.25), fell entirely outside the logic of the diagram.

General   Rust
Residential street

Reuring
Shopping street   *Local artery*

Ruis
Service alley Traffic artery

6
Design Nolensbuurt

This chapter synthesises the accumulated knowledge into a design proposal for the Nolensbuurt, a postwar neighbourhood situated in Middelland, north of Schiedam's historic city centre. It begins by outlining the overarching framework for the neighbourhood, followed by an exploration of the postwar context and the design leeway it offers.

Subsequently, three blocks are worked out in more detail by integrating the foundational design with the developed pattern language, alongside a deeper dive into street design and architectural expression.

The chapter concludes with a reflection on the extent to which this approach can be replicated in postwar neighbourhoods of other, larger scales.

Figure 6.1: The Nolensbuurt in may. Source: Author, 2025.

Rust
Reuring
Ruis
Public transport
Highway
Strategic building
Green structure

6.1 Layers of the framework

The first layer of the design for the Nolensbuurt focuses on establishing a coherent spatial framework that enables the integration of manufacturing. The most important step here is **zoning according to the 3 R's** (Rust, Reuring, and Ruis), based on the existing infrastructure and the opportunities it offers. Not only the street network, but also public transport plays a crucial role, as it can be a deciding factor where to build more housing stock. In this sense, the framework becomes a guiding structure for spatial decisions in the Nolensbuurt.

The second layer concerns the **green structure**. The Nolensbuurt has a recognisable layout shaped by east–west waterways, along which green spaces are present. These spaces, however, are currently underused and of little ecological quality. As the neighbourhood becomes more densely built-up through redevelopment, some green areas will inevitably be lost. Strengthening the existing green structure, and improving its connections to surrounding areas such as the Prinses Beatrixpark to the north or the existing green structure towards the west of the Nolensbuurt is therefore essential.

Street-typologies Nolensbuurt ▼
— Trafic artery
— Local artery
— Residential street
— Shopping street
— Service alley

Green-blue-structure Nolensbuurt ▶
Green structure
Water

Finally, two buildings are identified as strategic anchors. At the top of the map the **Technical School of Rotterdam** is indicated, which offers strong potential synergies with the proposed productive functions in the neighbourhood. At the bottom of the map an old school is indicated that is currently listed for demolition. Preserving it would be far more beneficial though, as it could be readily repurposed to accommodate smaller manufacturing businesses.

For more mapping and sections for the analysis of the Nolensbuurt, see Appendix 4.


0m   100m   200m

6.2 Designing in postwar contexts
Postwar neighbourhoods are characterised by uniform and affordable architecture, wide open spaces, and a rigid, rational urban layout. Although progressive at the time, decades of evolving planning ideals have pushed them out of contemporary urban design. Still, they embody values and ambitions of a distinct era and therefore ask for a thoughtful approach.

This creates a tension field between preserving the existing situation as much as possible and reshaping it to reflect contemporary ideas and ideals. To explore this spectrum, two extremes were tested: **cultural conservatism** and **anything goes**. The cultural conservative approach keeps interventions modest and closely aligned with existing structures and character, whereas the anything goes approach permits new ideas to override or reinterpret the inherited fabric. Neither direction is inherently better or worse; each leads to different outcomes depending on the project's ambitions and the stance a designer chooses to adopt.

6.2.1 Cultural conservatism
This alternative was designed with the intention of keeping the existing urban fabric as intact as possible. Interventions are limited to small extensions such as rooftop additions or plinth expansions, and only a few new volumes are introduced so that the open structure of the original plan remains intact. This approach restricts the available building footprint for manufacturing and therefore limits the range of businesses that can be accommodated. Expanding the plinth also inevitably introduces functions onto residential streets, creating friction with the framework.
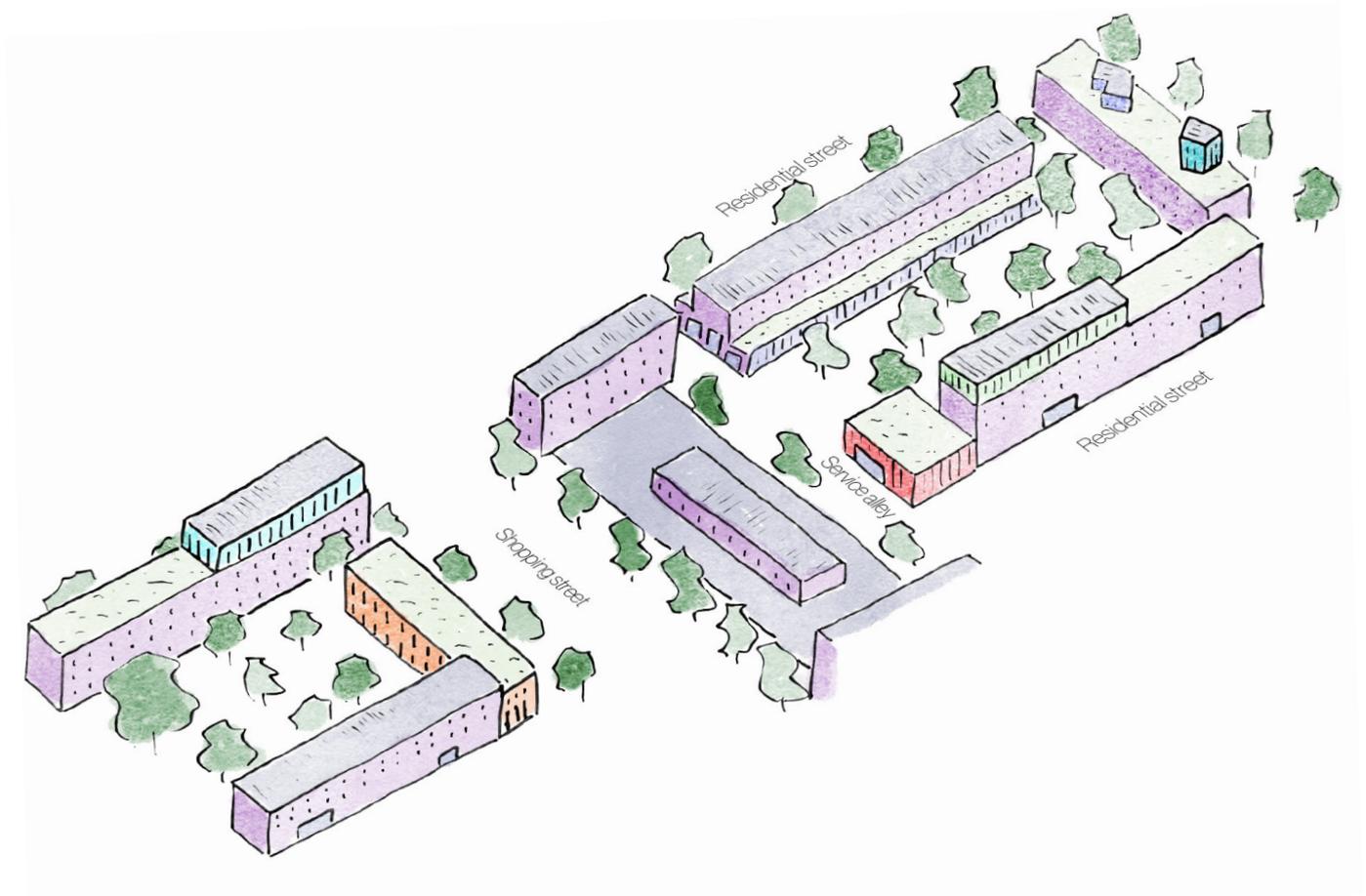
6.2.2 Anything goes

Anything Goes replaces some existing buildings with larger volumes that extend into the courtyards, significantly reshaping the structure of the block and reducing its green space a lot. These new buildings have a lot of architectural and typological freedom and do not necessarily align with the postwar context. The introduction of larger additions makes it easier to redefine the block's relationship with the surrounding streets, allowing for more entrances on multiple sides and that more closely line up with the 3 *R's*.
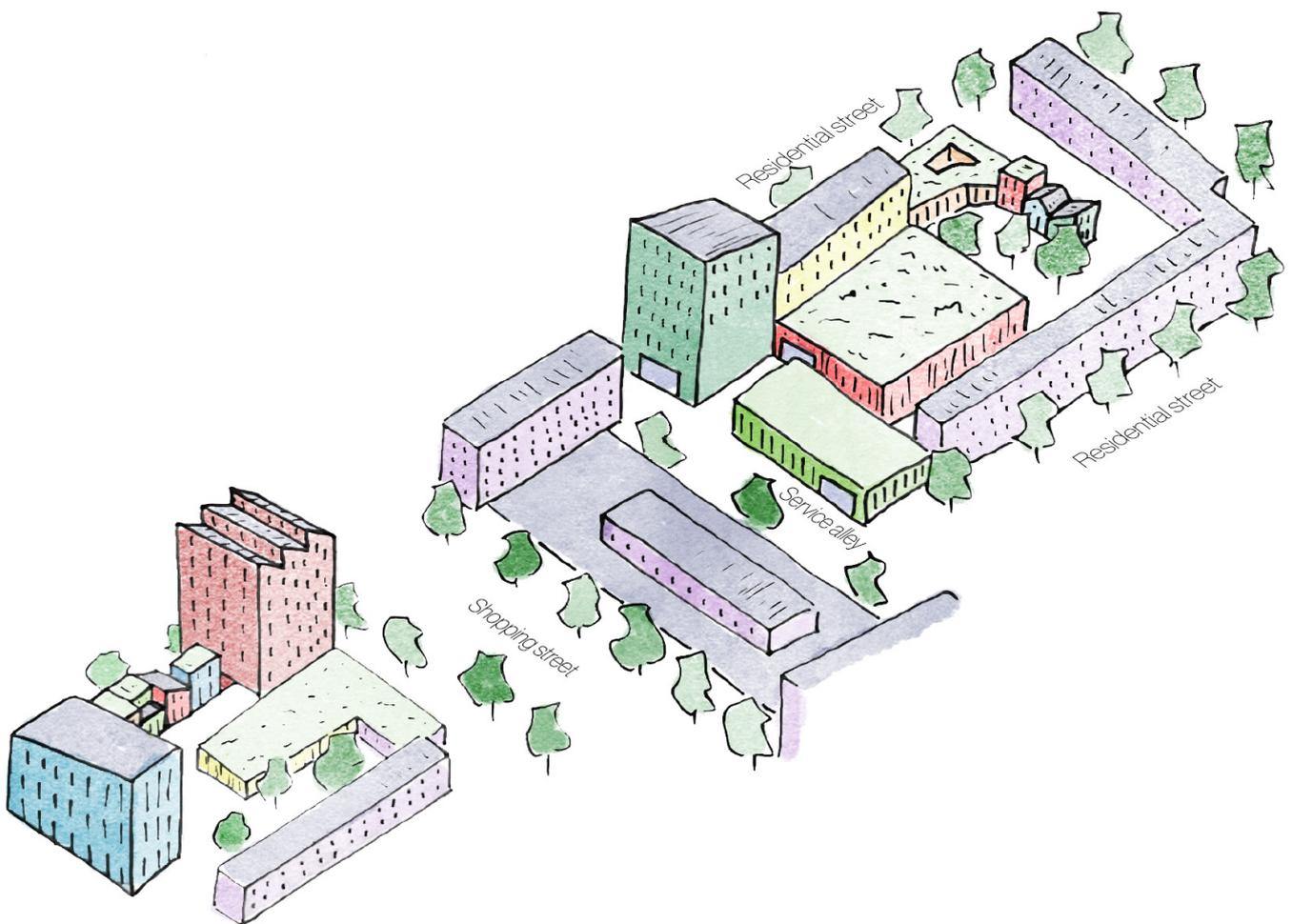
6.2.3 The alternatives on street level

It is important to see both options in more context than just the block itself to test what influence their designs have on the street. For this the two alternatives were tested along the Colijnstraat (the service alley in the Nolensbuurt) and its adjacent blocks.

The current streetscape is quite barren. The only functions present occupy former garages, which do not have any connection with the street and are usually closed with shutters. The opposite side of the street is used primarily for loading and unloading the shops located on the shopping street.

Elevation of two blocks along the Colijnstraat: current situation, cultural conservatism, and anything goes.

0m   12,5m   25m

In the cultural conservative alternative, the old garages are replaced with buildings of a bigger footprint and height meant for productive uses. By expanding and redesigning the plinth of existing walk-up flats, businesses gain the opportunity to have their storefronts on the corners, introducing some degree of street life. In this version, the green courtyards remain directly accessible from the street.

The anything goes variant transforms the streetscape almost unrecognisablely. Productive spaces are not confined to the street edge, as the block opens up to larger halls situated within the courtyard. The new buildings placed on the left (west) side of each block are larger in scale. The generous plinth also allows for other functions to activate the street such as residential lobbies or commercial spaces.

To understand how the framework shapes block and street levels and how manufacturing can be integrated within these scales, three representative blocks were developed in further detail. These blocks were selected to cover different challenges and are spread across the neighbourhood, each offering distinct spatial conditions that influence their design.

