Transforming The Garden City

AR3AH105 Graduation Studio
Resourceful Housing, Adapting 20th Century Heritage

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Contents

Abstract

This research explores methods to revitalise deteriorating Dutch mass housing neighbourhoods, with a primary focus on Amsterdam Nieuw-West. Despite the Netherlands' rich public housing tradition, the country is now experiencing a major housing shortage, while at the same time post-war public housing flats are being demolished at an alarming rate. Even though the social, cultural and material values of this heritage are widely recognised, demolition and new construction remains the de facto method for urban renewal in this context.

This research aims to bridge this gap between theory and practice by studying the challenges of renewal and renovation in this context. While prior works extensively covered Nieuw-West's renewal, this research uniquely integrates heritage with social and ecological sustainability considerations. It finds that the desire for demolition is driven by a complex interplay between, on one hand, the effects of spatial segregation and associated social problems and, on the other hand, a specific combination of physical attributes that amplify those problems while making addressing them difficult. Some of these attributes include undersized dwellings, poor accessibility, a lack of connection with the public space and the frequent use of inflexible construction systems.

It concludes that, to proliferate the practice of conservation, transformations need to satisfy the desire for more ambitious densification and dwelling diversification. Such projects need to reconnect the buildings and their inhabitants with their surroundings and find ways meet the needs of a new demographic that has taken root in this area. To overcome the negative stigma and make post war multifamily housing a desirable typology, interventions should aim beyond adequacy and take advantage of the potential of the existing structures to be transformed into generous and high-quality dwellings.

Glossary

Ecological Ceiling
The ecological ceiling is based on the the Planetary Boundaries framework (Rockström et al., 2009), an attempt at defining and measuring the limits and boundaries of the Earth's ecosystems and natural resources. It represents the maximum levels of human activities that can be sustained without a high risk of triggering significant ecological degradation or exceeding the planet's capacity to regenerate (Hill-Hansen & Jensen, 2023).

Gentrification
Gentrification is a form of urban renewal whereby traditionally low-income neighbourhoods are gradually transformed through the development of new more expensive housing, resulting in the displacement and exclusion of low-income households. Gentrification takes different forms depending on the context: van Gent (2013) shows how it has developed in Amsterdam and its exclusionary effects were demonstrated by (Hochstenbach & Musterd, 2021).

Heritage
"The resources inherited from the past that communities wish to pass on to future generations. It is an ecosystem that includes tangible and intangible dimensions resulting from the interaction between nature, fabric, and people through time." (Gonçalves et al., 2021)

Heritage Environment
"Heritage environment concerns the irreplaceable and non-renewable resources that form the overall urban ecosystem, with natural, tangible and intangible elements. It is an economic asset, knowledge capital and it ensures a better quality of life for present and future generations" (Gonçalves et al., 2021)

Planetary Boundaries
The planetary Boundaries framework (Rockström et al., 2009) defines nine planetary systems within which humanity must stay within to ensure a stable earth system. When planetary boundaries are exceeded, there is an increased risk of large scale, abrupt or irreversible environmental changes. As of 2023 six of the nine boundaries have been crossed.

Social Foundation
The social foundation is based on the social and economic SDG's proposed by the UN, defining the minimum set of social standards and conditions that are considered necessary for human well-being and a dignified life. The social foundation provides the basis for ensuring social equity and distributive economic development (Hill-Hansen & Jensen, 2023).

Sustainability
"The state of equilibrium in which the components of the ecosystem comprised by nature, humans and built environment, and its functions are maintained for present and future generations." (Gonçalves et al., 2021)

Sustainable Conservation
"The processes of management of change of the ecosystem inherited from the past, so its resources can benefit present generations while retaining its value for future generations." (Gonçalves et al., 2021)

The Right to Housing
Defined by the UN Human Rights Committee (1991) as the right to adequate shelter which includes: security of tenure, availability of services and infrastructure, affordability, habitability, accessibility, location and cultural adequacy.

Urban Renewal
Urban renewal refers to the process of redeveloping urban areas which have become disused or have fallen into decay. This can involve replacing ageing buildings, intensifying the land use through densification, or redesigning the public space. Urban renewal is often seen as being at odds with heritage preservation.

Introduction

The Netherlands has a strong public housing tradition spanning for over one hundred years. Schemes like the western garden cities in Amsterdam are internationally celebrated and have been studied extensively by planners, architects, and urban geographers alike. Today however, 122 years after the first public housing act was signed, the Netherlands is facing a severe housing shortage. At the same time social housing estates, in particular flats from the early post war decades, are being demolished at an alarming rate: in 2010 one out of every 100 social housing flats was being demolished (Wassenberg, 2011). The reasons for this are complex but can be attributed primarily to the poor condition and worsening reputation of mass housing in the Netherlands. Areas like the Bijlmer and Nieuw-West have become synonymous with ghettoisation, crime, and social decay. To combat this, these neighbourhoods became the focus of intense urban renewal efforts, which often involve extensive demolition and new construction.

In the Bijlmer this process has largely concluded, and 7000 of the original 13000 dwellings of the iconic hexagonal flats have already been demolished and replaced with more popular housing types, while much of the public green space was replaced with private gardens and street level parking (Wassenberg, 2011). The renewal in Nieuw-West was planned to be even larger at 13.300 dwellings demolished by 2015 (Gemeente Amsterdam, 2001), but due to the 2008 financial crisis and the increased recognition of the heritage significance of the area those numbers were never realised (Havinga et al., 2020). Instead, as of 2021 around 5000 dwellings have demolished, but the renewal is still ongoing (Hoog

Figure 1.1, artistic representation of problem statement. digital collage by author.


STOP GENTRIFICATIE
BETAALBARE
WONINGEN VOOR
GENTRIFICATIE IS RACISME
STOP GENTRIFICATIE
BETAALBARE
WONINGEN VOOR
JONGEREN UIT
NIEUW-WEST
FATSOEN BOVEN POEN
NIEUW-WEST
TEGEN
GENTRIFICATIE

& Wit, 2022). One of the main goals of this approach is social mixing: it is believed that a diversification of tenure and dwelling types would result in a better mix of ethnic and economic backgrounds. While a greater social mix has been achieved (Hoog & Wit, 2022), there is little concrete evidence that these policies have been effective in solving the perceived social problems (Bolt et al., 2010; Bond et al., 2011).

As a result, there are mounting questions around the effectiveness of the current approach to renewal as it drives urban inequality, results in unnecessary material waste, and erases the unique identity and history of our public housing neighbourhoods.

Urban inequality

In the 90s, social housing increasingly started to be seen as problematic, it became associated with poverty concentrations and social disorder. to combat this, the government encouraged the construction of owner-occupied and private rented housing to promote socio economic diversification (Musterd & Ostendorf, 2008), a process which became known as state-led gentrification (van Gent, 2013). At the same time the housing corporations, who own most of the housing stock in Nieuw-West, were privatised. As such, they became dependant on market activities, such as selling off or their existing stock, converting social-housing to private rent, and building owner occupied housing, to generate the income needed to build new social housing (Teernstra & Pinkster, 2016). The shift to market lead development has been associated with the displacement and exclusion of low-income households to the suburbs around the city (Hochstenbach & Musterd, 2021). Nieuw-West has also seen a significant decrease in ratio of social housing units, from 76% in 2000, to 53% in 2016 (Nio et al., 2016), while remaining tenants are increasingly and disproportionately affected by energy poverty compared to homeowners (Mulder et al., 2022).

Material waste

Construction and demolition waste (CDW) is responsible for over a third of all waste generated in the EU (Bilsen et al., 2018), and the Duch building sectors material use is responsible 11% of total carbon emissions

(Hekma, 2021). The Netherlands has one of the highest per capita CDW generation rates in the EU, at 1390 kg per person in 2014 (Villoria Sáez & Osmani, 2019). It does however, also have the highest material recovery rate of all EU countries, with only 1% of mineral CDW ending up in landfill (Villoria Sáez & Osmani, 2019). Unfortunately, most of this re-use is in the form of down-cycling, and the use of secondary materials for housing and utility buildings in particular was only 7% in 2014 (Arnoldussen, 2022). The national housing construction goal of 100.000 dwellings per year, and commitments to the Paris agreement are incompatible with the current approach. If the Dutch construction industry continues businesses as usual, it will exceed its carbon budget for a 1,5-degree warming scenario by 2027 (Bosch et al., 2023). Areas like Nieuw-West, where much of the material demand is used to replace existing dwellings, rather than adding to the total supply, hold significant potential for building and material re-use.

Loss of identity

Despite a complex and extensive system of heritage listings, most buildings outside the historic canal belt have very little concrete legal protections, and demolition and new construction remains the de facto method for urban renewal. (Gonçalves, 2023) found that one of the reasons practitioners generally prefer demolition, is because there is an emphasis of economic criteria in decision-making, while less tangible values, like inhabitants' health, maintenance costs, the environmental impact of the intervention, and heritage value are often under-represented in the decision-making process. Floor Milowski argues that in Amsterdam specifically, the economic function has taken precedence over the social cultural function, and that this is leading to a loss of the diversity and the unique identities of districts, causing the city to become increasingly homogenised (Milowski, 2022).

Literature Review

There has been an ongoing effort among Amsterdam policymakers to better protect and retain the value of existing urban areas. For example, by integrating (intangible) heritage values into sustainable development goals (Gemeente Amsterdam). These ideas are elaborated in the 'CGO (circular area development) framework' (Gemeente Amsterdam, 2019), based on the Doughnut Economics Model (Raworth, 2017). The CGO framework proposes a systematic approach to circular development which starts with the identification of existing forms of value, both tangible and intangible (Gemeente Amsterdam, 2019). While some existing values are proposed, concrete indicators to measure these values are yet to be defined.

In academia the integration of heritage and sustainability has been a topic of investigation for some time (Appendino, 2018; Berthold et al., 2015; Guzmán et al., 2017; Landorf, 2011; Norrström, 2013; Zamperini & Cinieri, 2013, 2017). However, these tend to focus on only one of the dimensions of sustainability, social, economic, or environmental, at a time. Comprehensive frameworks integrating heritage across all three dimensions have been proposed (Gonçalves, 2023; Pereira Roders, 2007), but there remains a gap in the transfer of knowledge to professional practice (Gonçalves, 2023).

This research attempts to bridge this gap between theory and practice by exploring the potential application of sustainable conservation methods to rehabilitate decaying Dutch mass housing neighbourhoods, with a particular focus on the post-war housing in Nieuw-West.

The research into renewal in Nieuw-West is substantial and extensive mapping of socio-spatial changes at various scale levels has been done in the past (Hoog & Wit, 2022; Nio et al., 2009, 2016). However, the link between heritage and sustainability was not a focus in these works.

Therefore, the unique contribution of this research comes mainly from the way it maps the impact of urban renewal across both social and environmental dimensions. It compares the impact and effectiveness of different approaches to renewal and uses these findings to ultimately propose a novel intervention, demonstrating the potential of heritage conservation for achieving socially and environmentally sustainable urbanisation.

Research Questions

The main research question of this thesis is:

How can the post-war public housing heritage of Amsterdam Niew-West support sustainable urbanisation towards a social foundation while remaining within our planetary boundaries?

The main question is broken down into sub-questions, and the research will consist of several phases.

Part I: What has been the effect of urban renewal on, the social foundation and ecological ceiling at the neighbourhood level, and what has the role of heritage been in this process?

By studying the renewal interventions and their impacts on social, ecological and heritage domains this question aims, firstly, to understand the impact and effectiveness of the chosen renewal strategies and, more importantly, to get a deeper understanding of the need that these interventions are trying to address.

Part II: How do different renewal strategies at the building level perform across these three dimensions, and what does this reveal about the challenges of re-using postwar flats?

While retrofitting of post-war housing is becoming more common, these projects still only represent a small minority of the renewal interventions in Nieuw-West. As discussed in the introduction, multifamily housing from the post war period much more likely to be demolished than other building types. Analysing a selection of case studies will give a picture the most common intervention

strategies and the problems they are trying to address.

Part III: How can we overcome the main barriers to reuse of post war multifamily housing and demonstrate the potential of heritage conservation for socially and environmentally sustainable urbanisation?

This question is partially answered by synthesising and contrasting the first two parts of the research with information from the literature and statements of consulted experts. However, this step remains in the realm of theory. The research makes another step towards practical implementation through a design exercise for a model case intervention to a typical building.

Methodology

Figure 2.1, doughnut of social foundation and planetary boundaries (Raworth 2017) adapted from (Hill-Hansen & Jensen, 2023).

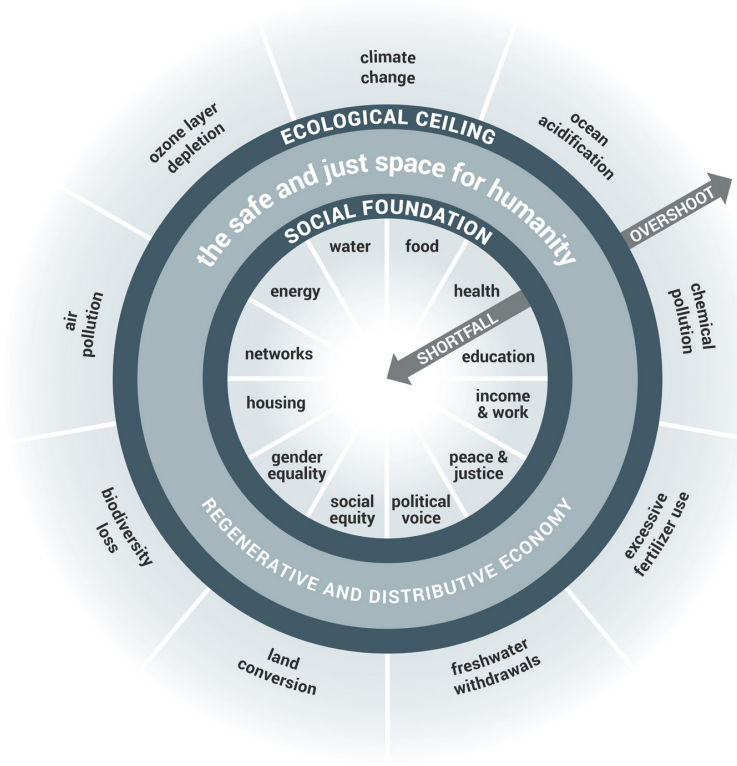
Figure 2.2, uniting the concepts of heritage and environment in three layers: intangible, tangible and natural (Gonçalves et al., 2022).