Block 2: Underutilised space

Block 1: Applying patterns

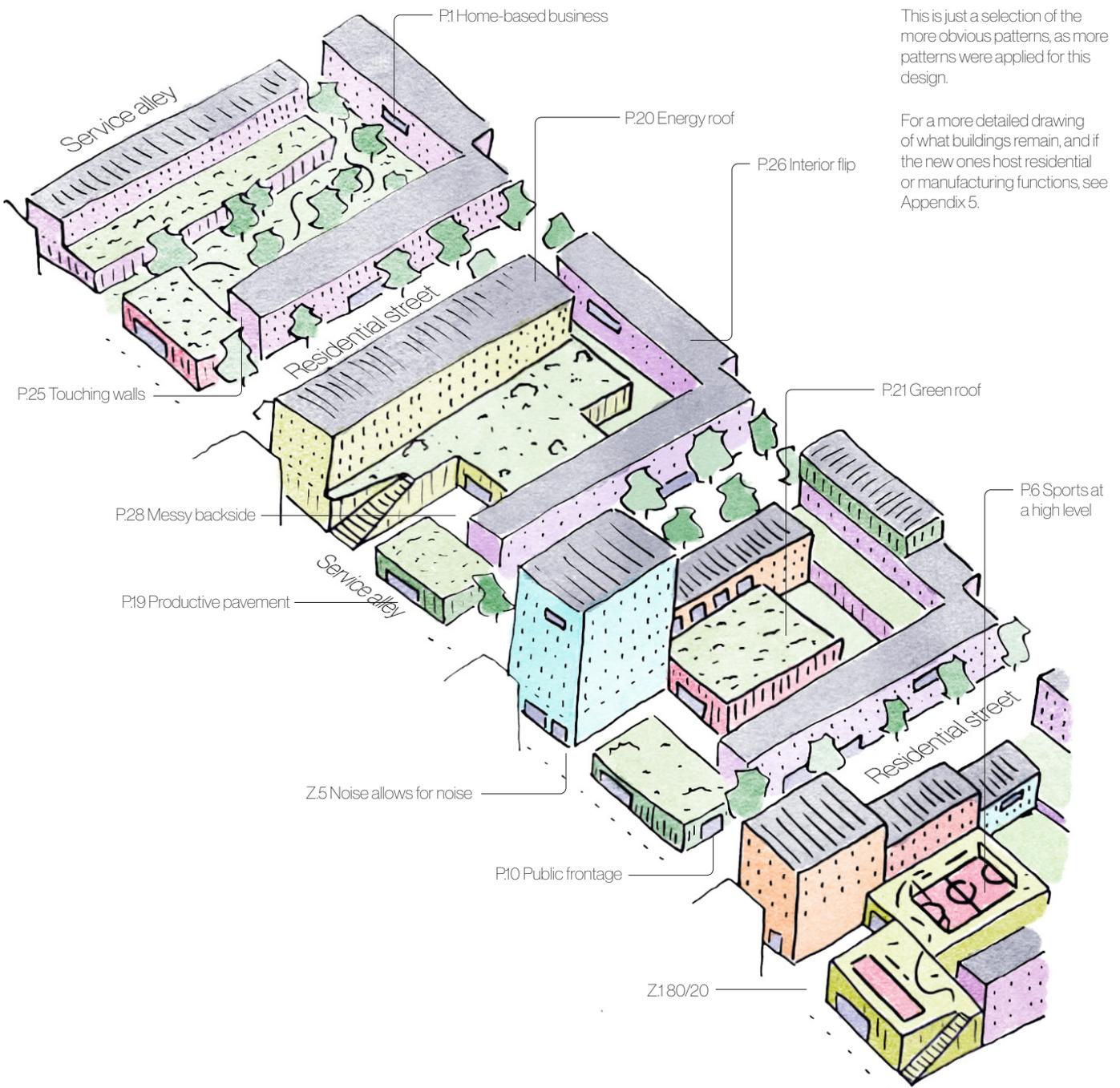Block 3: Reusing buildings

0m   100m   200m

6.3 Block 1: Applying patterns

Through the approach of testing two different variants, it became clearer where and how interventions on this scale could take place. Combined with the developed patterns, this informed the final design of the blocks along the Colijnstraat.

The outcome leans towards the anything goes approach, allowing a more diverse mix of building footprints and greater architectural and typological freedom. This enables most productive functions to front the service alley, while the residential streets remain primarily residential. New buildings form a defined street wall, defining public space and preventing businesses from fencing off their plots along the street. Roofs are activated to demonstrate additional spatial potentials such as sports facilities, community gardens, or energy roofs.

The block on the top-left incorporates more of the cultural conservative approach, preserving more of the existing fabric while still enabling productive functions. This is possible, because the adjacent street is part of the service alley and thus zoned as ruis, allowing for functions other than residential. This is done through extending the plinth of the building towards the courtyard.

P.1 Home-based business

P.20 Energy roof

P.26 Interior flip

P.25 Touching walls

P.21 Green roof

P.6 Sports at a high level

P.28 Messy backside

P.19 Productive pavement

Z.5 Noise allows for noise

P.10 Public frontage

Z.1 80/20

Service alley

Residential street

Service alley

Residential street

This is just a selection of the more obvious patterns, as more patterns were applied for this design.

For a more detailed drawing of what buildings remain, and if the new ones host residential or manufacturing functions, see Appendix 5.

The proposed changes will not occur overnight; rather, they should be able to grow orga-
nically from existing dynamics within the neighbourhood or city. A small, improvised work-
shop in someone's living room, for example, might gradually develop into a larger live–work
building. The process can also move in the opposite direction; where the restructuring and
densification of the neighbourhood, initiated by the municipality, is paired with the creation of
larger production spaces.
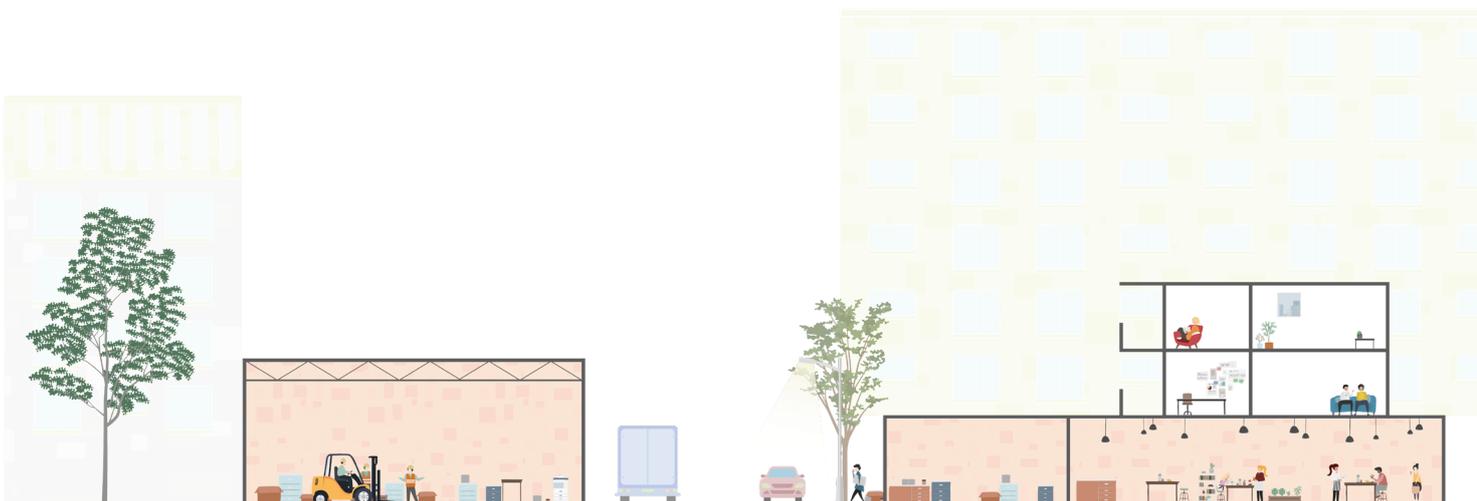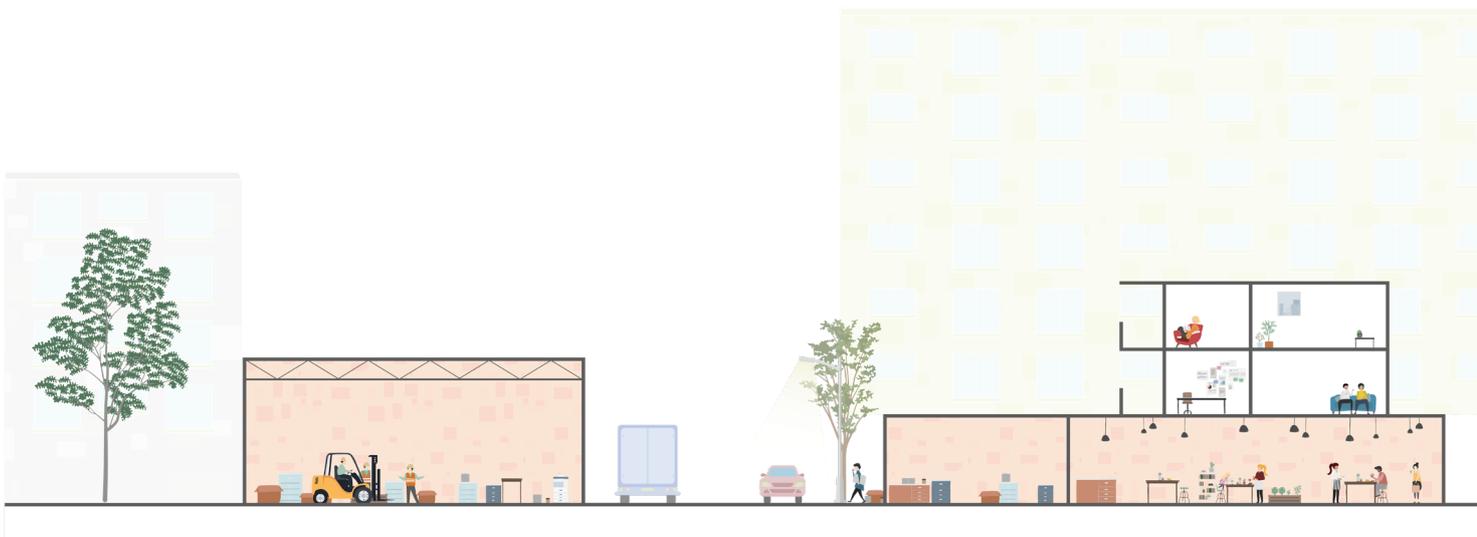
Productive functions start to emerge in the existing fabric as in disused garage spaces and rooms in dwellings.

Productive functions are able to grow within existing buildings or by replacing existing ones by buildings with a bigger footprint.

Productive functions are an integrated part of the neighbourhood, and new developments take this into account.
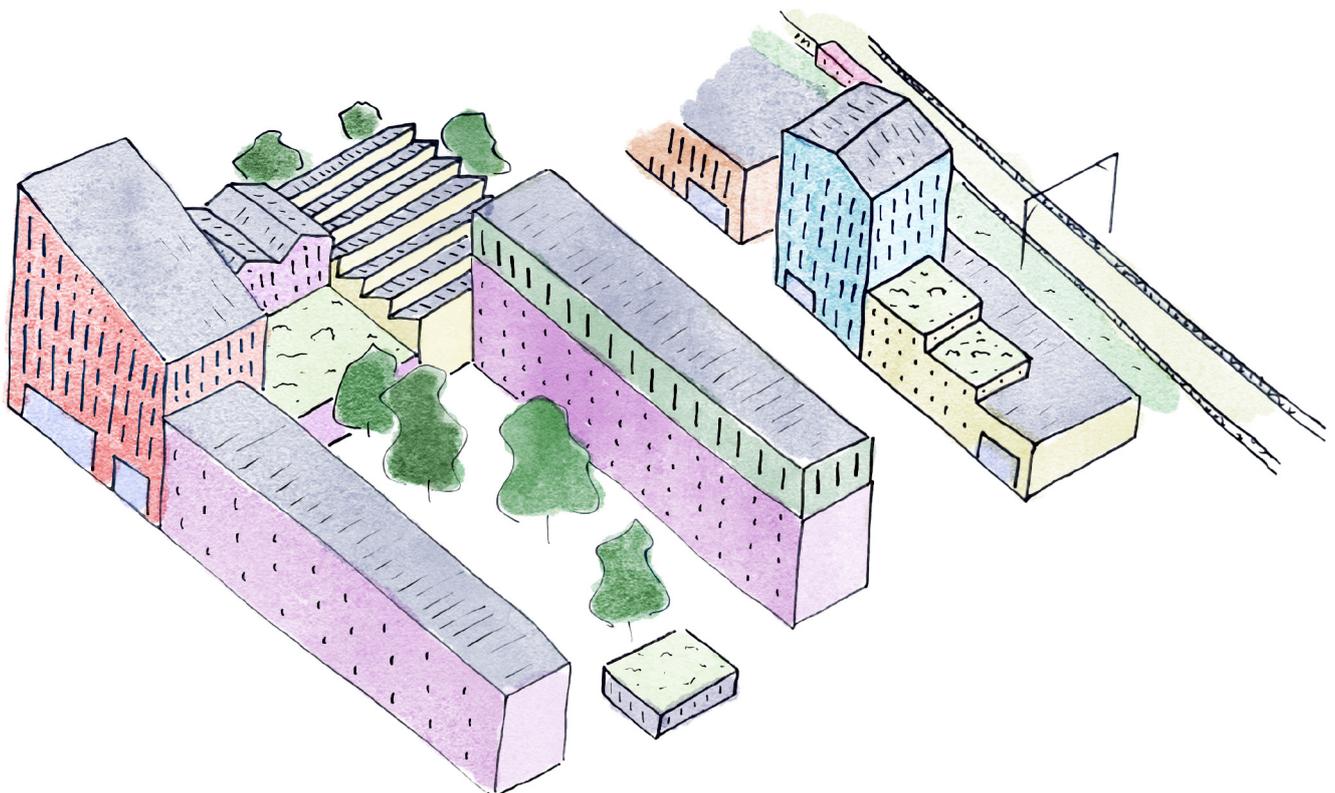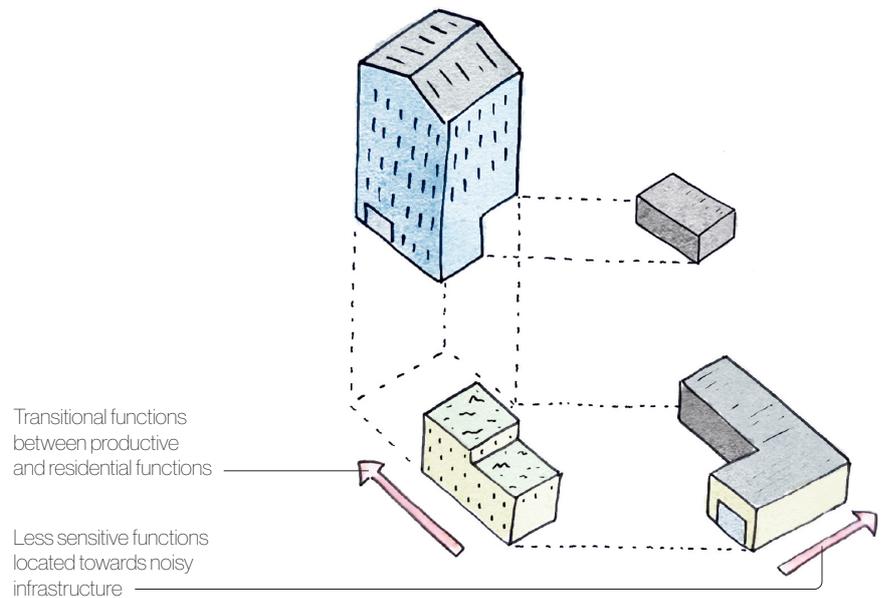
A sneak peek of a workshop located in one of the new buildings, providing local workspace and vocational training placements for students of the nearby technical school.

6.4 Block 2: Underutilised space

Making use of underutilised spaces also creates opportunities for developing productive programmes. In the Nolensbuurt, this could happen along the metro line, where a strip of roughly 20 metres in width offers room for a diverse mix of functions. In the framework, this street (Johan de Wittsingel) is already designated as ruis because of the noise generated by the metro, which makes it suitable for locating productive functions. As this is located close to a metro station, this can be combined with housing provided the design accounts for environmental disturbance (see for example the patterns Interior flip (P.26) or Transitional functions (Z.7)). This also gives the street more meaning than just hosting productive uses (see pattern 80/20 (Z.1)).

The block adjacent to this street has also been redesigned, replacing the long slab with new buildings to form two clearly defined blocks. The side towards the metro line is more suitable for productive programmes, while it would be logical to develop residential buildings on the spaces located on the other side.

Transitional functions between productive and residential functions

Less sensitive functions located towards noisy infrastructure

6.5 Block 3: Reusing buildings

Postwar neighbourhoods often contain unused buildings such as former garages or schools, and the Nolensbuurt is no exception. Next to the metro station stands an old school listed for demolition to make way for new housing. While densification projects like this one near public transit are logical, these buildings also offer the potential for affordable spaces for manufacturers (see pattern New ideas need old buildings (P.22) and Affordable spaces (P.31)).

To accommodate both needs, the design takes the building's structure as a starting point. Essentially, the school consists of three parts: a large-volume space with a ceiling height of around 3,5 metres, wrapped by a three-storey volume, with two additional wings attached. In the proposal, the two large volumes are retained and repurposed for productive uses, while the two wings are demolished to make room for housing. Higher densities are appropriate here due to the proximity of the metro station. This approach allows for both the densification of the neighbourhood and affordable manufacturing space, while preserving built heritage.

Demolished for new development

Retained for productive functions
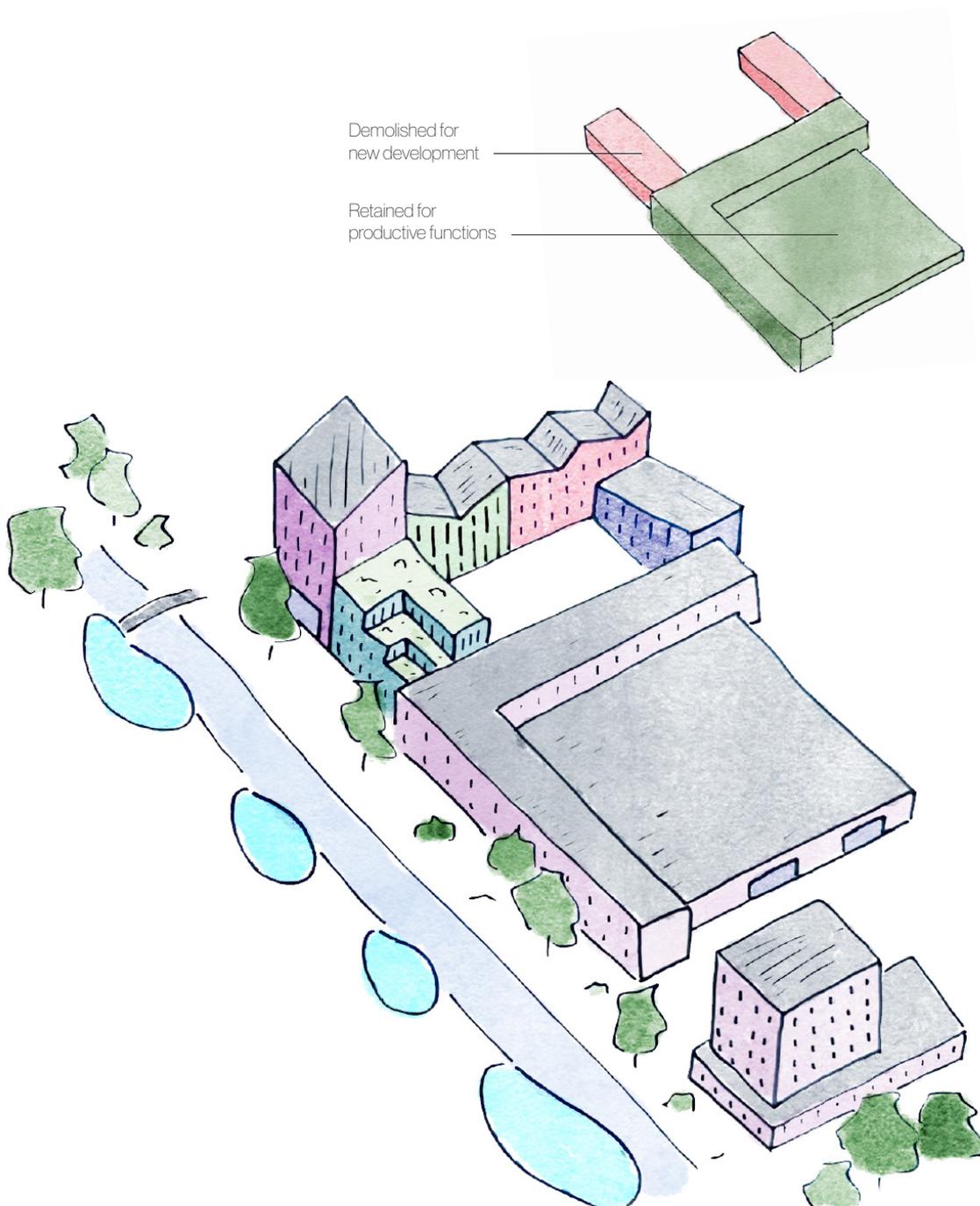
6.6 Public space design

With the renewal of the Nolensbuurt and the introduction of urban manufacturing, the public space also needs to be reconsidered. The clearest example of this is the Colijnstraat. Currently, it is dominated by paved surfaces to accommodate loading and unloading for the shops on the adjacent shopping street, as well as parking. With the redesign of the adjacent blocks, however, the Colijnstraat becomes more active as new businesses open onto it. This brings additional (heavier) traffic, which is directed onto a carriageway marked by Stelcon-plates. Where possible, traffic flows are separated by a green strip. In front of the manufacturing units, a productive pavement of Stelconplates is used to visibly signal the presence of productive functions in the public realm.

Current situation of the Colijn-straat.

0m   2,5m   5m
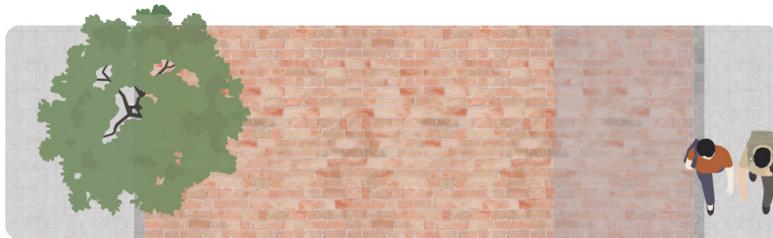
Redesign of the Colijnstraat.
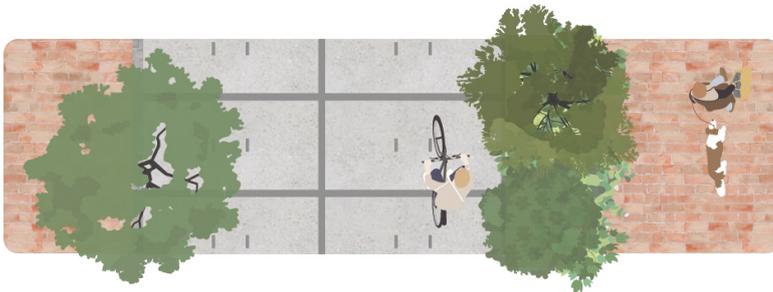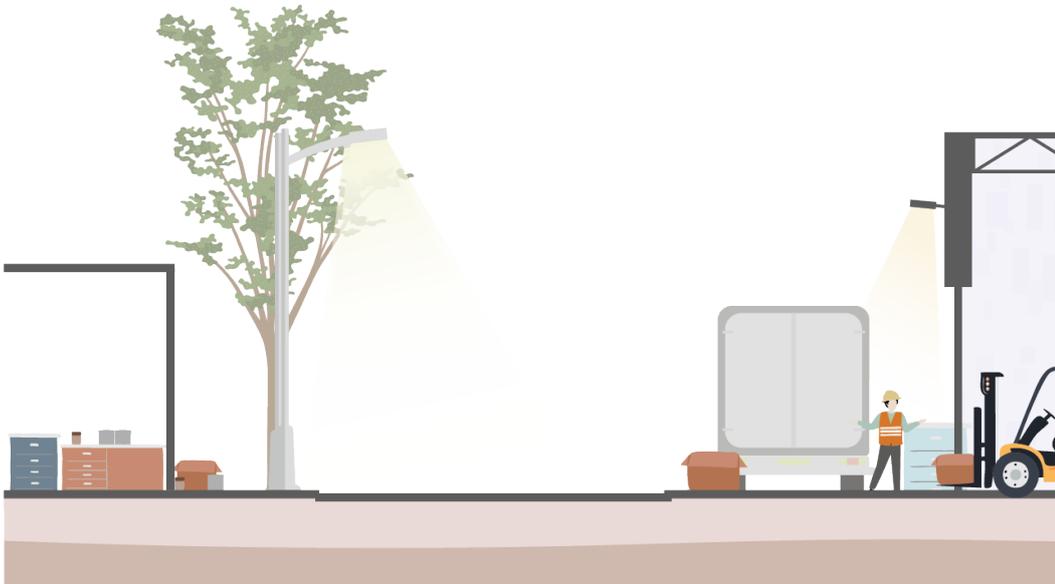
Green strips divide traffic flows where possible.
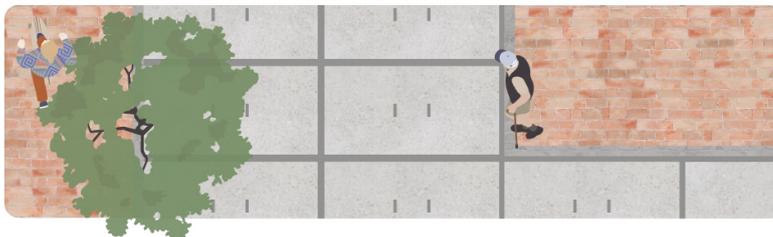
Difference in pavement marks different domains on the street.

Productive pavement of Stelconplates in front of manufacturing businesses.

A lively Colijnstraat where productive functions are supported through the introduction of new buildings that are able to accommodate manufacturing activities.

Residential streets in the Nolensbuurt are currently dominated by parking, often with two rows of perpendicular spaces flanking the carriageway. With the introduction of new functions and additional housing, parking will need to remain, but in a reduced form (two metro stations are located in the Nolensbuurt after all). One option is to replace perpendicular parking with parallel bays, freeing up space for more greenery, wider pavements, or to be able to expand the plinth or block.

The quality of the existing paving is also quite poor and would benefit from an upgrade. This could be combined with removing curbs from the street, so that the street becomes less divided, making it easier for pedestrians to claim more space.