Theoretical Framework

The terms heritage and sustainability can mean many different things to different people. Their definitions have changed over time, and new perspectives and definitions are formulated continuously. Therefore, it is useful to specify exactly which definitions are being used for this research, for this reason a glossary is included at the start of this thesis. However, it is also important to explain which frameworks these definitions are based on and why those were chosen specifically.

In the context of sustainable urbanisation, the relationship between social and environmental sustainability is of particular interest to this research. This relationship is best explained by the 'Doughnut Economics' framework for sustainable development (Raworth, 2017), which proposes that a 'safe and just space for humanity' that exist between an 'ecological ceiling' and a 'social foundation'. This model proposes to measure the performance of an economy not in terms of GDP growth, but by the extent to which it meets the needs of people, without overshooting the earths ecological carrying capacity. This model has been adopted for use in urban planning policy by the municipality of Amsterdam in the 'Environmental Vision 2050' (Gemeente Amsterdam, 2021). Others have proposed specific indicators for its use in urban development (Hill-Hansen & Jensen, 2023).

To define heritage and its relationship to sustainability the heritage values framework (Pereira Roders, 2007), and the concept of the 'heritage environment' are used. The heritage environment includes "the irreplaceable and non-renewable resources that form the overall urban ecosystem, with natural, tangible and intangible elements" (Gonçalves et al., 2021).


climate change
ocean acidification
chemical pollution
excessive fertilizer use
freshwater withdrawals
land conversion
biodiversity loss
air pollution
ozone layer depletion
ECOLOGICAL CEILING
the safe and just space for humanity
SOCIAL FOUNDATION
OVERSHOOT
SHORTFALL
REGENERATIVE AND DISTRIBUTIVE ECONOMY
water
food
health
education
income & work
peace & justice
political voice
social equity
gender equality
housing
networks
energy


rural
surroundings
infrastructure
land
fauna
traditions
buildings
skills
meanings
setting
air
aspirations
ambitions
spirit
landscape
place
knowledge
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resources
communities
urban
area
man-made
needs
nature
fabric
monuments
resource
sites
flora

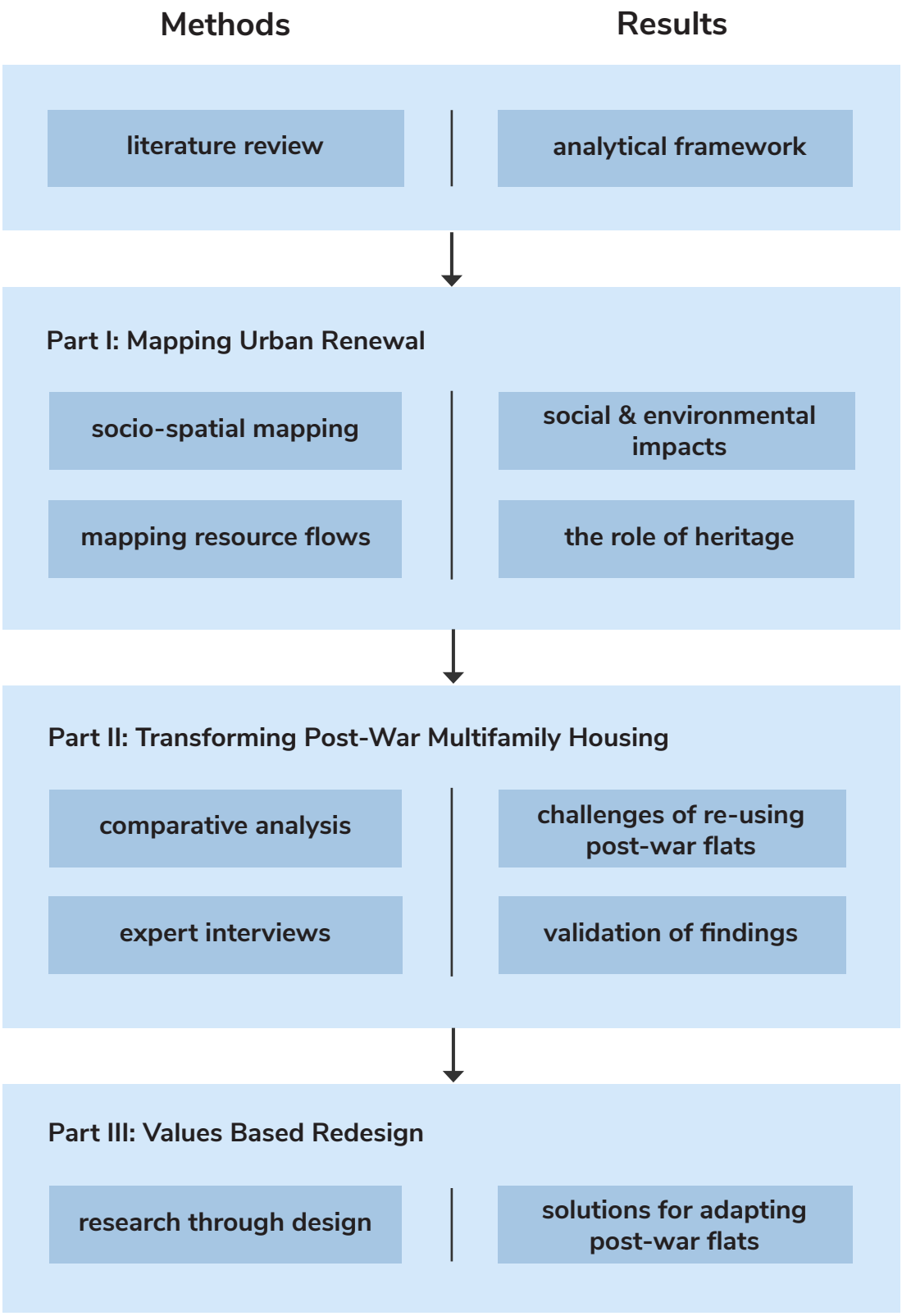

Methods
Results
literature review
analytical framework
Part I: Mapping Urban Renewal
socio-spatial mapping
social & environmental impacts
mapping resource flows
the role of heritage
Part II: Transforming Post-War Multifamily Housing
comparative analysis
challenges of re-using post-war flats
expert interviews
validation of findings
Part III: Values Based Redesign
research through design
solutions for adapting post-war flats

Figure 2.3, diagram showing research phases, methodos and results

Methods and Sources

This research uses a mixed methods approach. To provide a framework for the analysis of the case studies, a literature review of existing sustainable development and heritage frameworks is done to define a set of indicators to measure tangible and intangible values in the heritage environment that is relevant to the context and scale level of the case studies. For this it draws primarily from sustainable heritage indicators developed by (Gonçalves et al., 2022) and circular development indicators by (Hill-Hansen & Jensen, 2023). The creation of the analytical framework is explained in more detail in the next chapter.

In the first phase, to better understand the relationship between the social and environmental impact of urban renewal, the socio-spatial changes and associated resource flows in a case study area are be mapped at a neighbourhood level. This scale was chosen because it is small enough to study physical changes to the environment in detail, but large enough to compare these changes against publicly available social indicators. This is done using statistical data from Amsterdam's O&S (research and statistics) department, maps and plans from the city archive, and GIS data from the cities open data platform.

In the second phase, to compare the impact of specific intervention strategies at the building level, a selection of case studies from Nieuw-West representing various approaches to renewal are analysed using the previously defined indicators. Plans and other data about individual projects is collected from gebouwdin.amsterdam.nl and websites of housing corporations and responsible architects. To validate findings from the first to phases they are compared against the literature and discussed in informal interviews with experts.

In the third phase the findings and conclusions from the first two phases will be used to redesign a residential building in the case study neighbourhood, by leveraging the values and resources from the heritage environment.

Relevance

Relevance to the studio: The topic of the studio is 20th century heritage and resourceful housing. This research is interested in how neighbourhoods change and aims to understand how both tangible and intangible resources are used or disused, and will try to relate this to heritage values, and social and environmental impacts.

Social relevance: Nieuw-West contains many dwellings that are in dire need of upgrading, and there is an overall need for densification. This research will contribute to a better understanding of how this challenge can be approached in a more sustainable way, and could help implement some of the ambitious circularity goals of the 2050 environmental vision and establish a clearer relationship between sustainable development and heritage preservation.

Analytical Framework

Figure 2.4, selection of sustainable heritage values and indicators at the neighbourhood and bulding scale and the frameworks they draw upon.

The theoretical framework provides a set of values by which to measure the impact of urban renewal interventions. 'Doughnut for Urban Development' (Hill-Hansen & Jensen, 2023) and 'Building Passport for Sustainable Conservation' (Gonçalves, 2023), propose specific indicators based on the Doughnut Economics and Sustainable Heritage frameworks respectively. For this research, it is not possible to adopt these indicators directly. The Doughnut framework is very broad and covers issues beyond the scope of this research. The Building Passport is focused on analysing the sustainability potential of a building before an intervention, rather than the impact of an intervention. While these frameworks are not an exact fit, many of the indicators are still useful and can be adopted to the specific context and purpose of this research. This selection is made based on several factors:

Relevance to the scale level of the analysis and the type of intervention. The Doughnut model contains indicators which fall outside the impact area of the interventions that are being assessed, and as such will be excluded.

Availability of data, due to the broad scope of the research time for primary data collection is limited, so it is necessary to rely on publicly available data, which will inform the choice of indicators.

Specificity, certain indicators are quite general and therefore need to be supplemented with more location and context specific ones.

One such case are the heritage values from the building

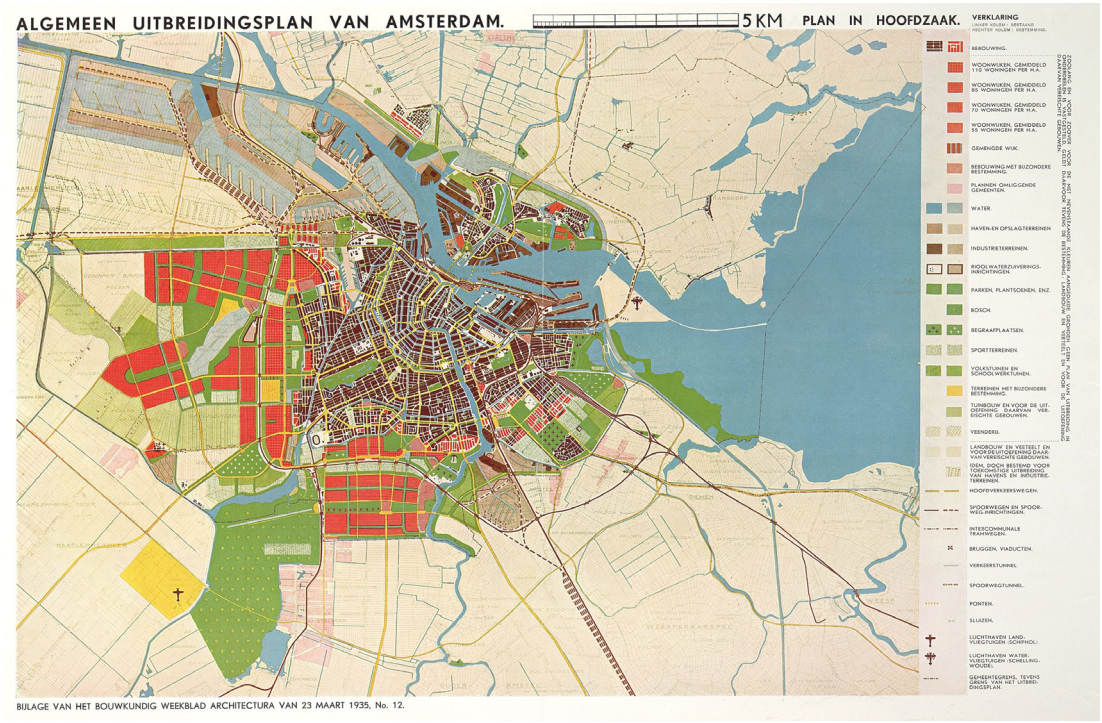
		value	indicator	source / framework: doughnut for urban development (Hill-Hansen & Jensen, 2023)	building passport for sustainable conservation (Gonçalves, 2023)	context specific attributes (Havinga et al. 2020)	right to adequate housing' dimensions (UN, 1991)	Shearing Layers (Brand, 1994)
neighbourhood scale	heritage values	urban scale	parcellation					
			greenspace					
			building typologies					
			ground floor function					
			building height					
	social values	affordable housing	% social housing					
			number of social housing					
			number of dwellings					
		habitable housing	m2 average floorspace per person					
			% overcrowding					
		accesibible housing	% accessible units (GF or lift)					
			% 0 stairs housing					
			% senior housing					
		citizen participation	Y/N citizens influenced decisions about urban renewal					
			neighbourhood activities / 1000 inhabitants					
		social cohesion	% vunerable people					
			SES score					
		diversity & equality	migration backgrounds					
			gini coefficient					
	ecological values	re-use	number of original dwelilngs					
			m2 original floorspace					
			tonnes of original material					
			tonnes of original embodied carbon					
		energy efficiency	% energy label B or higher					
building scale	heritage values	ensemble scale	parcellation					
			greenspace					
			building height					
		buildings scale	groundfloor fuction, closedness					
			façade: balconies					
			façade: external insulation					
			window: fenestration					
			window: pvc frames					
			interior: plan					
	social values	affordable housing	ownership and tenure					
			number of dwellings					
		habitable housing	m2 floorspace					
			thermal comfort					
		accesibible housing	% accessible housing units					
		citizen participation	citizens influenced decisions about urban renewal					
	ecological values	re-use	skin					
			structure					
			services					
		energy efficiency	improvement of energy labels					

passport, these are supplemented and measured using the most significant attributes from 'Heritage attributes of post-war housing in Amsterdam' (Havinga et al., 2020). This research conducted a significance assessment using expect interviews to determine significant attributes of post war housing at the scale of the building and the ensemble. The other value that was expanded on is housing, using values from the 'right to adequate housing' declaration (UN, 1991) including security of tenure, affordability, habitability and accessibility. The results of this selection are two sets of indicators, one for the building scale and one for the neighbourhood scale. The indicators are divided into three categories: heritage values, social values and ecological values.