0m   2,5m   5m
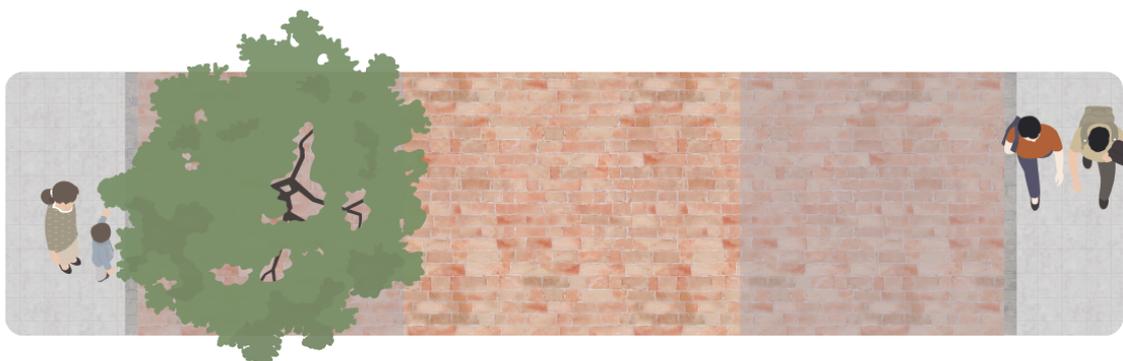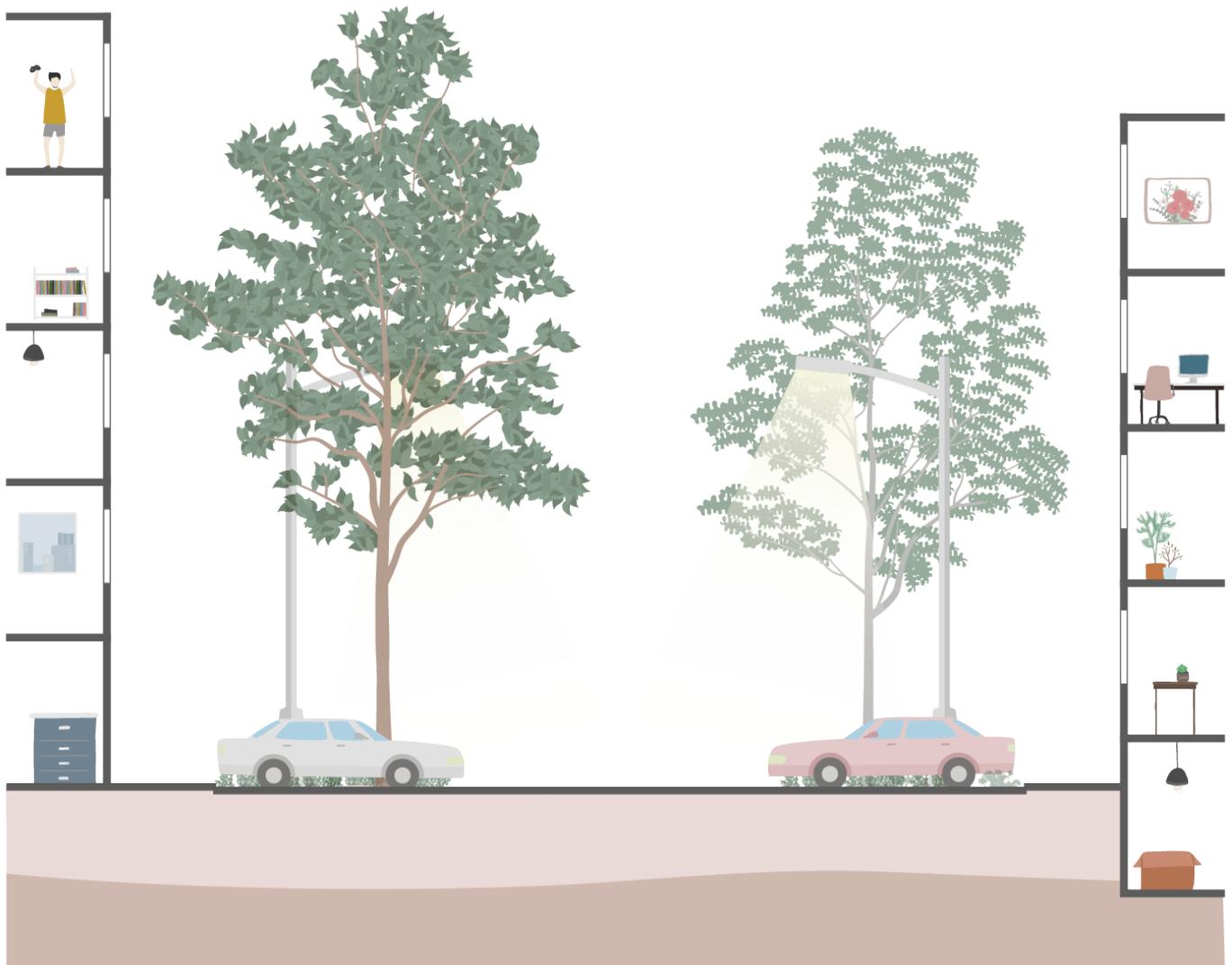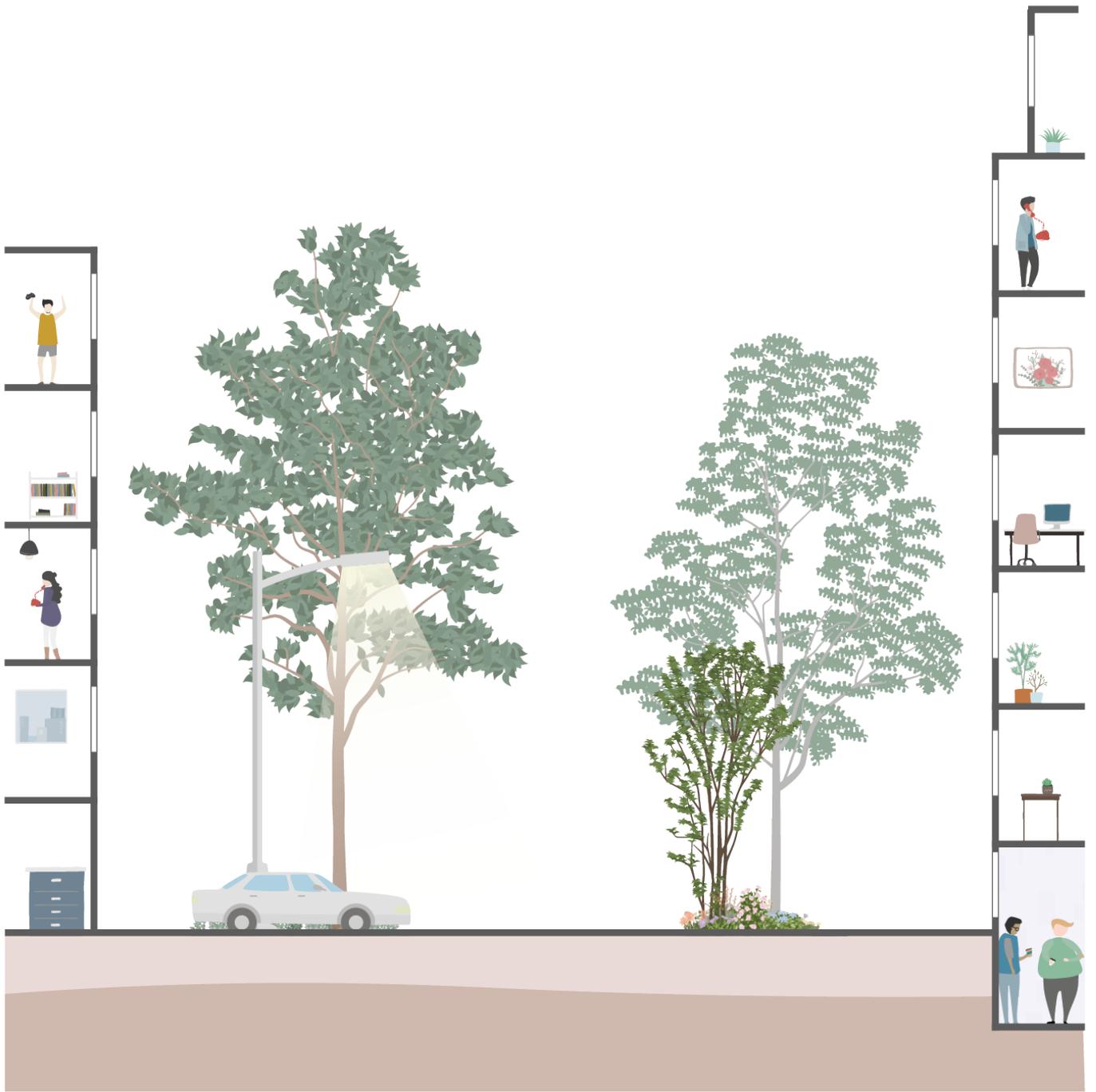
A residential street in the Nolens-buurt featuring improved public space through incorporating more greenery and higher-quality paving.

6.7 The architecture of different building typologies

Broadly, three building typologies are introduced in the design: residential buildings, live–work buildings, and work buildings. Each requires its own architectural logic within a productive neighbourhood. For residential buildings for example, it is most appropriate to position supporting functions such as parking or technical rooms towards the more disruptive activities (see ambition pattern Good transitions (A.3)). Pure work buildings, meanwhile, must integrate themselves carefully into the neighbourhood by activating any voids created by their building (see ambition pattern Activating voids (A.2)) and by maintaining a clear distinction between their front and back sides (see patterns Public frontage (P.10) and Messy backside (P.28)).

For purely residential buildings, architects should draw inspiration from the system-built characteristic of postwar architecture Contemporary interpretations of this are encouraged, such as building with timber. This could include employing a somewhat repetitive façade rhythm or a restrained colour palette. To reflect the introduction of productive functions within these neighbourhoods, the use of raw materials such as exposed concrete or steel beams could also be appropriate.

Figure 6.2: A repetative façade using contemporary materials designed by Tectône. Source: Lallement, 2020.

Figure 6.3: Exposed concrete used by OZ Architects in Amsterdam. Source: Studioninedots, n.d.

Figure 6.4: Exposed metal structure in residential building in Basel. Source: Esch Sintzel Architekten, n.d.

Figure 6.5: Metal sheets as materialisation for a residential building design by Wokshop. Source: Studioninedots, n.d.

Pure work buildings have considerable architectural freedom. While their design should remain functional, it should also be expressive to avoid the monotonous buildings seen on industrial estates. Strategies might include the use of bold colours or the exaggeration of certain elements, such as staircases leading to a publicly accessible rooftop. It is important, however, to ensure that these buildings engage with their surroundings rather than turning inward. This can be achieved, for instance, by incorporating (semi-)transparent materials (see the pattern Transparency (P.27)).

Figure 6.6: Colourful office building designed by MVRDV. Source: Renou & Drobny, n.d.

Figure 6.7: Market hall in Stockholm designed bij Tengbom using (semi-)transparent materials. Source: Gerlach, 2016.

These buildings should avoid overly specific designs and instead incorporate a degree of flexibility, allowing occupants to adapt the space to their needs. This can be achieved, for example, by creating an overarching, oversized structural framework in which individual programs or functions are arranged separately, enabling a wide variety of potential uses.
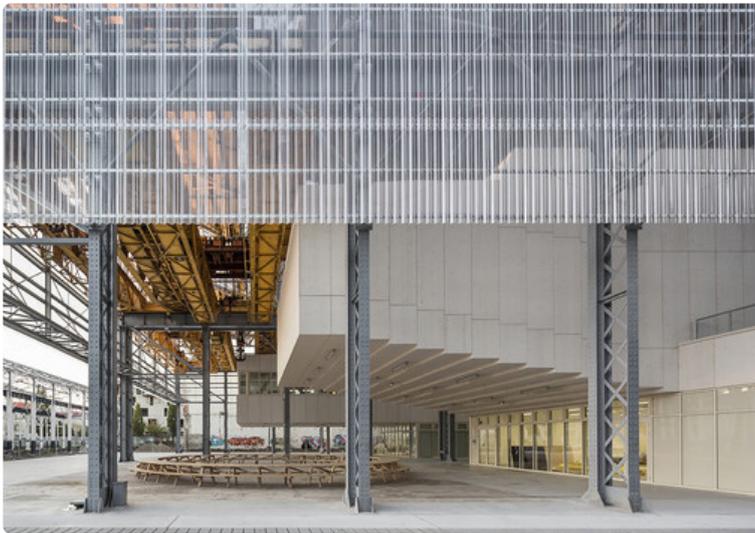
Figure 6.8: The School of Fine Arts in Nantes consists of stand-alone volumes inside a renovated industrial hall. Designed by Franklin Azzi Architecture. Source: Boegly, 2017.

Figure 6.9: Revitalised steel factory in Pittsburgh. Home to advanced manufacturing firms and organisations. Source: RIDC, n.d.

Live-work buildings should strike a balance between the two other typologies. This involves drawing inspiration from the system-built architecture of postwar neighbourhoods while having the flexibility to experiment with colour palettes and material choices like the work buildings do.

Figure 6.10: Housing project in Melbourne by Austin Maynard Architects. Source: Ross, 2023.

Figure 6.11: Colourful housing project designed by Belatchew Arkitekter in Uppsala using steel on the facade. Source: Lindman, n.d.

6.8 Assessing liveability

As concluded earlier, the Nolensbuurt currently performs poorly across almost all dimensions used to assess liveability (housing stock, physical environment, social cohesion and safety, only scoring well at amenities). Although it is difficult to quantify the extent to which the design influences each of these dimensions, all are addressed in some form.

The housing stock is addressed through the redesign of neighbourhood blocks, where additional dwellings are introduced either by replacing existing buildings with higher-density ones or by adapting current buildings to allow for housing on rooftops. Importantly, the intervention should not only increase the number of dwellings but should also diversify housing typologies, responding to the currently highly monotonous housing market in the Nolensbuurt.

The physical environment is also addressed through the design. While a portion of the existing green space (largely consisting of underused grass fields) is used to build new buildings, the neighbourhood's green structure along the waterways is upgraded, strengthening its connection to the broader green network of Schiedam. In addition, streets are redesigned to provide more space for slow traffic and high-quality greenery. When it comes to amenities, the neighbourhood already performs relatively well but is further strengthened through the addition of new functions within the neighbourhood.

Social cohesion is more difficult to measure directly; however, the emphasis this thesis places on the social embedding of manufacturing is expected to contribute positively. Manufacturing businesses can offer employment opportunities for local residents, support neighbourhood initiatives (for example by opening workshops outside working hours), or facilitate everyday encounters through new shops. Safety is similarly difficult to quantify, but increased activity throughout the neighbourhood is likely to result in more eyes on the street, which may contribute to an improved sense of safety.

6.9 Addressing late modernism

While the Nolensbuurt follows a relatively classical urban structure with clearly defined blocks arranged in a grid, the nearby neighbourhood of Groenoord Noord, developed only a decade later, represents a completely different interpretation of modernist planning principles. As the satellite image illustrates, Groenoord Noord lacks clearly articulated urban space as buildings are positioned as freestanding objects, forming **ensembles**, surrounded primarily by car-oriented infrastructure and large expanses of undefined green space.
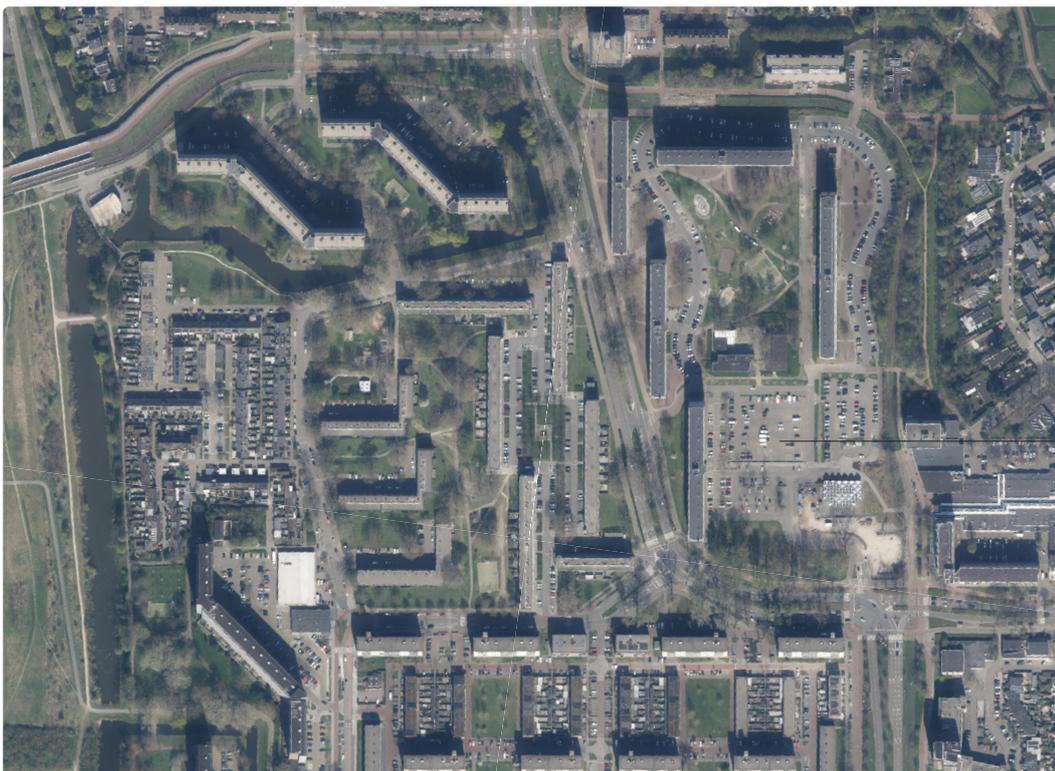

Figure 6.12: Satellite image of Groenoord. Source: Google, 2025.

Area of potential intervention

It becomes immediately clear that the design strategies proposed for the Nolensbuurt, which relies on the earlier defined block typologies, would operate very differently in Groenoord Noord. The neighbourhood is dominated by ensembles of deck-access flats reaching up to thirteen storeys. Preliminary design testing shows that these ensembles could theoretically accommodate buildings with footprints exceeding 15.000 m². While this scale could enable forms of manufacturing requiring larger spaces, inserting such volumes into the existing fabric would generate substantial voids, posing significant challenges not only for maintaining but also for enhancing liveability and spatial quality.

An alternative approach would be to introduce new buildings on the extensive parking areas that characterise the neighbourhood. The most logical site for such an intervention is the parking zone adjacent to the Hof van Spaland tram stop (see figure 6.12). Rather than placing a solitary building for manufacturing here, a **mixed-use building** combining production with residential or other programmes could contribute to the neighbourhood's vitality. Residential entrances could be oriented toward the livelier or quieter sides facing the shopping centre or the courtyard of the ensemble, while access for manufacturing activities could be directed toward the busier Mozartlaan (the principles of the 3 *R's* are also implementable here).