Part I:
Mapping The Effects of Urban Renewal

In this chapter the results and conclusion from the research at the neighbourhood scale are presented. The Kolenkitbuurt was chosen as a case study of urban renewal in Nieuw-West as it has been a focus of the efforts aimed at improving socio economic conditions and 'livability' and in many ways it is representative of the issues and challenges facing Nieuw-West as a whole. It was built right after the Second World War as part of the general expansion plan made by Cornelis van Eesteren, according to the garden city principles proposed by Ebenezer Howard. It consisted of rows of 4-story tenement blocks with mainly social rental apartments of under 60m2, many of them hosting large immigrant families (Miazzo & Kee, 2014). After 50 years it started to fall into decay, in 2004 it was declared the least popular neighbourhood of Amsterdam and in 2007 it was selected as part of a national program aimed at preventing 'ghettoization' and improving the physical, social and economic conditions (Miazzo & Kee, 2014). Over the next 15 years, large portions of the original neighbourhood were demolished, new owner-occupied housing was constructed, and public spaces were reorganised. Some areas were heavily densified, while others kept with the overall structure. The renewal saw several distinct phases in which variety of approaches were employed, from demolition & new construction to renovation and even reconstruction of existing dwellings. However, despite these extensive renewal efforts, it is not clear whether the conditions in the neighbourhood have significantly improved. This of course raises questions about the effectiveness of these approaches to renewal, particularly the impact on heritage and social and environmental sustainability. This case study will examine this impact to see what has been achieved, and at what cost.

Urban Renewal Case Study: de Kolenkitbuurt

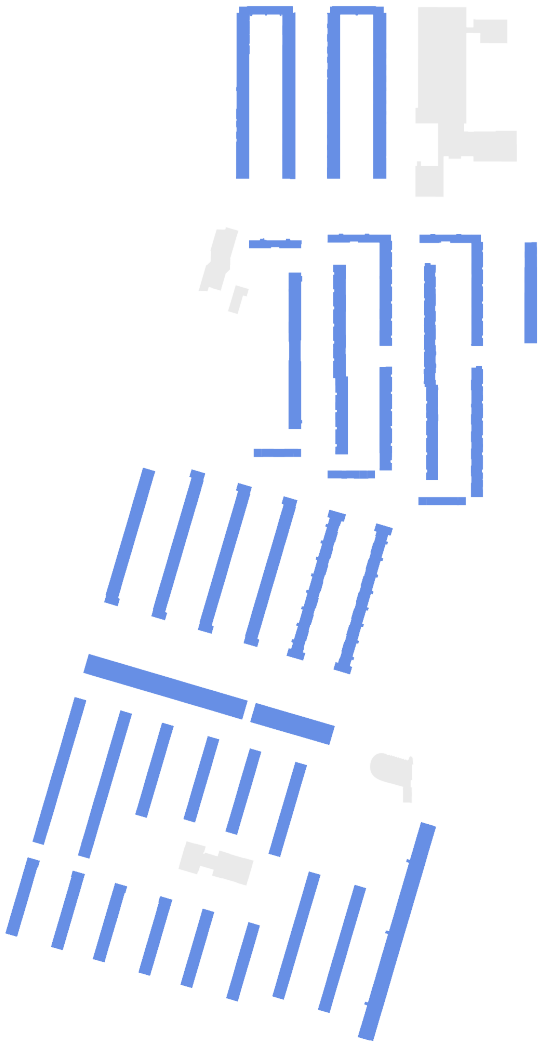


General Expansion Plan for Amsterdam, Cornelis van Eesteren, 1934.

Revised Expansionplan ‘West’ (including Kolenkitbuurt), Stadsarchief Amsterdam, 1936.

Areal photograph of the Kolenkitbuurt, Stadsarchief Amsterdam, June 17th 1983.

Areal photograph of the Kolenkitbuurt, Stadsarchief Amsterdam, Juli 9th 1957.

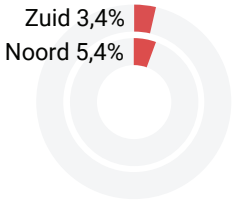


Source Data: Amsterdam Geo-Webservices

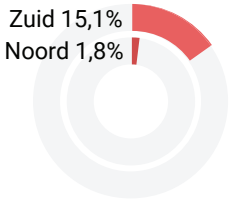
original corporation housing
converted to private rent
converted to owner occupied
new corporationhousing
new private rent
new owner occupied

Neighbourhood Satisfaction Percentile Rank

Neighbourhood satisfaction compared to other neighbourhoods in Amsterdam, higher is better



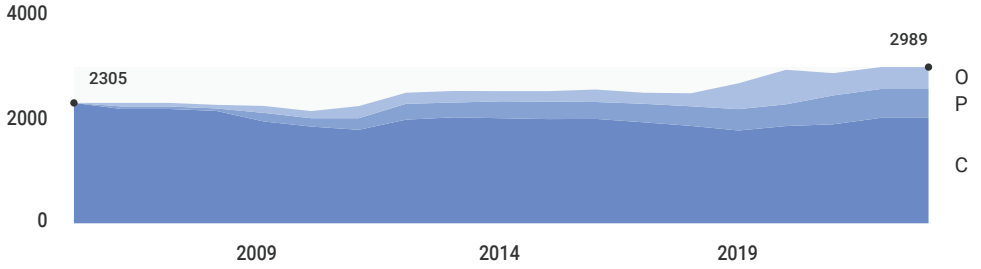
2005



2023

Number of Dwellings by Tenure

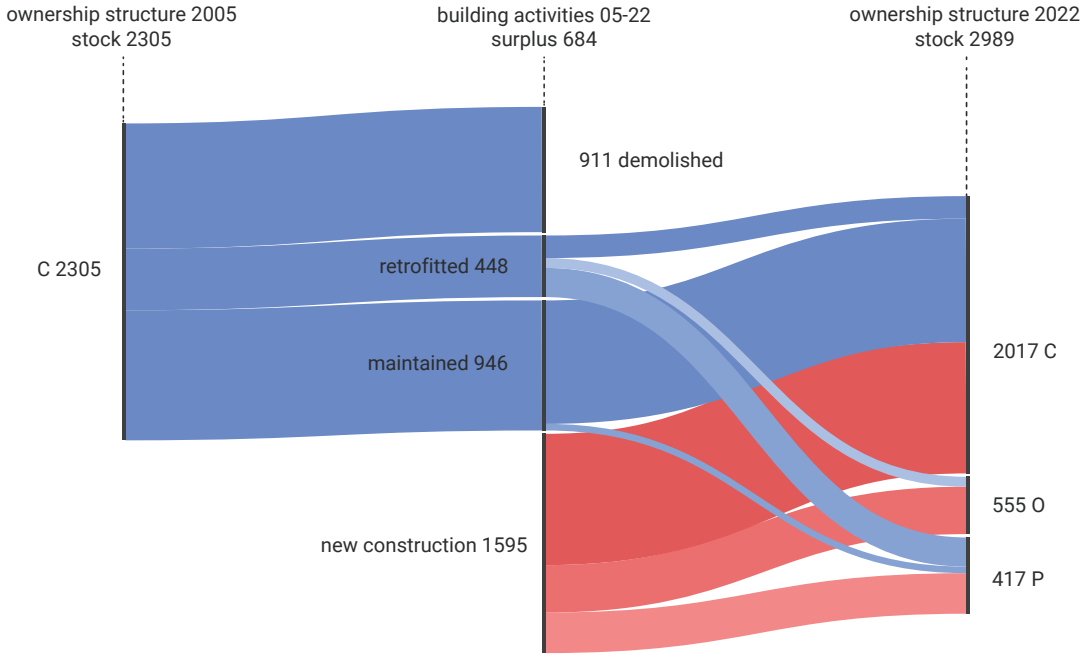
C = corporation housing
O = owner occupied
P = private rental



Renewal and Number of Dwellings by Tenure

This diagram shows the change in the number of dwellings between 2005 and 2022, the type of intervention they underwent, and the changes in tenure

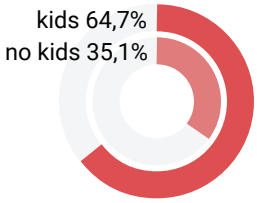
C = corporation housing
O = owner occupied
P = private rental



Source Data: O&S Amsterdam

Percentage of Overcrowded Households

Comparing households with and without children, lower is better. A household is considered overcrowded when there is less than 20 m2 per inhabitant



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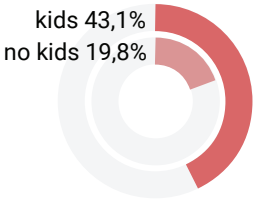
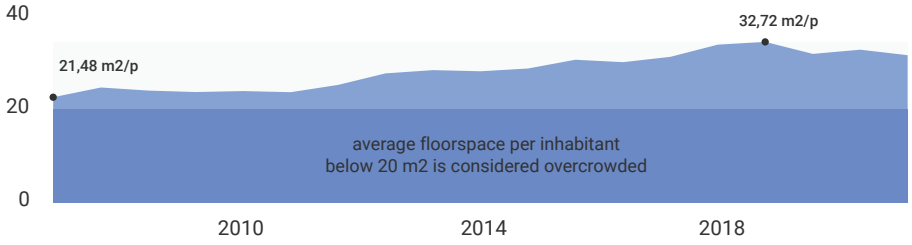


2023

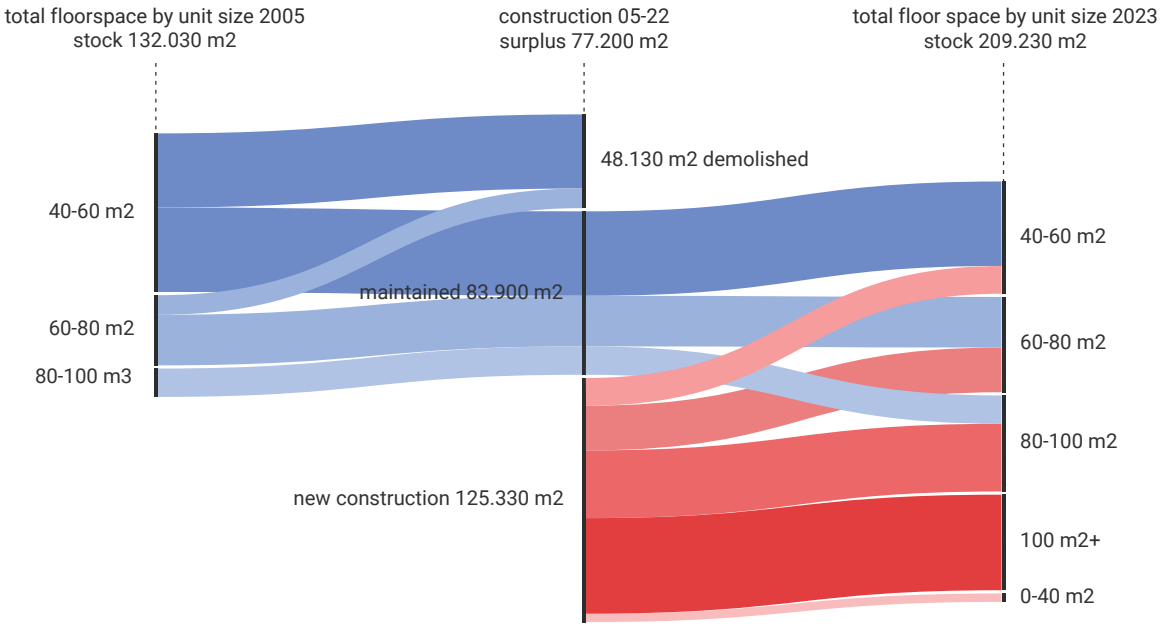
Average Floorspace Per Inhabitant

Graph showing the average floorspace per inhabitant in relation to the 20 m2 per inhabitant threshold

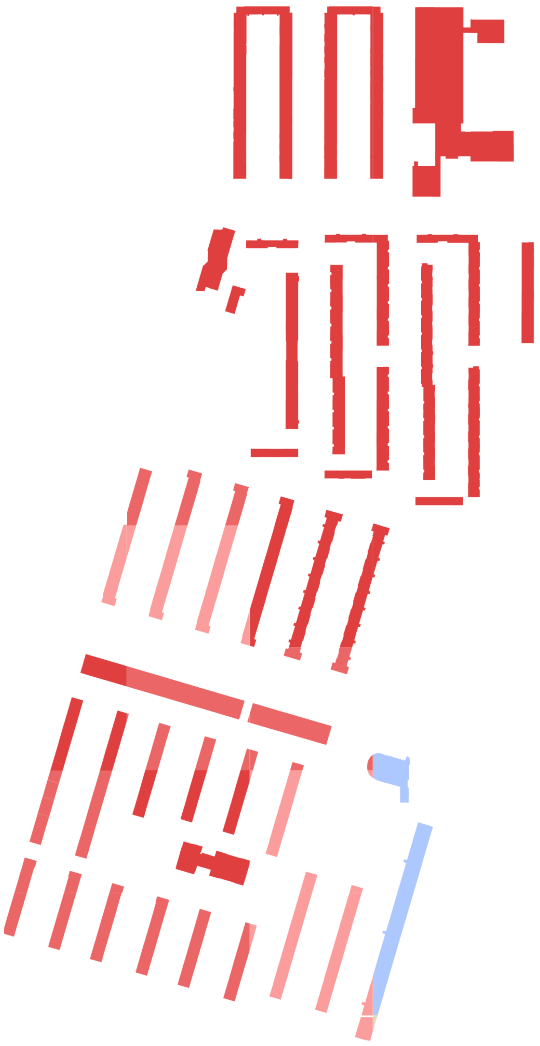


Renewal and Total Floorspace by Dwelling Size

This diagram shows the change in the total amount of floorspace between 2005 and 2022 and how it was changed, divided by dwelling size.