If additional buildings within the ensembles are not desirable, another strategy would involve adapting existing structures by **expanding their ground floors** to accommodate functions other than storage, similar to interventions implemented in the Bijlmer (see the reference study on page 52). Such spatial interventions would not only make better use of underutilised areas but also address the functional homogeneity that characterises the neighbourhood.

Although Groenoord Noord would deserve a dedicated design proposal, this lies beyond the scope of this thesis. The purpose of this example is to demonstrate that neighbourhoods without the block typologies defined in Chapter 4, and characterised instead by large-scale ensembles, require more carefully tailored, case-by-case spatial strategies to enable the integration of urban manufacturing.

7
Conclusion & Reflection

blue C

CAFÉ
BAR

Heinrichstrasse

Das Epizentrum
für guten Kaffee
von Café-Bar

22.00 - 03.00
ab 350 m

City
Hauptbahnhof

This thesis advocates a broader application of mixed-use development in urban areas by integrating manufacturing functions. Integrating such functions into existing neighbourhoods often presents challenges, as manufacturing can appear to conflict with residential uses. The research therefore focuses on addressing the specific challenges of introducing urban manufacturing into postwar neighbourhoods and proposes solutions through a pattern language that supports integration while maintaining or enhancing spatial quality and liveability. The main research question guiding this work is: How can urban manufacturing be integrated in a way that contributes to the spatial quality and liveability of postwar neighbourhoods? Four subquestions were formulated, which together provide an answer to the main question.

What defines urban manufacturing, and how can it be integrated to influence the spatial and operational logic of urban areas?

Urban manufacturing is defined not only by its physical location within city boundaries, but also by the extent to which production activities are embedded in and oriented towards the urban context. It encompasses a wide spectrum of businesses, from individuals making products at home to fully fledged factories, each with distinct spatial, operational, and environmental characteristics. This diversity makes simple classifications by scale or sector no longer effective. Instead, businesses must be assessed based on their actual performance.

The integration of urban manufacturing into cities must be supported through revised zoning policies, which are often operationalised through the *5R*-framework (Rust, Reuring, Ruis, Ruig, and Reus). This framework indicates which functions are suitable for particular areas based on their impact on their surroundings. Combined with the need to evaluate businesses on real operational characteristics rather than assumed categories, this led to the development of the Function Filter. This tool helps determine which functions can be accommodated within each *R* of the framework, ensuring that every business can find an appropriate place. It also should help to prevent easily mixable functions from occupying scarce industrial land, which should be reserved for activities that genuinely require distance from sensitive functions.

When manufacturing is integrated into urban areas through such frameworks and tools, it can positively influence the spatial and operational logic of cities by enabling local circular practices. Circular activities such as repair, refurbishment, and remanufacturing become more accessible when production is located close to consumers, facilitating shorter material flows, stronger local synergies, and reduced dependence on distant resource extraction.

What typologies characterise postwar neighbourhoods, and how can liveability be identified and defined within them?

Postwar development in the Netherlands is very diverse; five major neighbourhood typologies can be distinguished, each with their own densities and spatial structures. Among these, the garden city high-rise neighbourhoods show exceptionally low GSIs, being the result of extensive open spaces and an underused ground plane, which provides potential for spatial transformation.

These neighbourhoods display a clear set of recurring typologies across multiple scales. Starting with the building scale, three main residential types can be distinguished: ground-access terraced houses, walk-up apartments, and deck-access apartments. Terraced houses offer the highest potential for integrated productive activity due to their direct street connection and bigger footprint. Walk-up and deck-access buildings are more limited internally, but their ground-floor storage zones provide opportunities for repurposing into small-scale productive uses.

At the dwelling scale, analyses of time zones, nuisance sensitivity, and programmatic temperature reveal that rooms differ greatly in their capacity to coexist with productive functions. Bedrooms for example are very sensitive to nuisance, while storage spaces or bathrooms show higher tolerance and may act as buffers when designing with a mixed-use programme. Infrastructural typologies further shape opportunities for urban manufacturing: traffic arteries and service alleys are the most suitable due to their tolerance for noise and logistics, shopping streets offer limited potential, and local arteries require case-by-case assessment. Residential streets, remain the most sensitive and can only support low-impact or home-based production.

Liveability is an inherently subjective and dynamic concept shaped by both environmental quality and human experience. Mapping liveability across the MRDH shows that low-scoring neighbourhoods do not correlate strongly with any single neighbourhood type, underscoring that spatial form alone does not determine liveability. Instead, liveability emerges from the interplay between many different factors such as the quality of the physical environment, the availability of amenities or preserved safety.

How can a pattern language inform the integration of urban manufacturing while preserving liveability and spatial quality?

The pattern language developed in this thesis provides a structured approach for integrating urban manufacturing into postwar neighbourhoods while safeguarding liveability and spatial quality. It comprises an interconnected set of nearly fifty multi-scalar patterns, distilled through literature review, case studies, and design testing.

At the core of the language are five ambition patterns, which articulate the overarching principles that should always be addressed when introducing manufacturing into residential environments: Socially embed manufacturing (A.1), Activating voids (A.2), Good transitions (A.3), Quality urban environment (A.4), and Enable manufacturing (A.5). Each ambition is supported by a network of zoning and practical patterns that together offer pathways for implementation. The domains in which these ambitions can be realised vary: ambitions such as A.5 depend on patterns across all scales and levels of abstraction, whereas A.2 is rooted more strongly in small-scale, practical interventions.

These differences also imply variation in the actors required for implementation. Ambitions tied to larger-scale or more abstract patterns often rely on municipal steering while ambitions grounded in smaller-scale patterns can involve a more diverse set of actors, such as residents, local entrepreneurs, housing associations, or community organisations.

How can the pattern language be spatialised into a design for a postwar neighbourhood?

Spatialising the pattern language in the Nolensbuurt demonstrates how its multi-scalar logic can guide the transformation of a postwar neighbourhood into a productive, liveable urban area. At the neighbourhood scale, the *3R*-framework was applied to existing infrastructure, defining appropriate zones for different functions, while also integrating the green structure as a key spatial layer.

At the block scale, testing two contrasting design approaches (cultural conservatism and anything goes) highlighted the spectrum of interventions possible within postwar contexts. This informed the detailed design of three representative blocks, demonstrating how manufacturing can be integrated by applying the pattern language. The patterns proved adaptable across varying spatial conditions, guiding distinct design decisions for each block. Although the impact of the design on liveability is difficult to quantify, the introduction of new functions, improved use of underutilised space, architectural enhancements for new and existing buildings, and redesigned streets collectively contribute to a more vibrant urban environment with more spatial quality, which all certainly do not decrease liveability in the Nolensbuurt. The exercise confirms that the pattern language provides a structured yet flexible design approach, enabling the integration of urban manufacturing without compromising spatial quality and maintaining liveability of the neighbourhood.

This reflection is the outcome of a continuous process of critical self-evaluation carried out throughout the development of the thesis. The reflection is structured into several sub-chapters, reflecting on aspects as decisions, methods, and outcomes tracing how the research and design came to be.

Limitations

A major limitation of this thesis is the lack of interviews or engagement with anyone outside of the university. This constrains the practical applicability of the findings, as the results have not been anchored in local knowledge. Engaging with a representative from the Municipality of Schiedam, for instance, could have strengthened the feasibility of the proposed designs and recommendations, or facilitated connections with organisations and residents in the Nolensbuurt. Such contact might have provided valuable insight into how inhabitants currently experience their neighbourhood and whether the proposals of this thesis align with or address their concerns. I attempted to reach out to a manufacturing-related business operating in the Nolensbuurt to better understand local business conditions, but this was ultimately unsuccessful.

Scientific relevance

Scientific research on urban manufacturing is by no means a novelty. Some papers dive deeper into the question of how urban manufacturing is related to the circular economy like research by Hausleitner et al. (Urban Manufacturing for Circularity: Three Pathways to Move from Linear to Circular Cities, 2022) and Tsui et al. (The Role of Urban Manufacturing for a Circular Economy in Cities, 2020). Whereas others focus more on the socio-economic factors related to urban manufacturing like Orban et al. (Who benefits from productive activities?, 2021). Often it is the case though, that literature on urban manufacturing focuses on why it should return to urban areas (Tsui, 2023), and neglects the spatial challenges that come with reintegrating manufacturing.

While certain studies, such as those related to Cities of Making, propose spatial strategies for designing with manufacturing, very few studies have explored concrete design proposals. This is problematic as manufacturing is often associated with big buildings and nuisance and thus need clever design interventions to be properly fitted into the urban fabric. This thesis tries to fill this knowledge gap by showing how urban manufacturing can be integrated by proposing a site-specific design as well as with the pattern language that has been developed.

Societal relevance

The disappearance of manufacturing in urban areas is problematic as it can result in the loss of blue-collar jobs that trickle down to the economy of the city as a whole (Curran, 2007). The removal of manufacturing out of our daily lives also caused the production processes to turn into black-boxes, resulting in less understanding of the making of things (Sennett, 2008). Lastly, urban manufacturing could play an important role in the transformation to a circular economy as the volume of waste streams present in cities can be utilised for new forms of productive activity (Hill et al., 2020), as well as making it possible to have circular strategies located close to where people live. The integration of manufacturing in cities certainly brings challenges as identified in this thesis, but could also act as a catalyst to bring new dynamics into neighbourhoods that face challenges such as a programmatic homogeneity, decreased liveability, and poor spatial quality.

Ethical considerations

The absence of direct engagement with residents of the Nolensbuurt or representatives from the Municipality of Schiedam is my main concern. While my training in urban design provides tools to analyse and propose interventions, I am aware that my perspective is shaped by experiences in a very different spatial and social context than the one that I am working with for this thesis. The lack of local knowledge brings limitations, and it raises the question of whether it is appropriate for me to propose a far-reaching design for such environments.

Transferability

Developing typologies at multiple scales for postwar neighbourhoods has helped clarify where particular design decisions are most appropriately applied. Because these typologies were analysed at a broader scale than the Nolensbuurt alone, they hold relevance for other postwar neighbourhoods as well. The most significant instrument for ensuring transferability, however, is the pattern language. By its very nature, the tool is a way to generalise complex topics into smaller bits of knowledge. The language developed in this thesis focuses specifically on integrating urban manufacturing in a manner that supports liveability and spatial quality, and it should be used within that scope. For other dimensions related to urban manufacturing (such as circularity) alternative pattern languages may be more suitable, like the one developed by Cities of Making (Hill et al., 2020).

While the tools and typologies developed are in some shape or form transferable, it should be important to note that the outcome of the design phase is not. Although the design is based on the analysed typologies and pattern language, the site-specific spatial and social conditions will always lead to other outcomes.

Relation with the master's track and programme

The project evolved beyond a purely urban design focus, addressing broader, systemic aspects of urbanism and situating manufacturing within a larger urban system. This required an interscalar approach, moving from the regional scale down to the smallest scales where an urban designer can intervene, and every scale in between. The interscalar perspective, combined with systematic and integrated thinking, aligns this thesis closely with the Urbanism track, as these are precisely the themes that characterise this degree.

Methodology

In previous projects, I have reflected on the interplay between research and design, often concluding that both components informed one another, and thinking that I had developed a solid understanding of how to integrate them in the upcoming projects. This thesis, however, made me realise how easy it is to slip back into relying too heavily on one of the two.
With the way the graduation programme was set up, and the focus before the summer on establishing an extensive foundation for the thesis with the development of a conceptual, methodological and theoretical framework, it felt logical to lean more heavily into the theoretical side of the thesis. Although this groundwork ultimately supported later decision-making, I became so focused on the theoretical dimension that my tutors had to pull me out of this mode and had to force me to begin designing more. It was only after P2 and the summer break that I started to use design and research in an intertwined way. Questions emerging from design exploration regularly led to targeted research, and in turn, insights gained from this research, informed new design iterations. Looking back, I enjoyed this phase the most, as I gain more energy from designing and visualising than from solely conducting research.

Further reflecting on the second half of the graduation process made me realise that urban design research cannot be fully predetermined. The programme's structure, with its emphasis on developing the aforementioned frameworks early on, suggests that once these are established, the remainder of the thesis becomes an application of predefined steps leading to an expected answer. In practice, the project naturally shifted as new insights and design challenges emerged. When preparing for P3, I revisited the methodology and research questions formulated in P2 and noticed that I had drifted away from some, prioritising others, and yet the work I was doing still felt coherent and productive. This made me realise that research could also develop alongside design decisions and research findings, as the relevance of certain questions or methods shifts with the project's direction. While a clear methodological backbone remains essential, urban design is not a controlled scientific experiment with a single correct outcome. It is a subjective and iterative process, and sometimes it could be more meaningful to reflect afterwards on how research and design informed one another than to rigidly adhere to a predetermined methodological script.

Reflection on the design context

At first, I found it difficult to form a clear opinion on the spatial qualities of postwar neighbourhoods, and in some ways this is still the case. I realised that there is no single or definitive answer to what the values of postwar neighbourhoods are; these largely depend on the individual's perspective and design experience. Some may see the extensive green spaces as the main quality of these neighbourhoods, while others might appreciate the distinctive architecture. The following paragraphs summarise my own reflections, developed through working within postwar contexts thoughout this thesis:

Starting with the open blocks of postwar neighbourhoods that often centre around an open lawn which reflects the original intent to provide inhabitants with 'light, air, and space'. This design principle remains one of the main spatial qualities of the dwellings within these blocks as the unobstructed views and generous access to daylight that result from this layout are important assets and should be preserved as much as possible.

One of the downsides of these building blocks is their relatively low density and functional monotony. They predominantly consist of walk-up or deck-access apartment buildings of similar size and accommodate almost exclusively residential functions. Interventions within the block should thus focus on introducing other types of dwellings, but most importantly other functions than residential (such as manufacturing). While doing this, and introducing new volumes within a block, it is essential to design the massing in a way that preserves the qualities of light, air, and space that define housing within postwar neighbourhoods. This can be achieved, for example, by limiting the height of new volumes to minimise their impact or by intensifying existing building footprints (through replacing them with higher buildings).

Although the publicly accessible lawn at the centre of the block was originally intended to secure light, air, and space, and to serve as a place for the community to use, it can be concluded that these spaces often do not function as intended and remain underused. Preserving the spatial qualities of postwar neighbourhoods therefore does not necessarily depend on retaining these lawns, but rather on carefully considered massing that can possibly use up this lawn. This approach allows for more flexibility when working within postwar neighbourhood contexts, enabling adaptation rather than rigidly preserving their original layouts.