Source Data: O&S Amsterdam



Source Data: Leefbarometer.nl

Very Poor
Poor
Insufficient
Sufficient
Good
Very Good

Energy Label Below B

2022

G
F
E
D
C
B+

Source Data: EP-Online

Percentage of Welfare Clients

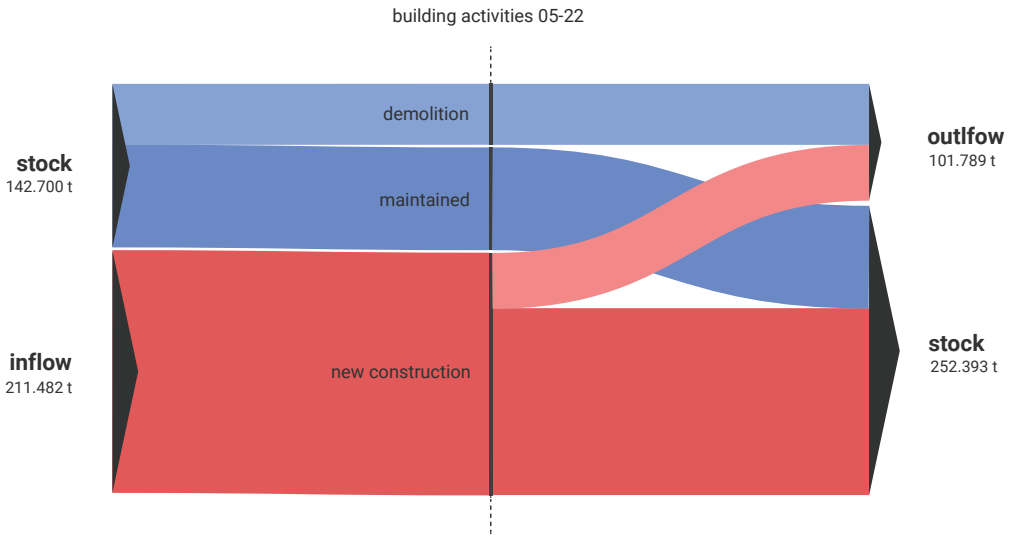
2021

>20%
15-20%
10-15%
5-10%
1-5%
<1%

Source Data: Regiomonitor Amsterdam

Material Flows

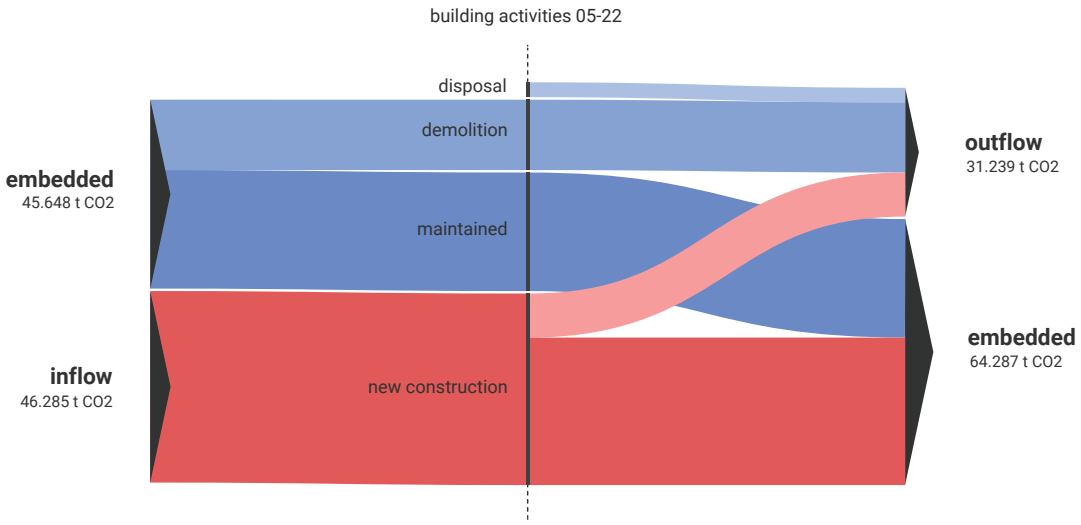
Diagram showing the material flows as a consequence of the renewal between 2005 and 2022, inflow shows the material added during construction, outflow represents the construction and demolition waste, and stock shows the embedded materials.



*Calculation for existing based on modeling of typical building, new construction based on average figures for new construction of a comparable building (Bosch et al. 2023).

Embodied Carbon Flows

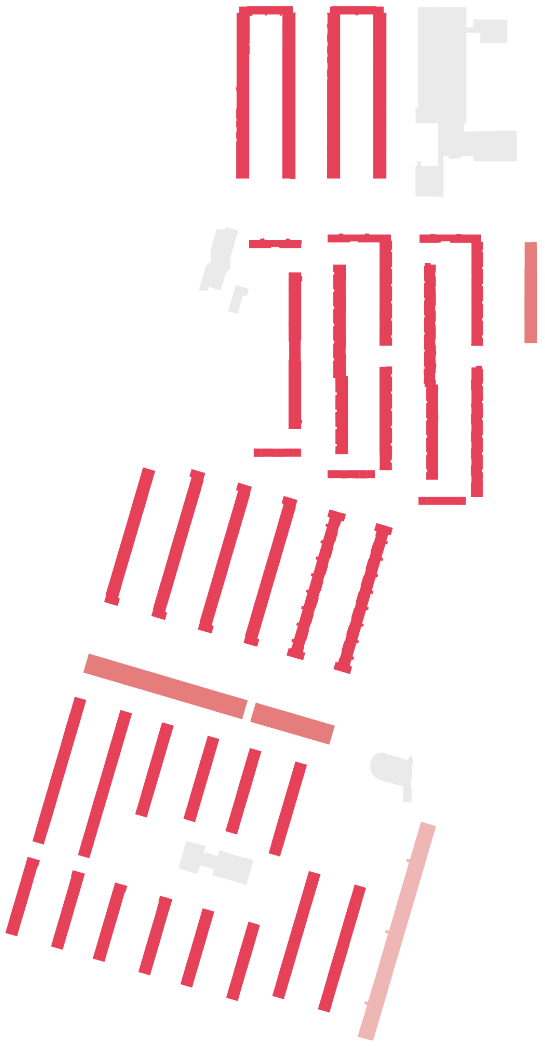
Diagram showing the embodied carbon flows as a consequence of the renewal between 2005 and 2022, inflow shows the additional CO2eq emitted as a consequence of construction, outflow represents the carbon emissions wasted through construction and demolition waste



*Calculation based on generic figures using Granta Edupack data set

Flexibility of Construction

1950-60



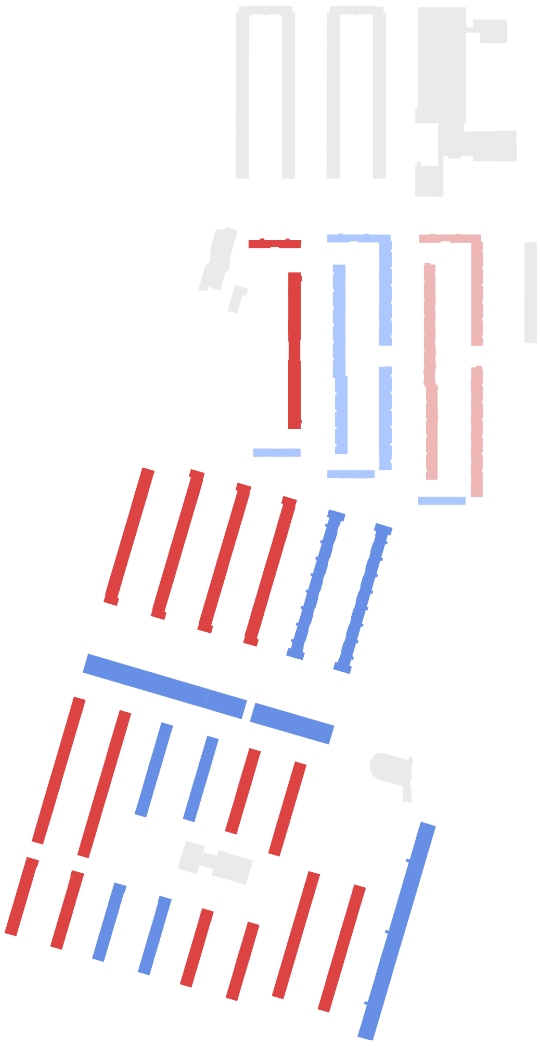
Fixed Plan

Free Plan

Free Facade & Plan

Non Residential

Source Data: Stadsarchief Amsterdam



Demolished
Planned Demolition
Renovated
Planned Renovation
No Data

Source Data: Gemeente Amsterdam

Figure 3.1, Overview of results of analysis at the neighbourhood level showing how indicators changed between 2005 and 2022.

	value	indicator	2005	2022	ratio	illustration
heritage values	urban scale	parcellation (% space used by buildings)	12,2%	20,9%	71,0%	n
		greenspace m2	87213	67531	-22,6%	n
		building typologies (% porch flats)	100,0%	47,6%	-52,4%	n
		ground floor function (% closed facade)	86%	46%	46,7%	n
		building height m	14,43	16,52857	14,5%	n
social values	affordable housing	% social housing	100%	67%	-33,0%	y
		number of social housing	2305	2017	-12,5%	y
		number of dwellings	2305	2989	29,7%	y
	habitable housing	m2 average floorspace per person	21,48	30,01	39,7%	y
		% overcrowding	35,1%	19,8%	43,6%	y
	accesibible housing	% accessible units (GF or lift)	22%	45,5%	103,6%	n
		% 0 stairs housing	8%	36%	332,2%	n
		% senior housing	0,8%	0,6%	-22,9%	n
	citizen participation	Y/N citizens influenced decisions about urban renewal			25,0%	n
		neighbourhood activities / 1000 inhabitants	7,8	2,8	-64,1%	n
	social cohesion	% vunerable people	19%	16%	-15,8%	n
		SES score	4,95	5,6	13,1%	n
	diversity & equalitiy	migration backgrounds	83%	79%	-5,9%	y
		gini coeficient	0,254	0,261	-3,0%	
ecological values	re-use	number of original dwellings	2305	1394	-39,5%	y
		m2 original floorspace	132030	83900	-36,5%	y
		tonnes of orignal material	142670	89522	-37,3%	y
		tonnes of original emodied carbon	45648	28648	-37,2%	y
	energy efficiency	% energy label B or higher	0%	63,80%	63,80%	y

Conclusion

Social Foundation

In the social dimension the main impact areas of renewal were densification and the diversification of tenure, and of dwelling types. This has resulted in a reduction in the ratio and number of social housing and a notable increase in the number of dwellings, similar to overall trends in Nieuw-West (Hoog & Wit, 2022), and the increase in the total amount of floorspace was significant. Dwellings under 60m2 make up most of those demolished and new dwellings are much larger on average (53 m2 compared to 84 m2). This is linked to a significant increase in the average floor space per occupant (21 m2 to 30 m2) and a reduction in the rates of overcrowding (35,1% to 19,8% - still higher than the Amsterdam average of 9,9%).

The rate of overcrowding in households with children was, and still is, much higher (previously 64,7%, now 43,1%). This trend is common in the northern areas of Nieuw-West (Geuzenveld-Slotermeer & Bos en Lommer) which averages around 50% compared to an average 29% for Amsterdam (Gemeente Amsterdam, 2023). One way to interpret the findings on overcrowding is to assume that the dwellings in this area are under sized. While this explanation is partially substantiated by the data on dwelling composition, it may not be the full story. Another explanation may be related to spatial segregation. Nieuw-West has a large immigrant population, and a higher concentration of households with 3, or 4+ children (Gemeente Amsterdam, 2023). The causes behind this phenomenon are outside the scope of this research, but it is relevant to note that current approaches to renewal seem to underserve households with larger families.

Ecological Ceiling

As expected, retrofitting performs much better on the ecological dimension than new construction. Both the material demand and carbon footprint of new construction is far higher than that of the existing, this can be explained by the larger floor area and more intensive material use of new dwellings. The energetic performance of retrofitted dwellings is typically comparable to new construction. A common argument against conservation is that it is more complex and almost as expensive as new construction. The housing corporations operate on limited financial means, so are understandably sensitive to cost concerns. Therefore, a mandatory multidimensional value assessment, LCA or tariff on material-based carbon emissions may be an effective tool for encouraging renovation practices. Based on informal interviews with experts it was found that there are practical examples in which such value assessments have helped to reverse the decision to demolish an ensemble of post-war flats (K. Waarheid, personal communication, 22 December 2023).

Heritage

The role of heritage in achieving these outcomes remains limited. On the one hand, retrofits resulted in tenure conversion much more often than new construction (only 36% remained social housing, compared to 60% of new construction). On the other hand, retrofits contributed much less to densification or diversification of dwelling types. Demolition and new construction resulted on average in a 75% increase in the number of dwellings and a 58% increase in dwelling size. Retrofitting by comparison only achieved an average 8,2% increase in the number of dwellings and a 9,2% increase in dwelling size. In general, densification and diversification of dwelling types appears more difficult to achieve through retrofitting. Fewer and smaller dwellings also mean less income, which suggests developers may be resorting to tenure conversions as a profit generation tool in retrofitting projects. The limited role of heritage buildings in achieving densification and dwelling differentiation, suggest that to promote the practice of retrofitting, more ambitious and radical interventions that can facilitate these outcomes are needed.

Implications

Beyond this it is important to think carefully about the impact these interventions may have on communities. Desegregation or 'social-mixing' have been the main policy used to address the social problems in Nieuw-West. However researchers have questioned the effectiveness of this approach, suggesting that the increase in neighbourhood satisfaction may simply be a consequence of physical improvements to the public space instead (Bolt et al., 2010; Bond et al., 2011). This may also be the case in the Kolenkitbuurt: while generic indicators like the 'livability index' have gone up, neighbourhood satisfaction, social cohesion and equality indicators have not improved significantly.

There is even some evidence to suggest that social mixing has heightened segregation and inequality at the block and building level, creating so called 'pockets of poverty', and resulting in tensions between old and new residents (Nio et al., 2016). This phenomenon can clearly be observed in the Kolenkitbuurt, where people receiving social welfare, mainly concentrate in older, worse maintained blocks. The same blocks also found have worse energy performance, which disproportionately exposes this already vulnerable group to energy poverty, similar to what was found by Mulder et al. (2022).

These findings highlight the importance of approaching urban renewal in an integral way, incorporating both social and ecological considerations, to mitigate negative social outcomes and ensure that the benefits of renewal are distributed in a more equitable way. Eikelenboom et al. (2021) show the value of integrating social elements within circular strategies through community networks, adapting them to their needs and building community support. Likewise Van Hoffen et al. (2023) emphasise the importance of holistic renovations that combine physical housing improvements with socio economic interventions for achieving the best physical, mental and social health and well-being outcomes for residents in disadvantaged neighbourhoods. In the case study area, the projects which achieved the best results in social, ecological and heritage dimensions, were those where residents self organised and used their rights to exercise

influence over the design and decision-making process. This resulted in the decision to renovate four out eight blocks, preserving social housing, heritage values and material resources (woon.nl, 2020). This achievement is significant as residents were able to influence strategic decisions regarding gentrification and tenure conversion, which did not happen in other participatory design schemes (Teernstra & Pinkster, 2016).

Part II: Transforming Post-War Multifamily Housing, Challenges & Strategies

In this chapter the results and conclusion from the research at the building scale are presented. While transformation of post-war housing flats is becoming more common, these projects still only represent a small minority of the renewal interventions in Nieuw-West. To better understand the challenges with re-using this typology nine transformation projects cases were analysed, four from the initial case study area of the Kolenkitbuurt and five more from other neighbourhoods around Nieuw-West. This diverse selection includes a variety of intervention strategies, both big and small, used for the most common building types in Nieuw-West: the porch and gallery flats. These strategies range from careful restoration to total 'make-over', to demolition and reconstruction. Despite this variety, several trends emerge among these interventions that give insight into the desired changes and problems with these buildings. The results are visualised in heat maps and radar plots to make overall trends visible, and diagrams are made to show how these changes are expressed spatially in the interventions.

Renovation Case Studies

1. De Nieuwe Akbar
2. De Leeuw
3. De Verfdozen
4. Klarenstraat
5. Bakemabuurt
6. Dudok Haken
7. Seneca Flat
8. Koel Kit
9. Filosoof
10. Complex 50 en 117
11. Blomwijckerpad
12. Staalmanplein


1
2
3
4
5
6
7
8
9
10
11
12

1. De Nieuwe Akbar

2. De Leeuw

5. Bakemabuurt

6. Dudok Haken

9. De Filosoof

10. Complex 50 en 117

Images: Stadsarchief Amsterdam

3. De Verfdozen

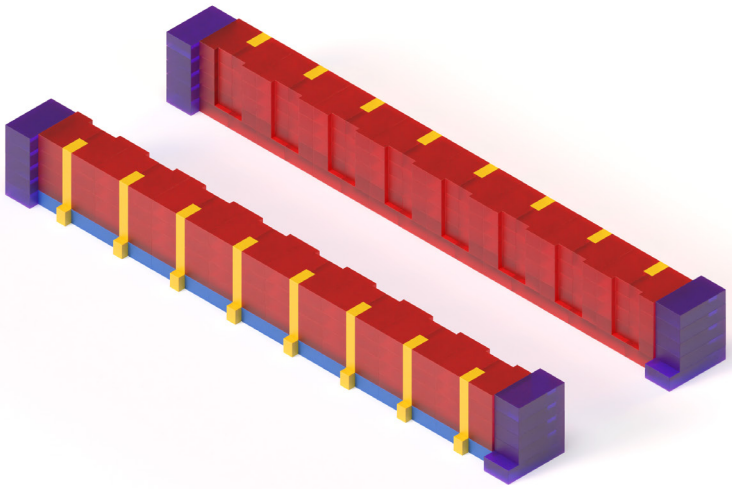
4. Klarenstraat

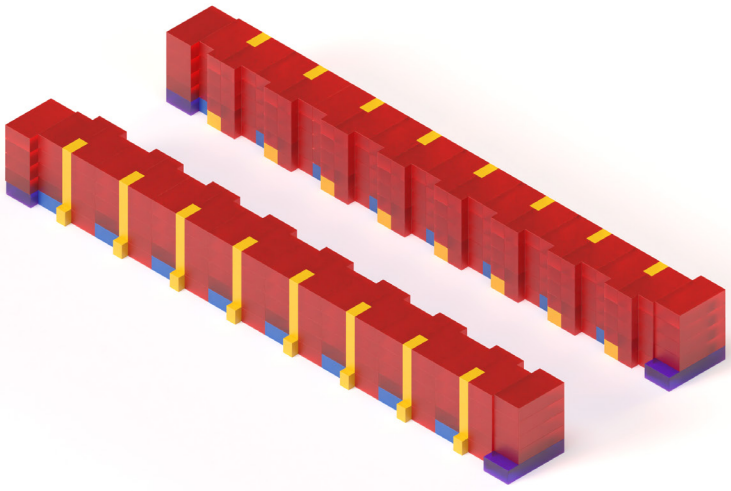
7. Seneca Flat

8. Koel Kit

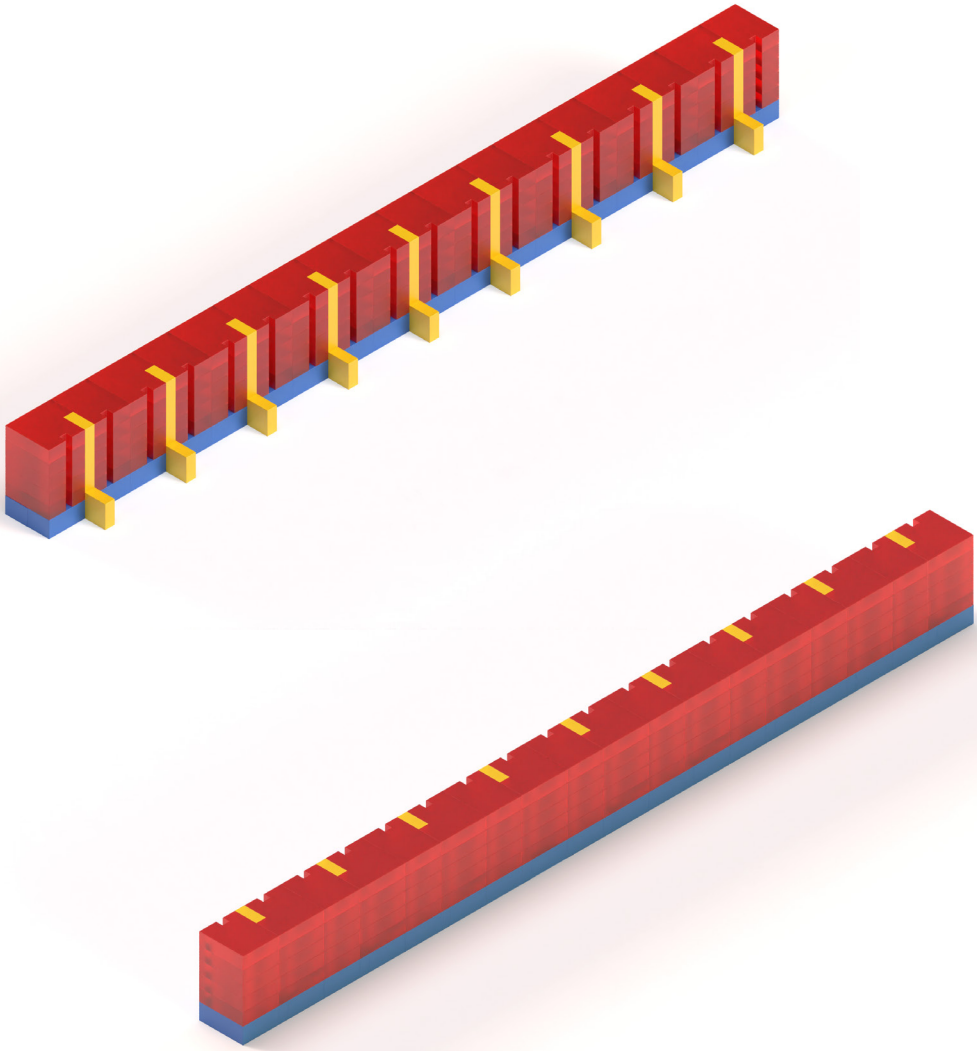
11. Blomwijckerpad

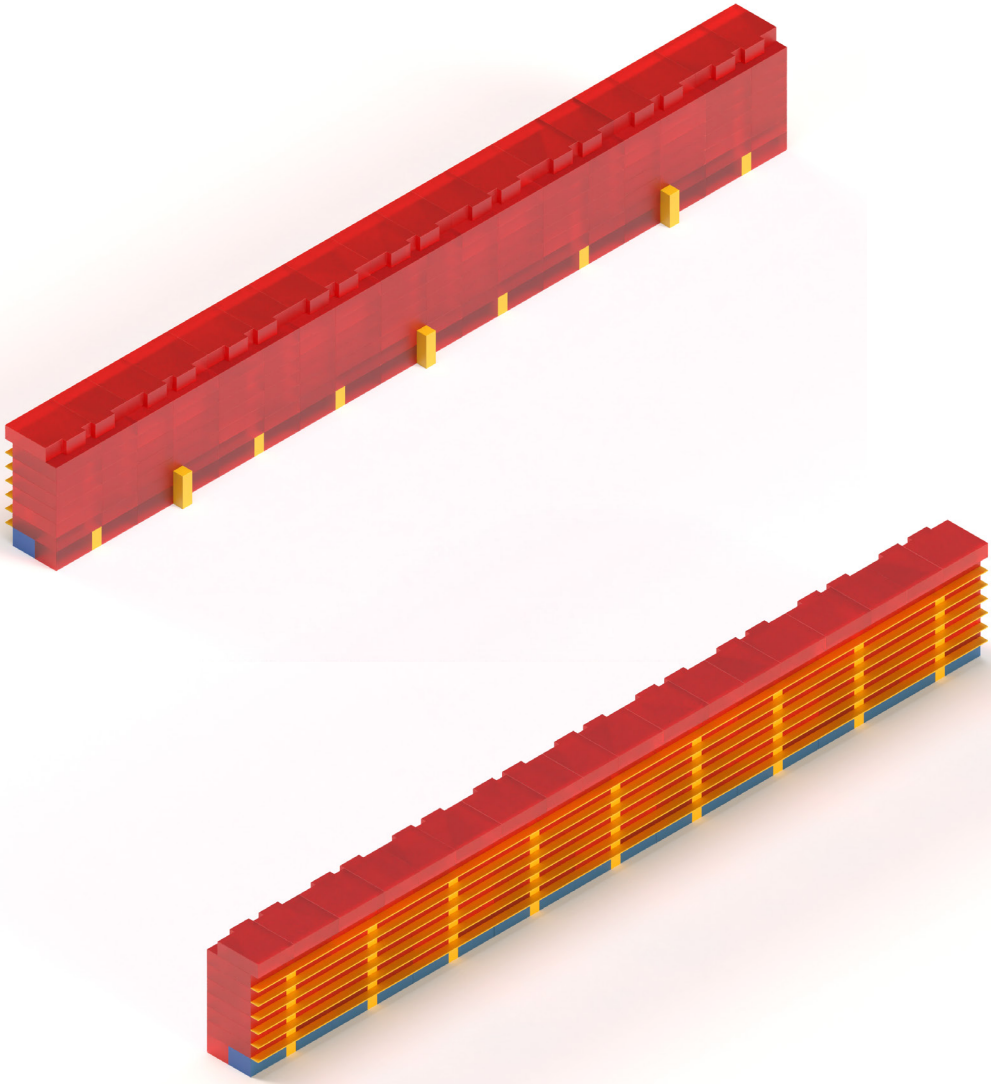
12. Staalmanplein





Commercial
Residential
Storage
Circulation





Commercial
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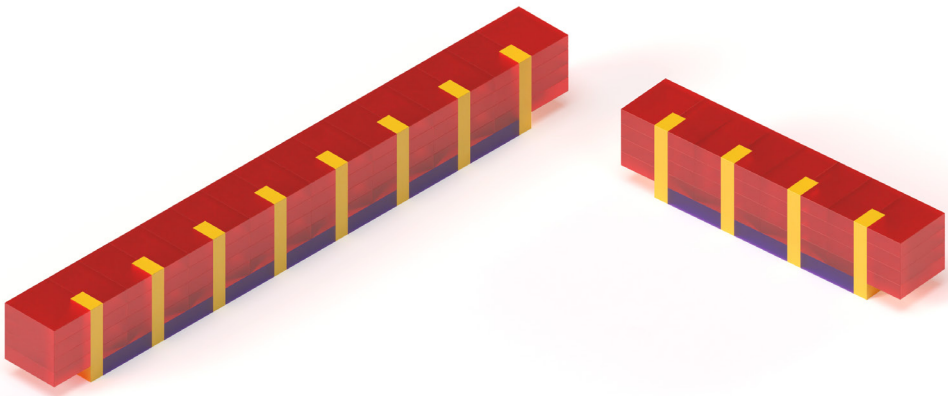
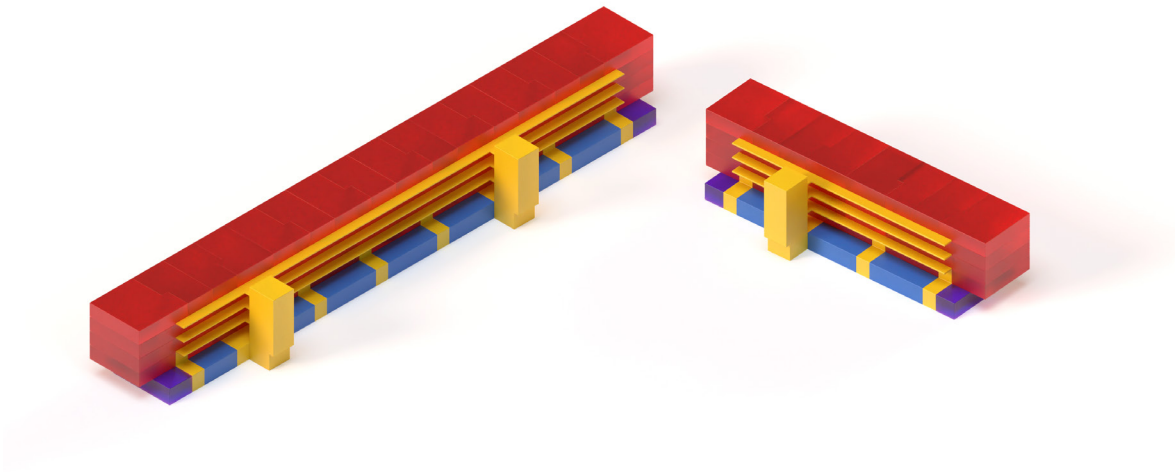
Storage
Circulation