An additional argument for building on these lawns is the current abundance of green space in many postwar neighbourhoods due to the repetition of the blocks, which may partly explain their underusage. By concentrating public space more by reducing the central lawns within blocks, residents are encouraged to make greater use of the remaining green structures, where the strong green–blue networks typical of these neighbourhoods become particularly relevant. While block-level green spaces often lack spatial quality, the neighbourhood-wide green structure has greater potential to function as a connected system that extends across the border of the neighbourhood, creating more meaningful public green space.

Finally, the architecture characteristic of postwar neighbourhoods is largely defined by sober and rigid residential blocks. This appearance is the result of the large-scale industrialisation of construction in response to the high demand for housing at the time. Although this architecture is not always appreciated today, the conditions that shaped it may be more relevant than ever. New construction in these neighbourhoods can draw on contemporary forms of system-based or industrialised building methods, and have this reflected in their architecture. In addition, an assessment should be made at the neighbourhood level to identify buildings of particular architectural or representative value, in order to support informed decisions when demolition is considered.

Personal reflection

While it is certainly exciting to spend a year working on a topic I am very invested in, the autonomy of the graduation process can also be unexpectedly confronting. Over the past year, I have become increasingly aware of my own working style as I tend to operate in sprints rather than in a steady consistent flow. When I have a clear sense of direction, I am able to work focused and efficiently for long hours. However, when I lose that sense of direction, I can become stuck, unsure of how to proceed. This was particularly evident around P2, where an intense period of long days towards the deadline was followed by a period of disorientation in which I struggled to identify the next steps.

Stepping away from the thesis during the summer break helped enormously. Taking time off and traveling abroad to visit inspiring projects (and sometimes secretly reading papers or policy documents) allowed me to return to the thesis with new ideas. This made me realise that for me creativity cannot be forced. When I become stuck, it is often more productive to shift my attention elsewhere and return later with a fresh perspective.

I also realised that my sprint-based working method has another consequence: during periods of high productivity, I generate large amounts of material in a relatively short time. This makes it easy to lose oversight of what has been produced and what insights have emerged from it. As a result, I sometimes found it difficult to clearly articulate the reason behind certain decisions. While these decisions felt coherent to me after months of immersion, this was not always immediately evident to others who engaged with the project every now and then. This made me recognise the importance of not only producing work, but of taking deliberate moments to step back, review, and synthesise.

Design reflection

I also want to reflect on the outcome of the design itself. Looking back at my initial pitch during the early weeks of the graduation programme, I questioned whether integrating manufacturing into a neighbourhood was truly a good idea, given the potential nuisance and pollution. At the time, I suggested that "if we want to use space more efficiently, maybe our cities have to become more unpleasant." Now, I asked myself: will the Nolensbuurt actually get worse when my design is implemented, or is it really possible to integrate manufacturing without compromising quality of life?

Ultimately, this thesis has been about preventing degraded neighbourhoods with the integration of urban manufacturing by maintaining spatial quality and liveability. I hope that I have at least partly succeeded in that. For example, the addition of productive functions in postwar neighbourhoods like the Nolensbuurt has the potential to inject new life into these areas. And though the demolition of buildings should not be considered lightly, it creates opportunities to introduce a wider variety of programmes beyond residential use (as well as ensuring no net loss of dwellings). Much of the nuisance traditionally associated with manufacturing can be mitigated through architectural design, which contains noise, vibrations, and odours within buildings. Urban design measures, such as volume studies and street layout, further reduce impacts, showing that, with careful design, manufacturing can also be integrated in a pleasant way.

Bibliography

References

- Alexander, C., Ishikawa, S., & Silverstein, M. (1977). A pattern language: Towns, Buildings, Construction. Oxford University Press.
- Altes, W. K. K., & Tambach, M. (2008). Municipal strategies for introducing housing on industrial estates as part of compact-city policies in the Netherlands. Cities, 25(4), 218–229. https://doi.org/10.1016/j.cities.2008.04.005
- Atteveld, J., De Bies, M., Krassenberg, H., Van 't Hoff, M., & Verschoor Boisen, M. (2021). Superplinten Handboek.
- Bibri, S. E., Krogstie, J., & Kärrholm, M. (2020). Compact city planning and development: Emerging practices and strategies for achieving the goals of sustainability. Developments in The Built Environment, 4, 100021. https://doi.org/10.1016/j.dibe.2020.100021
- Boegheim, P., Gadet, J., Kroon, P., Loutfi, J., Van Niewenhuizen, A., Ter Voort, L., & Stokman, W. (2017). Ruimte voor de economie van morgen.
- Bruinsma, R., & Barrois, J. (2019). Milieuzonering nieuwe stijl.
- Bruinsma, R., Geuke, J. W., De Hek, M., Oosterwijk, D., & Drost, W. (2024). Activiteiten en milieuzonering.
- Buchanan, R. A. (2025, 24 november). History of technology. https://www.britannica.com/technology/history-of-technology
- Calisto Friant, M., Vermeulen, W. J. V., & Salomone, R. (2023). Transition to a Sustainable Circular Society: More than Just Resource Efficiency. Circular Economy And Sustainability, 4(1), 23–42. https://doi.org/10.1007/s43615-023-00272-3
- Canon of the Netherlands. (z.d.). Zwart Nazareth. Canon Of The Netherlands. https://www.canonvannederland.nl/nl/page/169836/zwart-nazareth
- Cicerchia, A. (1996). Indicators for the measurement of the quality of urban life. Social Indicators Research, 39(3), 321–358. https://doi.org/10.1007/bf00286400
- Curran, W. (2007). "From the Frying Pan to the Oven": Gentrification and the Experience of Industrial Displacement in Williamsburg, Brooklyn. Urban Studies, 44(8), 1427–1440. https://doi.org/10.1080/00420980701373438
- De Boeck, S., & Ryckewaert, M. (2020). The Preservation of Productive Activities in Brussels: The Interplay between Zoning and Industrial Gentrification. Urban Planning, 5(3), 351–363. https://doi.org/10.17645/up.v5i3.3092
- De Zwarte Hond. (2021). Inspiratieboek voor een kwalitatieve functiemix.
- Dellot, B., Warden, J., & Hill, A. V. (2018). Cities Report Brussels. https://citiesofmaking.com/cities-report/
- Dewilde, C. (2017). Explaining the declined affordability of housing for low-income private renters across Western Europe. Urban Studies, 55(12), 2618–2639. https://doi.org/10.1177/0042098017729077
- Ellen MacArthur Foundation. (2013). Towards the circular economy Vol. 1: an economic and business rationale for an accelerated transition. https://www.ellenmacarthurfoundation.org/towards-the-circular-economy-vol-1-an-economic-and-business-rationale-for-an
- Endhoven, T., Van Hoek, T., Koning, M., Bleumink, P., Olsder, R., & Verwaal, M. (2019). Ruimte voor economische activiteit tot 2030.
- Ferm, J., Panayotopoulos-Tsiros, D., & Griffiths, S. (2021). Planning Urban Manufacturing, Industrial Building Typologies, and Built Environments: Lessons From Inner London. Urban Planning, 6(3), 350–367. https://doi.org/10.17645/up.v6i3.4357
- Furlan, C., Wandl, A., Cavalieri, C., & Unceta, P. M. (2022). Territorialising circularity. In The Geojournal library (pp. 31–49). https://doi.org/10.1007/978-3-030-78536-9_2
- Geuting, E., Breekmans, J., & Eringfeld, W. (2019). Mengtypologie & toepasbaarheid.
- Gladek, E., Van Exter, P., Roemers, G., Schlueter, L., De Winter, J., Galle, N., & Dufourmont, J. (2018). Circular Rotterfdam.
- Green Leigh, N. (2013). Strengthening Urban Industry: The Importance of Infrastructure and Location. In Infrastructure and Land Policies. https://www.lincolninst.edu/publications/books/infrastructure-land-policies
- Harbers, A., Van Amsterdam, H., & Spoon, M. (2024). Rudifun 2024 [Dataset]. https://www.pbl.nl/publicaties/rudifun-2024

- Hausleitner, B., Hill, A., Domenech, T., & Sanz, V. M. (2022). Urban Manufacturing for Circularity: Three Pathways to Move from Linear to Circular Cities. In The Geojournal library (pp. 89–103). https://doi.org/10.1007/978-3-030-78536-9_5
- Hill, A. V., Croxford, B., Domenech, T., Hausleitner, B., Meyer, H., Orban, A., Sanz, V. M., Vanin, F., & Warden, J. (2020). Foundries of the Future. In TU Delft Bouwkunde eBooks. TU Delft Open. https://doi.org/10.47982/bookrxiv.9
- Hoppenbrouwer, E., & Louw, E. (2005). Mixed-use development: Theory and practice in Amsterdam's Eastern Docklands. European Planning Studies, 13(7), 967–983. https://doi.org/10.1080/09654310500242048
- Jacobs, J. (1961). The Death and Life of Great American Cities. The Yale Law Journal. https://doi.org/10.2307/794509
- Kakuda, Y. (2019). Characteristics of Workplace Residence and the Local Community in the Area of Small Factories. https://ocu-omu.repo.nii.ac.jp/records/2012069
- Kishna, M., & Prins, A. G. (2024). Monitoring van circulariteitstrategieën.
- Kitchin, R. M. (1996). Methodological convergence in cognitive mapping research: investigating configurational knowledge. Journal Of Environmental Psychology, 16(3), 163–185. https://doi.org/10.1006/jevp.1996.0015
- Kluck, J., Kleerekoper, L., Erwin, S., Corpel, L., Bons, P., Arif, Z., Geisler, L., Veenbos, K., & Koekoek, A. (2023, 1 september). Computer leert wijktypen bepalen voor heel Nederland: een studie naar het inzetten van kunstmatige intelligentie voor het bepalen van wijktypen. HvA Research Database. https://research.hva.nl/en/publications/computer-leert-wijktypen-bepalen-voor-heel-nederland-een-studie-n/
- Lawrence, R. J. (1996). Building bridges for studies of housing quality. Nordisk Arkitekturforskning.
- Leidelmeijer, K., & Mandemakers, J. (2022). Leefbaarheid in Nederland 2020.
- Leidelmeijer, K., & Van Kamp, I. (2003). Kwaliteit van de Leefomgeving en Leefbaarheid.
- Leinfelder, H., & Pisman, A. (2008). A methodological framework for a political approach of mixed land use, tested in the urbanised region of Flanders, Belgium. http://doi.org/1854/11730
- marco.broekman. (2019). Schieoevers Noord Delft Ontwikkelplan.
- Mei Architects. (2022). Kabel District Delft Definitief Ontwerp Stedenbouwkundig Plan.
- Meyer, H., Hausleitner, B., Muñoz Sanz, V., & Klapwijk, A. (2018). Cities Report Rotterdam. https://citiesofmaking.com/cities-report/
- Meyer, K. (2023). Next Generation Small Urban Manufacturing: Apprentices' Perspective on Location Factors, Mixed-Use, and Shared Spaces. Urban Planning, 8(4). https://doi.org/10.17645/up.v8i4.7040
- Michalos, A. C. (1996). Migration and the quality of life: A review essay. Social Indicators Research, 39(2), 121–166. https://doi.org/10.1007/bf00286971
- Ministry of Land, Infrastructure and Transport. (2003). Urban Land Use Planning System in Japan. https://www.mlit.go.jp/common/001050453.pdf
- Municipality of Amsterdam. (2020). Amsterdam Circulair 2020-2025.
- Municipality of Rotterdam. (2023). Programmaplan Rotterdam Circulair 2023.
- Municipality of Schiedam. (z.d.). Nieuwbouwprojecten in Schiedam. https://www.sdam.nl/wonenin/c/nieuwbouwprojecten
- Municipality of Schiedam. (2017). Bestemmingsplan Nieuwland 2016. https://www.schiedam.nl/sites/default/files/inline-files/Bestemmingsplan%20Nieuwland%202016%20-%20Toelichting%20vd.pdf
- Paans, O., & Pasel, R. (2014). Situational urbanism: Directing Postwar Urbanity : an Adaptive Methodology for Urban Transformation. Jovis Verlag.
- Phillips-Fein, K. (1998). The still-industrial city: why cities shouldn't just let manufacturing go. The American Prospect.
- Rademacher & De Vries. (n.d.). Zuid-Holland Bedrijventerreinen.
- Rood, T., & Evenhuis, E. (2022). Ruimte voor circulaire economie.
- Rowley, A. (1996). Mixed-use Development: Ambiguous concept, simplistic analysis and wishful thinking? Planning Practice And Research, 11(1), 85–98. https://doi.org/10.1080/02697459650036477
- Sassen, S. (1990). Economic Restructuring and the American City. Annual Review Of

Sociology, 16(1), 465–490. https://doi.org/10.1146/annurev.so.16.080190.002341

- Sennett, R. (2008). The craftsman. Yale University Press.
- STEC Groep. (z.d.). Mengen wonen en werken. https://stec.nl/expertise/mengen-wo-nen-en-werken/
- STEC Groep. (2024). Ruimtelijke voetafdruk circulaire economie.
- Stuyt, M. L. (2020). Make Compact Work. TU Delft.
- Szalai, A. (1980). The Meaning of Comparative Research on the Quality of Life.
- Theye, M. (2025). Where Industry Meets the Tides. TU Delft.
- Tjallingii, S. (1996). Ecological conditions. Strategies and structures in environmental planning. Data Archiving And Networked Services (DANS). http://resolver.tudelft.nl/uuid:42120bb6-793e-4a23-85cf-947c68720f64
- Tsui, T. (2023). A+BE | Architecture and the Built Environment, No. 20 (2023): Spatial approaches to a circular economy. In Research Repository (Delft University of Technology). https://doi.org/10.7480/abe.2023.20
- Tsui, T., Peck, D., Geldermans, B., & Van Timmeren, A. (2020). The Role of Urban Manufacturing for a Circular Economy in Cities. Sustainability, 13(1), 23. https://doi.org/10.3390/su13010023
- Van Es, E., Harbusch, G., Maurer, B., Pérez, M., Somer, K., & Weiss, D. (2014). Atlas of the functional city : CIAM 4 and comparative urban analysis. In Medical Entomology and Zoology. http://ci.nii.ac.jp/ncid/BB1740812X
- Warden, J. (2018, 27 juni). London's manufacturing: a brief history. https://citiesofmaking.com/londons-manufacturing-a-brief-history/
- Wilkinson, F. (2024). Industrialization, Labor and Life. https://education.nationalgeographic.org/resource/industrialization-labor-and-life/
- Zandbelt, D., Stapel, R., Ram, M., Broekman, M., Van Der Zee, F., Chen, Y., Hamelaar, R., Van Balken, K., Stauttener, T., Quartel, E., & Van De Grootevheen, S. (2019). Metro Mix.