De Verfdozen

1956





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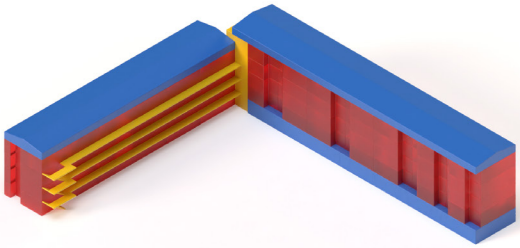
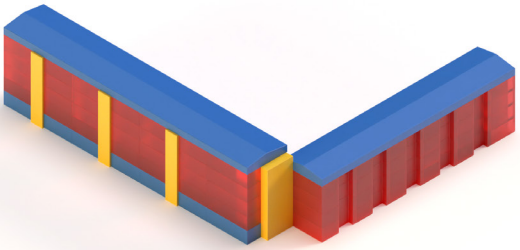
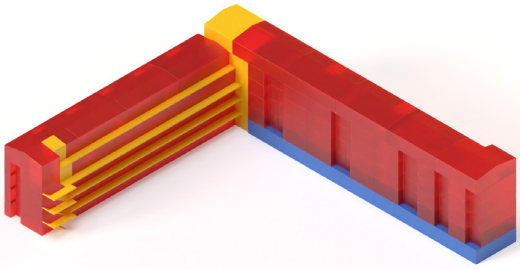
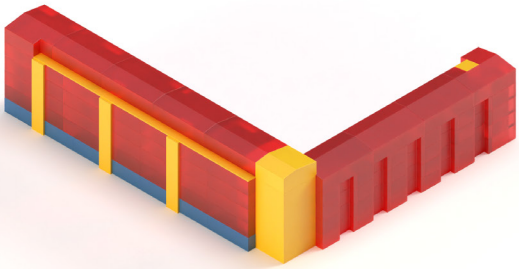
Circulation







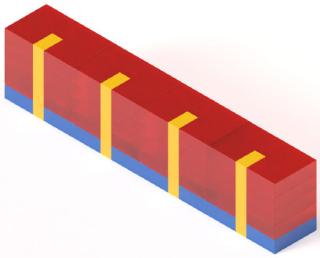


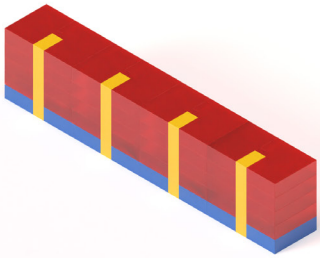
Commercial

Residential

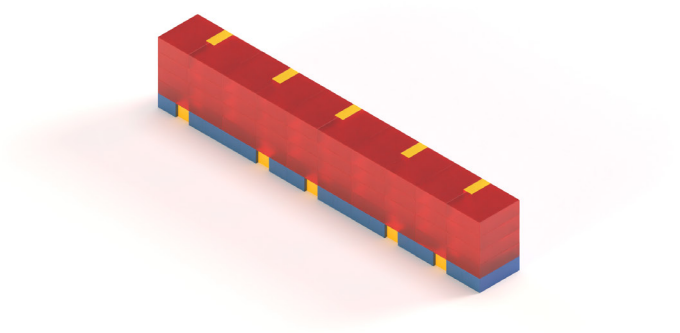
Storage

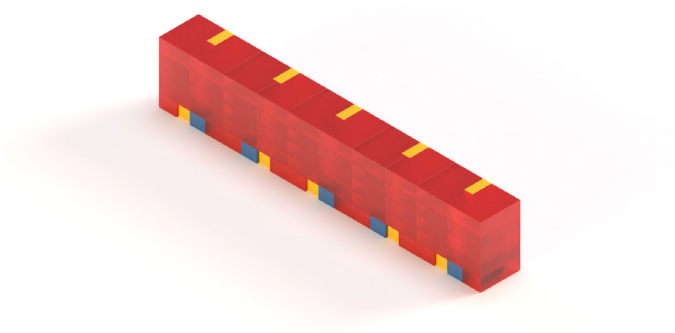
Circulation





Commercial
Residential
Storage
Circulation

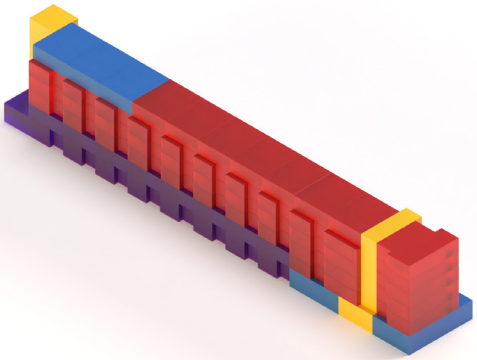


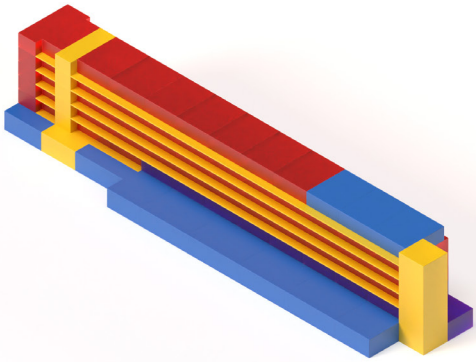


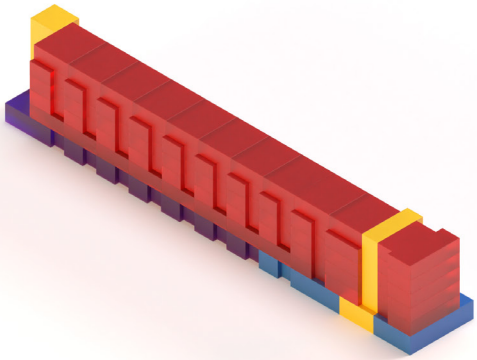
Commercial
Residential
Storage
Circulation

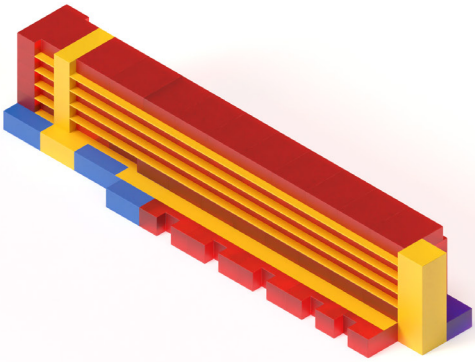
De Seneca Flat

1957









Commercial
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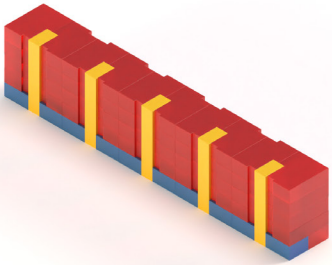

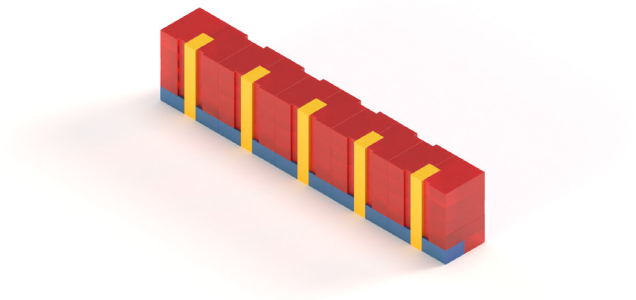

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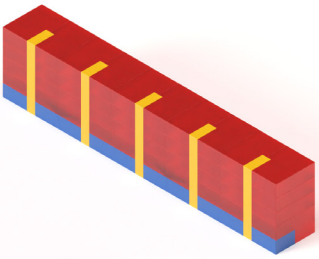
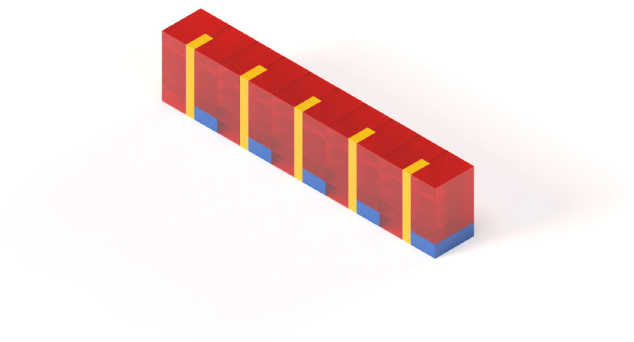


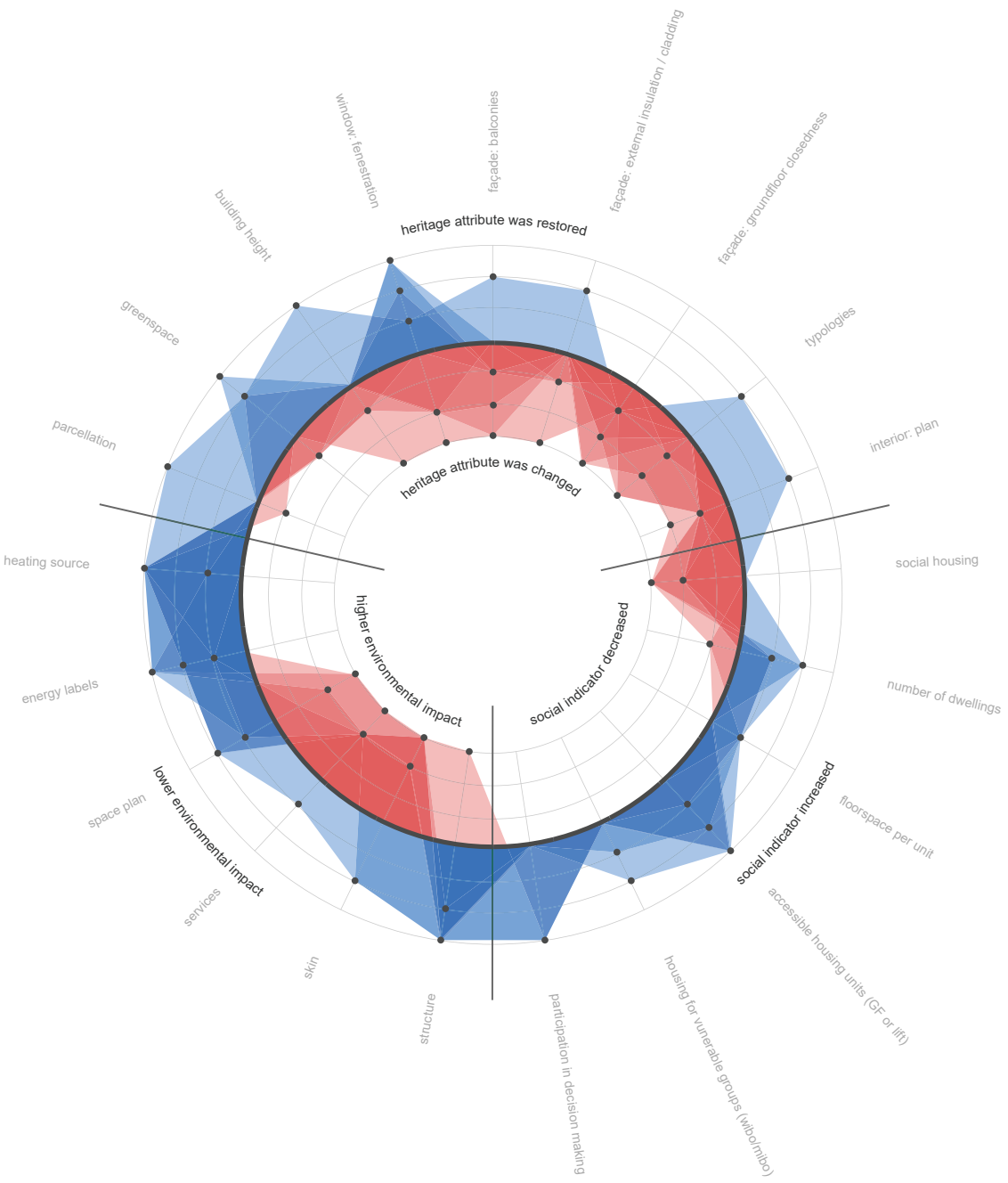


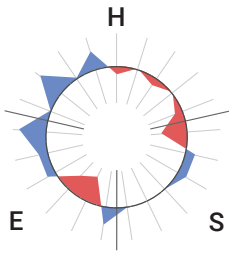
Commercial
Residential
Storage
Circulation

heritage values scale	1	2	3	4	5	6	7
compared to the original state this attribute was...	completely changed	mostly changed	partially changed	neither changed or restored	partially restored	mostly restored	fully restored
social values scale	0%	33%	67%	100%	133%	167%	200%
change relative to starting situation	0x	x0,67	x0,33	x1	1,33x	1,67x	2x
re-use values scale		1	2	3	4	5	
this layer was...		completely replaced	mostly replaced	around equal parts re-used and replaced	mostly re-used	fully re-used	
energy label scale		1	2	3	4	5	
		E or lower	D	C	B	A	
heating source scale			1	3	5		
			natural gas	no data	heating grid		

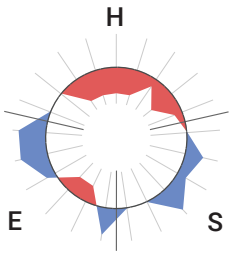
Table 4.1, overview results comparative analysis retrofitting case studies (right) and legend showing scoring system (left)

		value	indicator	case studies								
												
building scale	heritage values	ensemble scale	parcellation	4	4	3	4	4	4	4	4	7
			greenspace	7	4	4	3	3	3	4	6	6
			building height	4	1	4	3	4	3	4	4	7
		buildings scale	window: fenestration	6	1	7	2	2	4	7	2	5
			façade: balconies	3	1	3	1	2	3	4	4	6
			façade: external insulation / cladding	4	1	4	4	4	3	4	3	6
			façade: groundfloor closedness	3	3	2	1	2	4	1	4	3
			typologies	4	1	1	2	4	3	4	4	6
			interior: plan	3	3	3	2	3	4	3	3	6
	social values	affordable housing	% social housing	10,3%	100,0%	100,0%	0,0%	55,6%	50,0%	0,0%	53,5%	100,0%
			number of dwellings	102,9%	158,3%	96,8%	75,0%	100,0%	110,3%	136,4%	100,0%	100,0%
		habitable housing	% floorspace per unit	115,1%	118,8%	100,0%	133,3%	100,0%	115,4%	100,0%	100,0%	100,0%
		accesibible housing	% accessible housing units (GF or lift)	100,0%	200,0%	197,0%	133,3%	100,0%	152,5%	200,0%	100,0%	100,0%
			% housing for vunerable groups (wibo/mibo)	100,0%	100,0%	134,4%	100,0%	100,0%	117,7%	100,0%	100,0%	100,0%
		citizen participation	Y/N inhabitants influenced decisionmaking				y				y	y
	ecological values	material re-use	structure	4	5	5	5	5	5	5	5	1
			skin	1	1	2	1	1	4	2	1	1
			services	2	2	2	2	1	3	2	2	1
			space plan	3	3	4	2	1	4	3	4	1
		energy efficiency	energy labels	3	5	4	5	4	4	5	4	5
			heating source	5	5	5	3	3	5	3	5	5

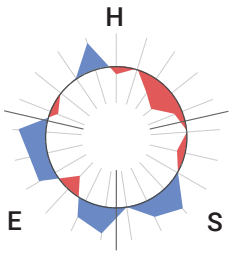

heritage attribute was restored
façade: balconies
façade: external insulation / cladding
façade: groundfloor closedness
typologies
interior: plan
social housing
number of dwellings
floorspace per unit
accessible housing units (GF or lift)
housing for vulnerable groups (wlbo/mlbo)
participation in decision making
structure
skin
services
lower environmental impact
space plan
energy labels
heating source
parcellation
greenspace
building height
window: fenestration
heritage attribute was changed
higher environmental impact
social indicator decreased
social indicator increased



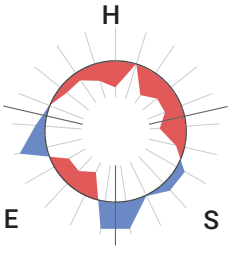
1. De Nieuwe Akbar



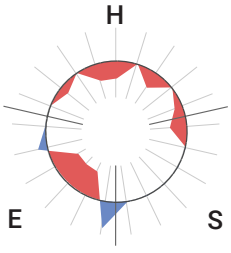
2. De Leeuw



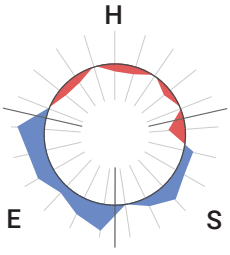
3. De Verfdozen



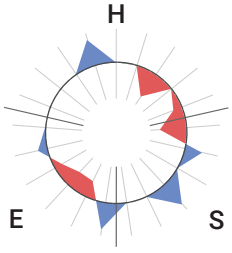
4. Klarenstraat



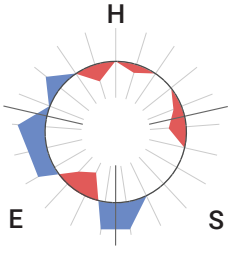
5. Bakemabuurt



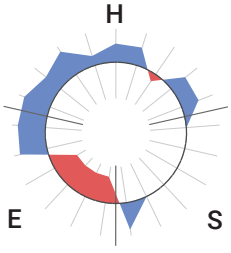
6. Dudok Haken



7. Seneca Flat



8. Koel Kit



9. De Filosoof

Conclusion

Accessibility and Connection

When looking at the results of the case study analysis, some common patterns arise. In many cases the number of accessible units (by ground floor or lift) was increased dramatically by converting from point to deck access. This is because buildings from this period lack elevators, which limits the demographics that can access and use the dwellings. Point access represents the most common type (60% of buildings) in Nieuw-West (Havinga et al., 2020). Parallel to this trend is the attribute 'ground floor closedness' which is changed in almost all cases, for example by introducing ground floor dwellings facing the street side. In research by Havinga (2020), this attribute was given a high negative significance by experts, and 70% of the buildings with point access also have a closed or partially closed ground floor. This finding emphasises the importance of creating a stronger connection to the street, a theme that featured prominently in almost all examined case studies.

Densification and Differentiation

The size and number of dwellings was also increased frequently, though, as discussed before, usually not substantially. Still this serves as further evidence of a desire for more and larger dwellings. More interesting are the ways in which this effect is achieved. In most examples dwellings are added by 'topping up' or converting existing spaces into dwellings. Increases in size and diversification of dwelling types, however, is mainly achieved through merging of multiple units, which works in contradiction to the former aim. Strategies such as 'thickening' of the façade, for example by adding

wintergardens as seen in the work French architects Lacaton & Vassal are almost never used in this context. Findings from interviews with experienced practitioners suggested this may be because larger dwellings provide no additional value to housing corporations, as social housing rent prices are legally restricted (A. Gooijer, personal communication, 21 December 2023). This is an unfortunate fact as precedent set by Lacaton & Vassal demonstrates that following this strategy significant gains in size, quality and health of dwellings can be made at relatively low cost compared to new construction (Druot et al., 2013).

Adaptability

In general, the findings in this research agree with the literature and statements from consulted experts. However, because the case studies only consist of successful retrofits, this introduces the potential for selection bias. It is possible that these selected cases had some properties that made them particularly suitable for retrofitting that are not found in all buildings. From conversations with experts, it was found that the flexibility of structure of the building is a major factor determining whether good quality, diversified apartments can be created through renovation (K. Waarheid, personal communication, 22 December 2023). One of the objectives of the post-war reconstruction period was to create standardised structures using columns and slabs, following the modernist principle of the free plan, to ensure they could easily be adapted in the future. However, in practice this often did not happen, perhaps because contractors chose to cut corners to save on material costs or because they were unfamiliar with these novel ways of building. The result is that in may cases the interior dividing walls are now an essential part of the loadbearing structure, such that the 50s layouts with their numerous small rooms became hard wired into the plan. This phenomenon appears to be particularly prevalent in the Kolenkitbuurt, which was built directly after the war, and may offer a perspective on why demolition in this area was so extensive. This problem highlights the importance of the use of flexible building systems, an issue which is only becoming more relevant in light of the climate crisis, resource scarcity and continuing urbanisation.

Limitations

The neighbourhood studied in phase I was chosen because boasts high rate of demolition in the last 10 years based on reports from Amsterdam Sloopt (Ronners & van Elburg, 2023). This case is representative of Nieuw-West as a whole, and many of the challenges with this area have been assessed to be reflective of the other neighbourhoods. However, as the analysis covers only this one area, it is not possible to compare findings to interventions in other neighbourhoods.

The case studies chosen in phase II ware assessed as being representative interventions, however, they only make up a small sample (n=9) and the case studies only consist of successful retrofits. To minimise the risk of sampling bias, key findings are compared against the literature and expert opinions in the conclusion of each chapter, but one should still be careful when generalising the findings from this research to a wider context. A more rigorous approach would have been to start with a comprehensive list of retrofitting interventions in Nieuw-West and choose the projects based on some predefined criteria. It would also be interesting to compare cases that were demolished with examples that were retrofitted to see if what factors influence the decision to demolish or preserve a building.

Due to the scope and limited time available, this research mainly relies on synthesising and comparing existing data. For most indicators only a single source was used, so it is not possible to verify their accuracy. However, all data was collected from official government sources so can generally be assumed to be accurate. The selection of indicators was made by combining several different frameworks as described in the methodology. This was

mainly done at the discretion of the author based on the availability of data and relevance to the specific context. A more rigorous approach would have been to start with a larger selection of frameworks and make a selection based on common themes and frequently used indicators as done in Beyond Good Intentions (Gonçalves, 2023).

Part III: Values Based Redesign

This chapter marks the transition from research for design to research through design. Whereas the previous phases follow a more conventional approach to research, this phase employs design as a tool to develop novel solutions to the challenges that have been identified. To do so the conclusions from the initial phases are translated into a design brief for an intervention to a typical post-war housing flat in Nieuw-West. The goal for this intervention is to serve as model case and provide a toolbox of solutions for sustainable urbanisation and the conservation of post-war flats and in Nieuw-West and other similar neighbourhoods.

The building that was chosen for this intervention is located on the western end of the Confuciusplein in Geuzenveld-Slotermeer, the northern part of Nieuw-West. This building was chosen for two important reasons. First, because it possesses many of the typical characteristics of this typology which have been found to be problematic in the research. Second, because it has qualities that are less common but considered to be representative of the ideals of modernist architecture in Nieuw-West. These qualities include unique window fenestrations, the use of flexible construction systems and the inclusion of commercial spaces. Despite being recognised as important heritage attributes, many of these qualities have been lost by careless maintenance. The building also has no special heritage listing, leaving it at risk of demolition. The task of the redesign is therefore to restore the heritage qualities, address the problems and shortcomings of the original design, and take advantage of the flexible construction system to create high quality dwellings.

Redesign Case: Confuciusplein Building

Sketch of the expansionplan for Slotermeer, Stadsarchief Amsterdam, 1950.

Areal photograph of the Confuciusbuurt, Stadsarchief Amsterdam, n.d.

Confuciusplein building, Stadsarchief Amsterdam, n.d.

Original facade of Confuciusplein building, Jan Versnel/MAI, n.d.

Design Brief

This thesis takes the position that to preserve the post-war heritage of the western garden cities, it is necessary to go beyond the legislative protection of cityscapes or the conservation of individual buildings. Instead, the garden city project must be continued, and its founding ideals of light, space and air adapted to the needs of today. Interventions should aim beyond sufficiency and take advantage of the potential of the existing structures to be transformed into generous and high-quality dwellings. To prevent further privatisation and demolition of the social housing stock, this project aims to turn the porch flat into a desirable alternative to the single-family home. By reconnecting the buildings to their surroundings and supporting community development, the negative stigma surrounding collective housing can be overcome to position it as a viable alternative to the prevailing ideology of home-ownership. To show that by re-using the existing, and doing more with less, we can meet today's housing needs while remaining within our planetary boundaries.

Identify Existing Values

The concept of the Heritage Environment (Gonçalves et al., 2021) divides these into tangible, intangible and natural values. This framework can be used as a basis to existing values and incorporate them into ciruclar design strategies. The findings from the neighbourhood case study highlight the importance of engaging local stakeholder groups in the design process. A participatory design process is outside the scope of this research, but it may be possible to conduct some small surveys or interviews to profile stakeholder interests or create persona's to represent the main stakeholder groups

Connect to Surroundings

The ground floor level plays a key role in the public space. It is the place where the building meets the ground, and where most strongly affects its presence in the neighbourhood, but also the place through which residents arrive home. This space needs to accommodate residential, commercial, and public functions, but also services like storage rooms, car and bicycle parking, trash collection, expedition vehicles etc. The magnitude and complexity of the demands placed on the plinth in contemporary mixed use buildings in Amsterdam is best documented in 'Super Plinten' (Atteveld et al., 2020). This research elegantly solves these requirements in the traditional closed city block. The challenge is doing the same in the more open and linear urban structure of the garden city model. Designs should consider the inclusion of spaces that support local communities and provide opportunities for local businesses. Furthermore, transitional spaces that create buffers between public and private, such as small front gardens or semi-public collective green spaces, can help enhance a sense of ownership and improve the use of the public space.

Diversify Typologies

When Nieuw-West was originally built, dwellings were designed with the needs of a traditional family in mind: a private kitchen and bathroom, a living room and two or three bedrooms. Due to material scarcity and high demand for housing after the war these requirements were crammed in minimal footprints resulting in small rooms. Today households take many different forms and these household all have different requirements. This creates a demand for new dwelling typologies, and more importantly for more flexible buildings that are able to adapt to ever changing needs.

Densify to Create Value

Retrofitting projects often turn to tenure conversion as a means of generating income. However, considering the current housing crisis, further reduction of the social housing stock is not desirable. Interventions should instead focus on adding more density to generate income needed to upgrade the entire building, this way all residents can benefit. When it comes to adding density,

the challenge is doing so without compromising on the existing qualities of the garden city model. Building next to or against existing buildings will always compromise access to light and reduce the available green space. Building on top is always limited by the bearing capacity of the existing foundations. Every situation will require a unique, carefully considered intervention that responds to the local needs and fits within the existing structure.

Community Spaces

There is a steep drop in the number of communal activities in both the kolenkit and confuciusbuurt since 2020 (Dashboard Kencijfers, 2023), suggesting the impact of covid on communities may still be felt. Providing 'third places' to support various communal activities as well as spaces for entrepeneurs to experiment could aid in the recovery of social life and strengthen vunerable communities.

Adapatability and Dissasembly

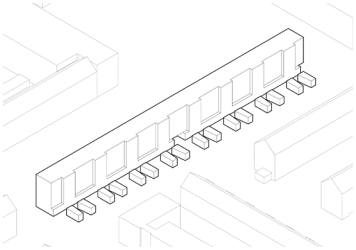
Design for disassembly and adaptability will become increasingly important for closing resource loops, not only for new construction, but also when working with the existing. Earlier phases of the research show how the use of inflexible construction systems in the past has held back and complicated re-use today. Interventions can also help increase adaptability of existing structures, for example by allowing multiple units to be joined together.

Research to Design

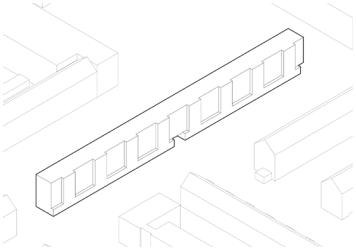
The research explored the topics of housing, heritage, and the climate crisis in the context of urban renewal in post-war mass housing neighbourhoods like Amsterdam Nieuw-West. It identified three main challenges: growing urban inequality, material waste and the loss of neighbourhood identity. The research used a variety of methods, including socio-spatial mapping, mapping of resource flows, comparative analysis, and expert interviews, to interrogate the ways in which contemporary urban renewal and refurbishment practices contend with these issues. This provided insight into the present challenges, shortcomings, and areas of latent potential. The project furthers this research by redesigning a post-war multifamily housing flat into a mixed-use collective housing ensemble. It explores ways of diversifying and densifying typologies, reconnecting with the context, and reusing existing materials, with the aim of delivering a project which addresses the issues of heritage, social and ecological sustainability in integral and novel ways.