Image sources

- 1.1: Jongkind, J. (1868). Jongkind, J. (1868). Demolition work in Rue des Franc-Bourgeois St. Marcel. https://artsandculture.google.com/asset/demolition-work-in-rue-des-franc-bourgeois-st-marcel-johan-barthold-jongkind/AQFVD6eYTpsyOQ?hl=en
- 1.2: Dralle, G. (n.d.). Personeel helpt met het in- of uitladen van een vrachtwagen van de Firma Georg Dralle. https://beeldbank.schiedam.nl/beeld/detail/9bb06243-6ee9-07ac-b730-50901f9aea89/media/403415ce-1ff7-bd14-c889-eca9c7c2c02d?mode=-detail&view=horizontal&q=dralle&rows=1&page=10
- 1.3: Krijger, A. (1980). Luchtfoto 's-Graveland. https://beeldbank.schiedam.nl/beeld/detail/14926f0c-f983-a954-9f54-8d5be4d5606a/media/bb89cc05-c3ca-3782-ccf9-64e85d8e07a2?mode=detail&view=horizontal&q=spaanse%20polder&rows=1&page=30
- 1.4: Municipal Archives of Schiedam. (n.d.). Fabriek van Stalen Meubelen gebr. de Wit. https://beeldbank.schiedam.nl/beeld/detail/a5064c78-9810-9926-7dec-15498ef1fb28/media/6cc78e70-f881-313d-d39b-bf111ae670ae
- 1.5: Municipal Archives of Schiedam. (n.d.). Bouw van een draaikrans voor een kraan op de Werf van Gusto. https://beeldbank.schiedam.nl/beeld/detail/f2d8c7ac-aa44-ef20-d7d7-5fb2547bec3f/media/502013c7-e777-6537-13f6-e03744a1d3f3
- 1.6: Blok. (1956). Eerste Nederlandse Fabriek van Manometers. https://beeldbank.schiedam.nl/beeld/detail/97de8f88-c543-4f5d-324b-260dfbc83a39/media/f14406e0-2c77-5328-7f0c-04ab5ab8b36d
- 1.7: Created by author
- 1.8: Municipality of Schiedam. (1961). Parkweg. https://www.schiedam.nl/ruimtelijkeplannen/NL.IMRO.0606.BP00046-0002/t_NL.IMRO.0606.BP00046-0002.html
- 1.9: Dijkstra, R. (1970). Gezicht op het Chopinplein met daarachter een groot gedeelte van de wijk Groenoord. https://beeldbank.schiedam.nl/beeld/detail/53070294-e620-73a3-a2b9-0f69d0182d76/media/9d176b0f-56e5-5347-4947-8380e4af88f0?mode=detail&view=horizontal&q=groenoord&rows=1&page=50
- 1:10: Created by author
- 1.11: Breur. (1951). De montagehal van de eerste Nederlandse fabriek van manometers aan de Lange Achterweg. https://beeldbank.schiedam.nl/beeld/detail/544944fc-9a22-6b3c-169b-ae23712a024b/media/e5da51b0-a89d-1013-8c14-04cf25211ad0?mode=-detail&view=horizontal&q=manometers&rows=1&page=6
- 1.12: Created by author

- 2.1: Collette, R. (n.d.). Koppelstukken welke bewerkt worden op de carousselbank. https://beeldbank.schiedam.nl/beeld/detail/db981e4d-4b08-85e4-5969-d99d62167f0d/media/ba6653ff-b18f-8878-33ce-1141c3926b97?mode=detail&view=horizontal&q=koppelstukken&rows=1&page=1

- 3.1: Municipal Archives of Schiedam. (1910). 55 tons mastbok Antèe voor de werf van Gusto. https://beeldbank.schiedam.nl/beeld/detail/2ca006cb-9111-d7b2-fe50-e336b-fe33f59/media/a665884b-7d15-3e66-822f-9ee2ca73d7f7?mode=detail&view=horizontal&q=mastbok&rows=1&page=21
- 3.2: Hoppenbrouwer, E., & Louw, E. (2005). Mixed-use development: Theory and practice in Amsterdam's Eastern Docklands. European Planning Studies, 13(7), 967–983. https://doi.org/10.1080/09654310500242048
- 3.3: Leinfelder, H., & Pisman, A. (2008). A methodological framework for a political approach of mixed land use, tested in the urbanised region of Flanders, Belgium. http://doi.org/1854/11730
- 3.4: KimuraMatsumoto architects office. (n.d.). House A / Shop B. https://kmrmtmt.com/en/projects/housea-shopb
- 3.5: Created by author
- 3.6: Phalt Architekten. (n.d.). Metallwerkstatt Dynamo Zurich. https://phalt.ch/de/projekte/metallwerkstatt-dynamo/
- 3.7: Created by author

- 3.8: Freitag. (n.d.). Factory tours. https://freitag.ch/ja_NL/mission/community/factory-tour?srsltid=AfmBOoo4Q2-eXc_8Htvlz_KFyu-MA5JADPkXWWx-BU-RBOcHOoUHEQ2-6
- 3.9: Bruinsma, R., Geuke, J. W., De Hek, M., Oosterwijk, D., & Drost, W. (2024). Activiteiten en milieuzonering.
- 3.10: Kishna, M., Rood, T., & Prins, A. G. (2019). R-ladder. https://www.pbl.nl/downloads/pbl-2019-achtergrondrapport-bij-circulaire-economie-in-kaart-3403-1pdf; Theye, M. (2025). Where Industry Meets the Tides. TU Delft.
- 3.11: Calisto Friant, M., Vermeulen, W. J. V., & Salomone, R. (2023). Transition to a Sustainable Circular Society: More than Just Resource Efficiency. Circular Economy And Sustainability, 4(1), 23–42. https://doi.org/10.1007/s43615-023-00272-3
- 3.12: Kishna, M., & Prins, A. G. (2024). Monitoring van circulariteitstrategieën.

- 4.1: Dijkstra, R. (1970). Luchtfoto Groenoord. https://beeldbank.schiedam.nl/beeld/detail/794fd046-1c52-6c24-b7e8-18bf131be14a/media/5618be7f-5c97-2f60-d1c2-411342705101?mode=detail&view=horizontal&q=groenoord&rows=1&page=149
- 4.2: Leidelmeijer, K., & Van Kamp, I. (2003). Kwaliteit van de Leefomgeving en Leefbaarheid.
- 4.3: Leidelmeijer, K., & Mandemakers, J. (2022). Leefbaarheid in Nederland 2020.
- 4.4: Leidelmeijer, K., & Mandemakers, J. (2022). Leefbaarheid in Nederland 2020.

- 5.1: Created by author
- 5.2: Created by author
- 5.3: Created by author
- 5.4: Created by author
- 5.5: Created by author
- 5.6: Created by author

- 6.1: Created by author
- 6.2: Lallement, C. (2020). Apartments in Illkirch. https://www.archdaily.com/970898/apartments-in-illkirch-graffenstaden-tectone?ad_medium=gallery
- 6.3: Studioninedots. (n.d.). De Admiraal. https://studioninedots.nl/project/oostenburg/
- 6.4: Studioninedots. (n.d.). De Warmoes. https://studioninedots.nl/project/oostenburg/
- 6.5: Esch Sintzel Architekten. (n.d.). Conversion of a Wine Storage into Housing. https://www.eschsintzel.ch/en/selection/projects/lysbuechel-sued/?cat=planned
- 6.6: Renou, S., & Drobny, L. (n.d.). Haus 1. https://www.mvrdv.com/projects/1079/haus-1
- 6.7: Gerlach, F. (2016). Östermalm's Temporary Market Hall. https://www.archdaily.com/788616/ostermalms-temporary-market-hall-tengbom?ad_medium=gallery
- 6.8: Boegly, L. (2017). Alstom Warehouses, Nantes Métropole Higher School of Fine Arts. https://www.archdaily.com/915442/alstom-warehouses-nantes-metropole-higher-school-of-fine-arts-franklin-azzi-architecture
- 6.9: RIDC. (n.d.). Mill 29. https://ridc.org/park/mill-19/
- 6.10: Ross, T. (2023). Apartment block by Austin Maynard Architects. https://www.dezeen.com/2023/12/29/bright-yellow-balconies-enliven-melbourne-apartment-block-by-austin-maynard-architects/
- 6.11: Lindman, A. E. (n.d.). An apartment complex in Uppsala. https://belatchew.com/en/projekt/fjarilen/
- 6.12: Google. (2025). Satellite image of Groenoord. Google Maps.

- 7.1: Created by author

- 8.1: Created by author

Appendix

Appendix 1 - Historical analysis

1890 - Residential and manufacturing mixed on a fine grain

1920 - Expansion to the river with the development of a new harbour

1940 - New harbours get developed as production shifts more towards the river

1960 - Development of the industrial estate Spaanse Polder

2025 - Manufacturing and residential are almost completely separated

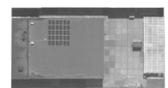# Appendix 2 - Design testing footprint

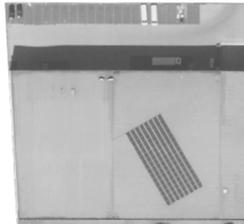~6.000m²

250m²	400m²	600m²	800m²	900m²	1.200m²

1.300m²	2.000m²	3.600m²	4.700m²

5.000m²	6.200m²	8.000m²

10.000m²	17.500m²
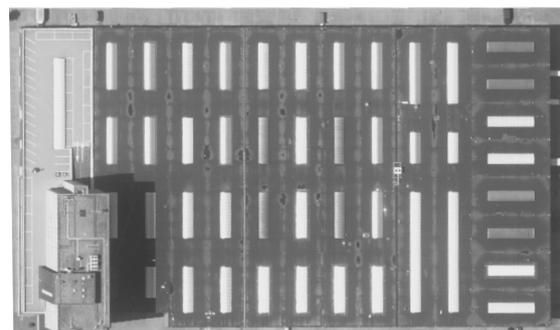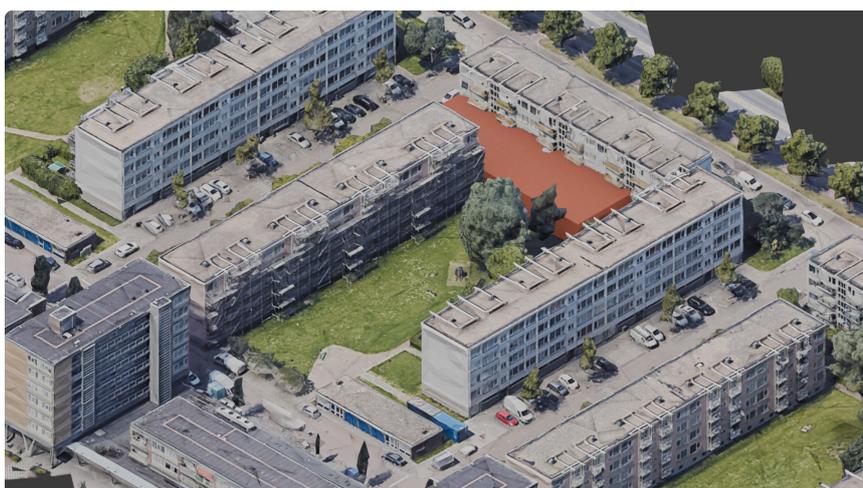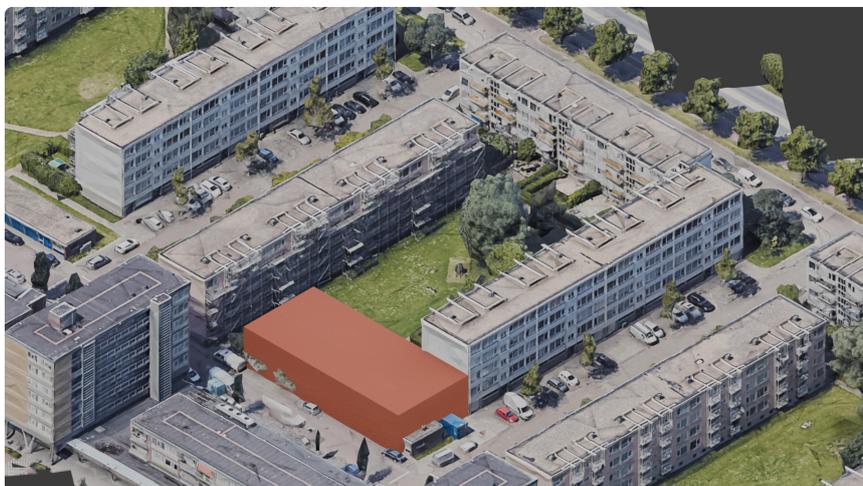
Appendix 4 - Nolensbuurt analysis

Typologies in Nolensbuurt
- Half-closed
- Stroken
- Open
- Comb
- Ensemble
- Wall

0m   100m   200m

Connection with street
Little to none

0m   100m   200m

Colijnstraat (Service alley)

| 1,5 m. | 2 m. | 5,5 m. | 2 m. | 3 m. |
| Pedestrian path | Parking | Carriageway | Parking | Pedestrian path |

0m   5m   10m
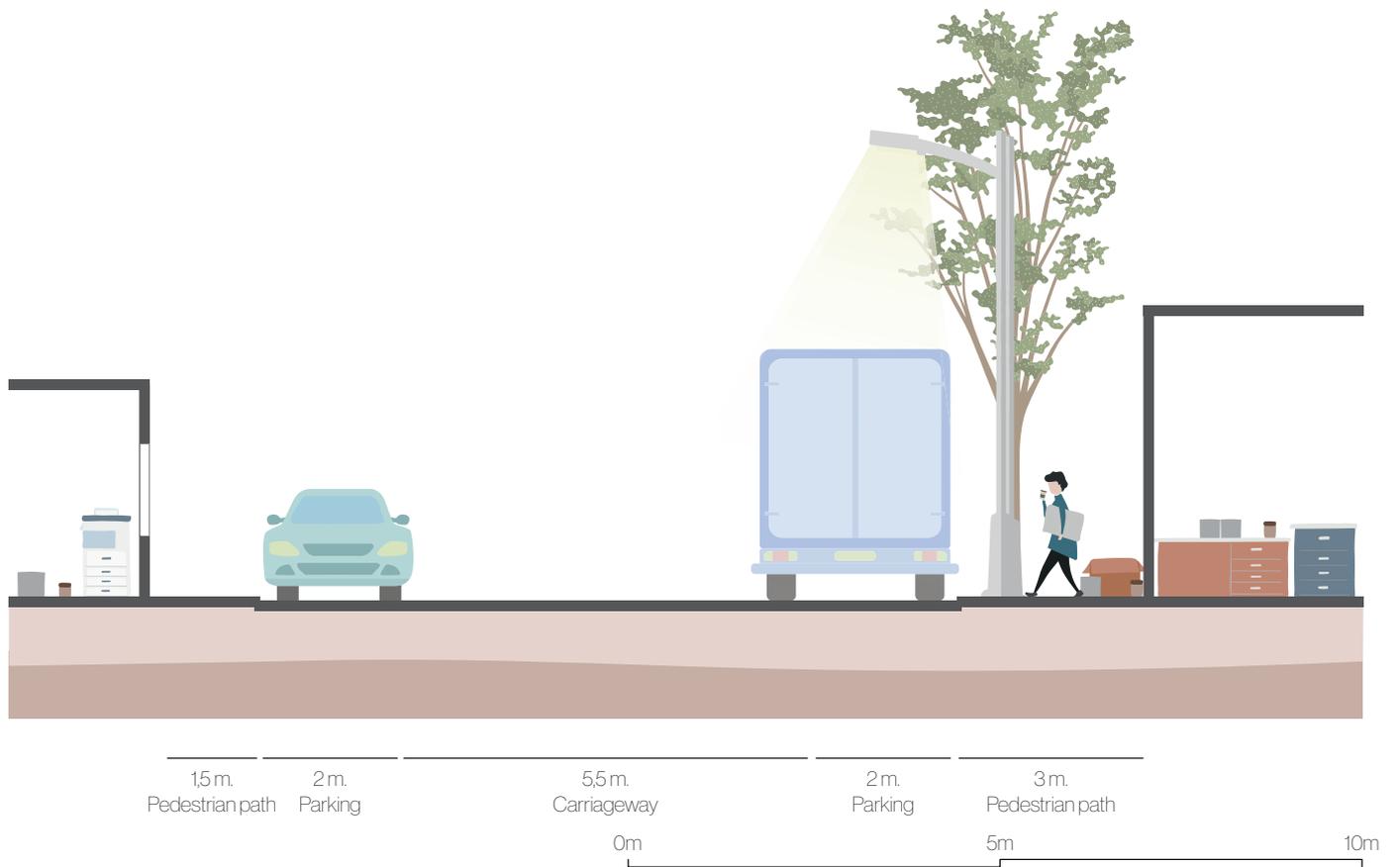
Nieuwe Damlaan (Traffic artery)

2 m.	2 m.	2 m.	4 m.
Pedestrian path	Bike lane	Parking	Car lane

0m   5m   10m

4 m.
Car lane

2 m.
Parking

3 m.
Bike lane

2 m.
Pedestrian path

Monseigneur Nolenslaan (Shopping street)

6 m.
Pedestrian path

3 m.
Bike lane

0m   5m   10m

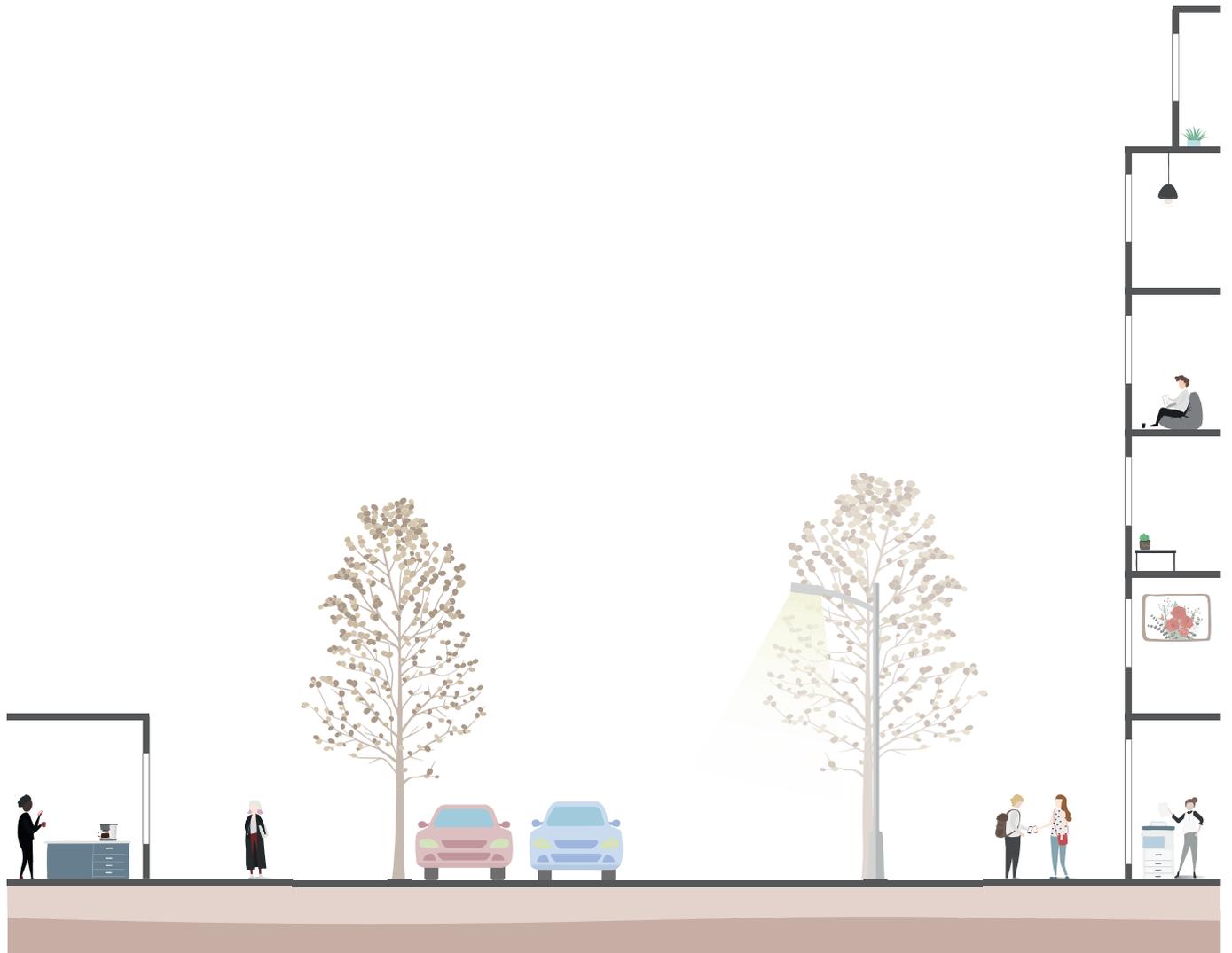| 5 m. | 5,5 m. | 2 m. | 1,5 m. |
| Parking | Carriageway | Parking | Pedestrian path |

Parkweg (Local artery)

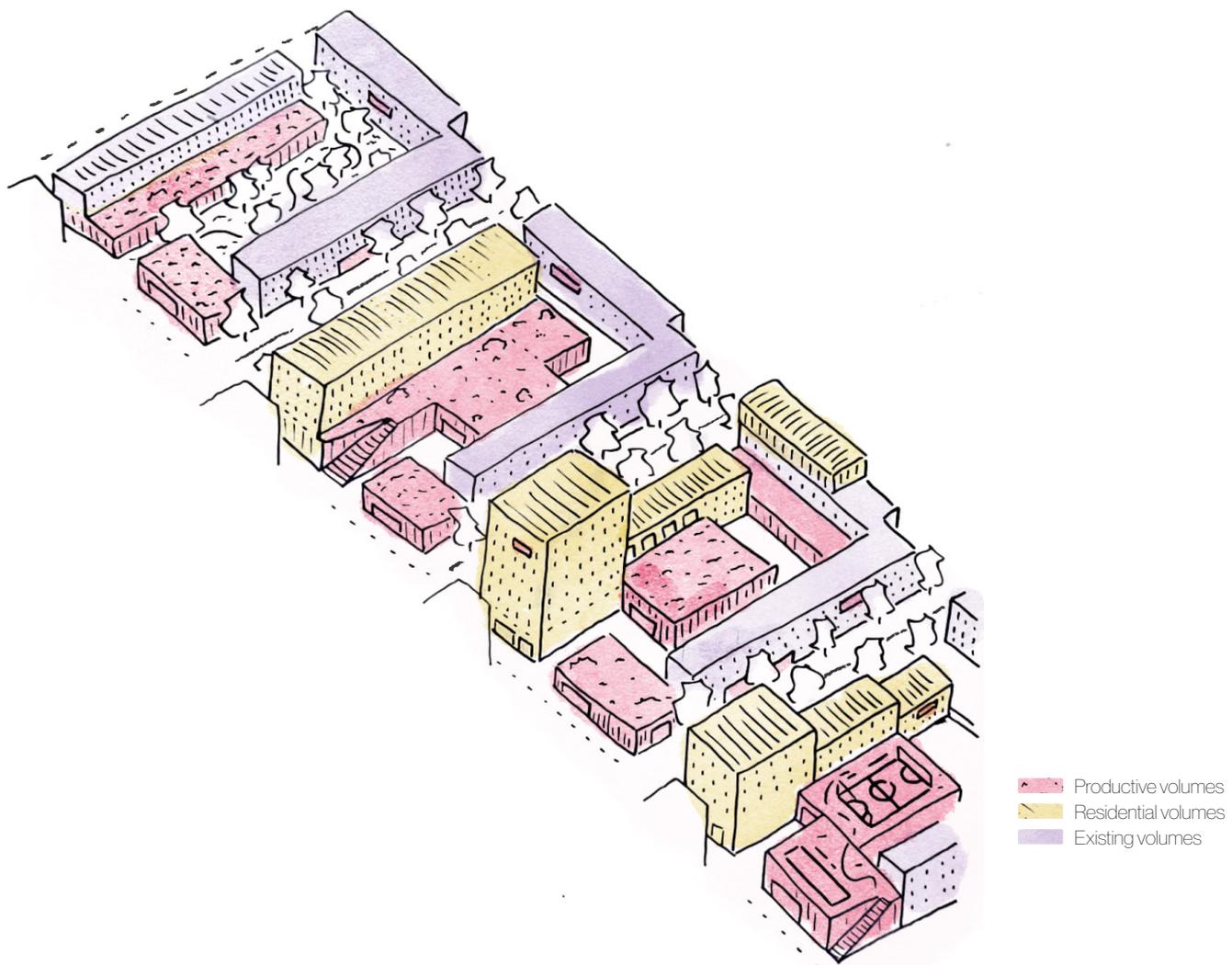| 3 m. Pedestrian path | 2 m. Bike lane | 2 m. Parking | 5,5 m. Carriageway | 2 m. Parking | 2 m. Bike lane | 3 m. Pedestrian path |

Albardastraat (Residential street)

1,8 m.	5 m.	5,5 m.	5 m.	1,8 m.
Pedestrian path	Parking	Carriageway	Parking	Pedestrian path

0m   5m   10m
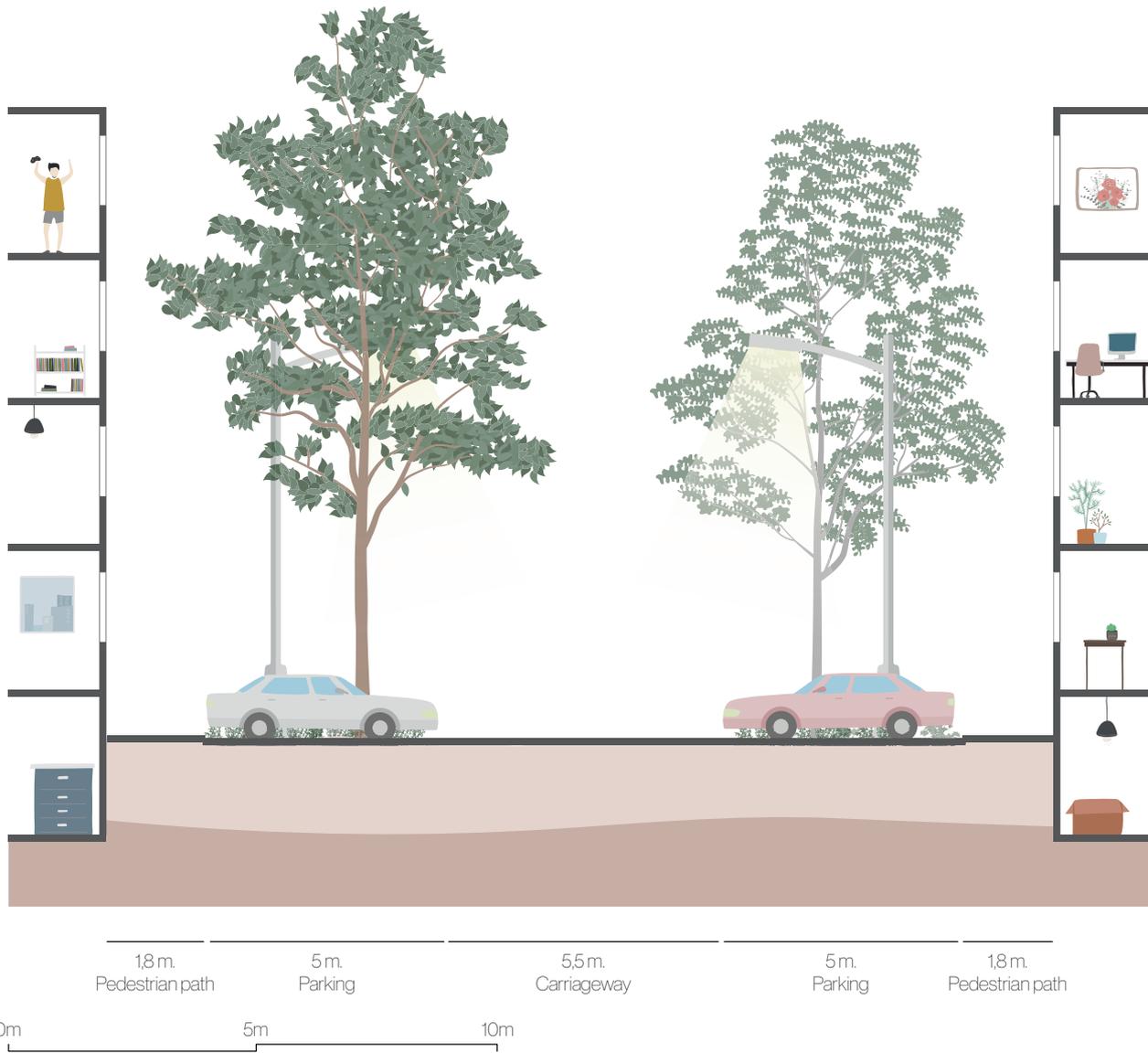
Appendix 5 - Volumes of the design

Productive volumes
Residential volumes
Existing volumes

This thesis advocates a broader application of mixed-use development in urban areas by integrating manufacturing functions. Integrating such functions into existing neighbourhoods often presents challenges, as manufacturing can appear to conflict with residential uses. The research therefore focuses on addressing the specific challenges of introducing urban manufacturing into postwar neighbourhoods and proposes solutions through a pattern language that supports integration while maintaining or enhancing spatial quality and liveability, which is tested through a design for the Nolensbuurt, Schiedam.