The research found that need for diversification and densification is often used to argue for demolition & new construction, in particular there is a lack of dwellings that can accommodate larger families (3-4+ children) in Geuzenveld & Slotermeer. In response the project tries to find ways to add significant density to the existing building while fitting within existing urban structure. The existing apartments are extended and granted generous outdoor spaces. This enables the creation of a bathroom larger & wc. The living area is extended and integrated with an open plan kitchen. Part of this room can be separated off with a frosted glass sliding wall, allowing it to be used as a separate

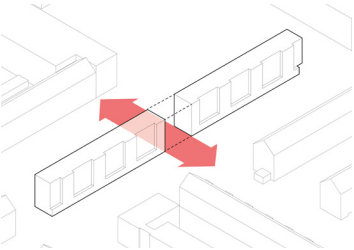
Massing Diagrams



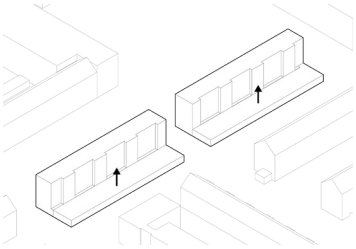
1. Existing Situation



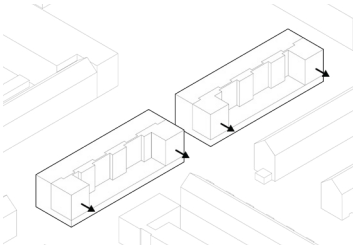
2. Removing Bike Storage



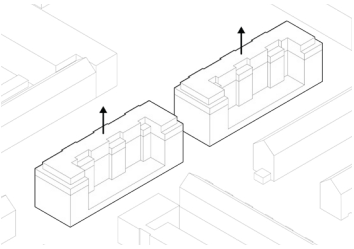
3. Enlarging The Passage



4. Expanding The Plinth

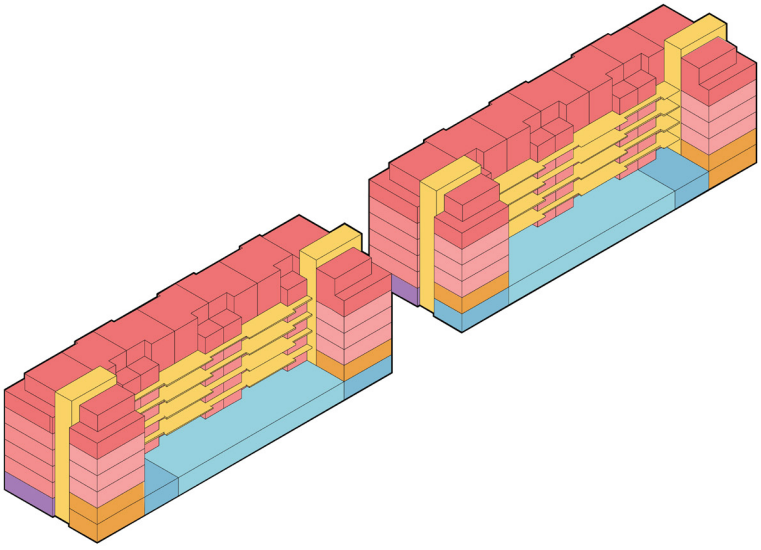


5. Creating a Corner



6. Topping Up

Program Diagram



Residential

Circulation

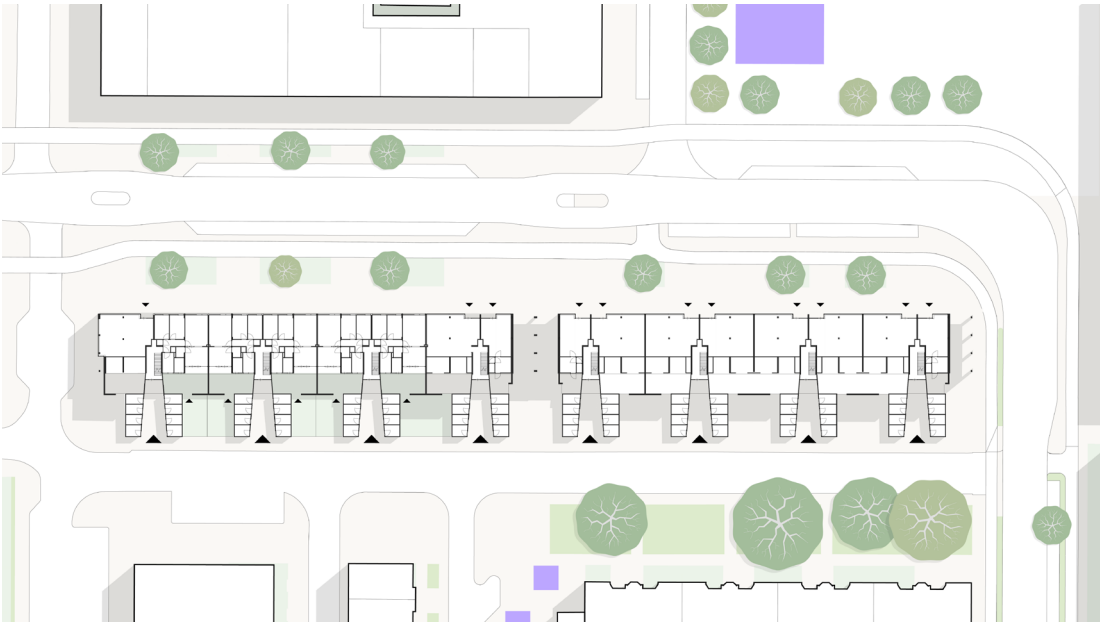
Communal

Car/Bike Parking

Commerical

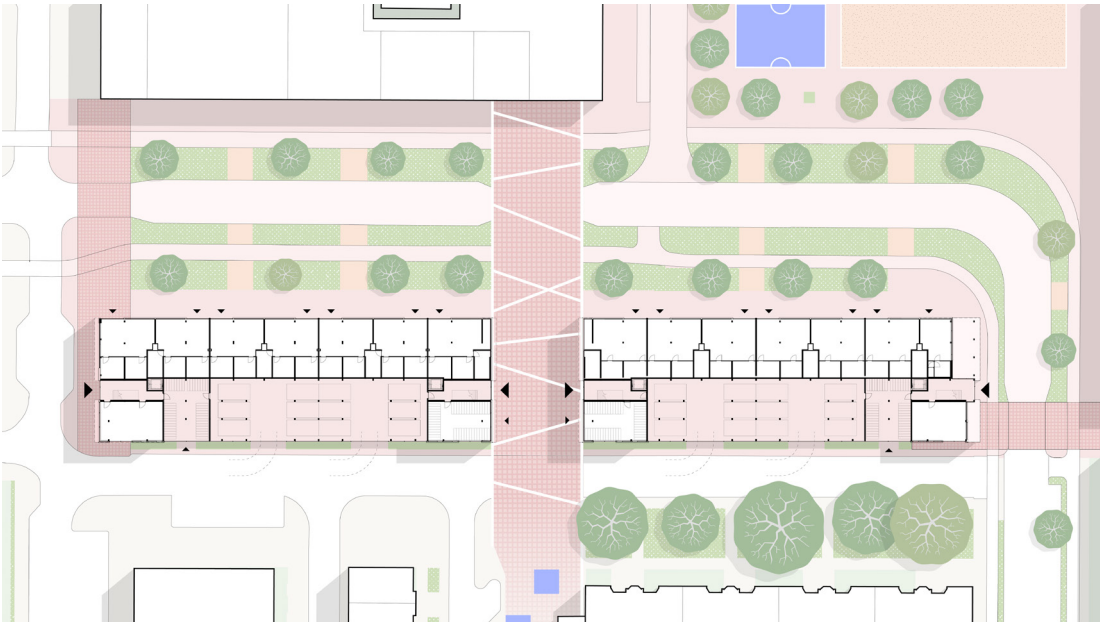
Ground Plan Existing Situation

This plan shows the existing situation and the challenges it poses in regards to the connection with the public space.



Ground Plan Redesign Proposal

This plan shows the improvements made to the public space, and the way the building connects to it as described in the text.



bedroom. New larger rooftop maisonettes are added which are comparable in size to more traditional row houses and come with significantly more outdoor space than typical apartments of that size. Finally, smaller two-bedroom apartments are added on the corner, all together these provide a broad range of typologies to accommodate a variety of household compositions. As a result, the total floor space in the building is more than doubled, the number of apartments is increased by 23 and the average floor space of each apartment is increased significantly. Thanks to the characteristically wide streets and careful testing the massing the proposed densification has no significant effect on the available sunlight hours on the surrounding buildings or the existing apartments inside the building.

Another common issue that was found in the research, is that these post-war flats are disconnected from the street level by storage boxes, garages, and tall fences, which creates an unpleasant atmosphere on the street level. For the building chosen in the design case, this issue is particularly prominent. Storage boxes protrude outwards towards the street, limiting visibility around the entrances and creating many dark corners. A long, low, and narrow passage is the only connection between the plaza on one side and the neighbourhood on the other. To solve this the exiting passage is enlarged, improving walk-ability at the urban level, and making new openings in the façade letting in more light and creating new connections on to the street. New larger, more clearly legible, and transparent entrances are created at the ends of the, now two, buildings.

One of the main conclusions from the research was that in conventional refurbishments, shearing layers other than the structure are typically not re-used. In response a detailed map of the existing materials was made, much of the exiting building was left in place and ways to re-use the materials that are removed are found. This includes all the existing insulated glazing units, as well as a significant portion of the brick and concrete removed from the structure. Compared to conventional demolition and new construction, the project achieves a 54% reduction in carbon emissions. Compared to conventional refurbishment, the project achieves a 16%

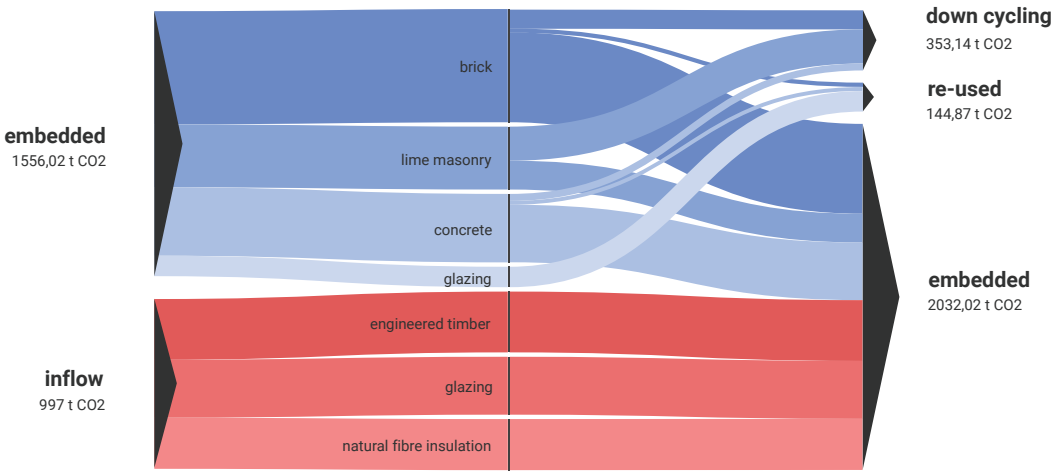
reduction in carbon emissions. This second result is lower than expect, which can partially be explained by the fact that a comparatively small amount of material was removed from the building to begin with as an effort was made to retain a part of the space plan.

However, there is some unused potential as the brick & concrete re-used in the facade represents only a portion of what is available. The facade could have been designed to have less glazed area, this would have reduced the carbon footprint caused by glazing, and substituted it with re-used materials. However, the glazed area is high in part because there are multiple layers which function a winter garden, significantly reducing operational emissions. Therefore, more detailed analysis is needed to know the environmental impact of the glazing over the entire lifespan of the building and determine the best option. Some of the impact of the glazing is be offset by the re-use of the existing IGU's, and by using demountable glazing units, to make future re-use / remanufacture easier.

The design found promise in the interaction between the social, heritage and ecological related interventions. For example, an extension of the floor plate and the addition of a second skin can simultaneously be used to increase available floor space, improve accessibility, act as a collective sheltered outdoor space, capture solar gains, improve thermal insulation, drive stack ventilation, provide shading, provide noise insulation, support vegetation etc. Demonstrating the potential for such an intervention to make improvements many areas at once, while reducing the carbon footprint by reconfiguring materials from elsewhere in the building, serves as proof of the value of conservation even in cases where significant change may be desirable.

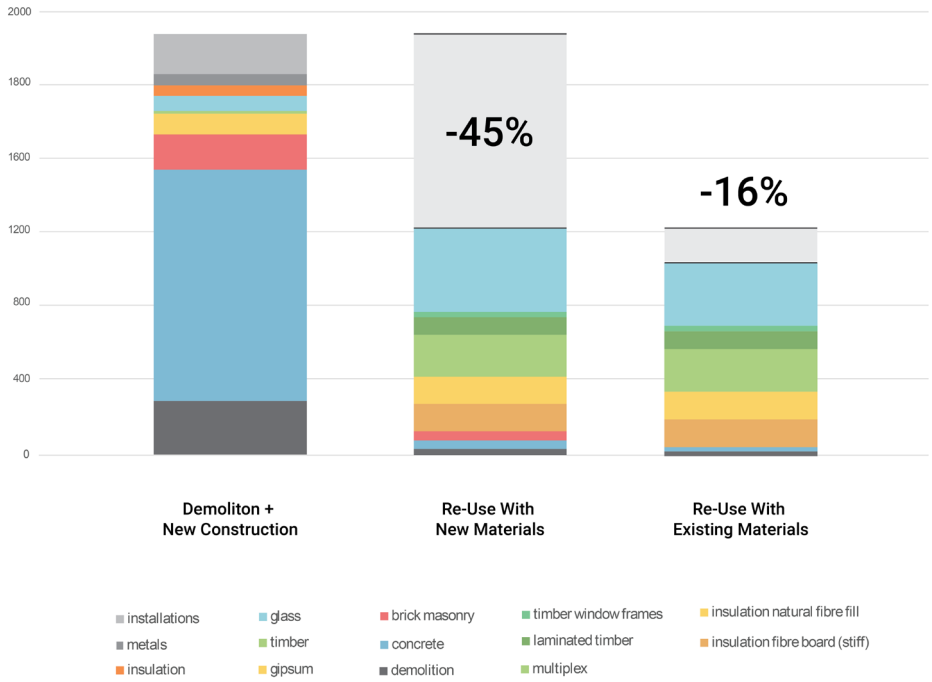
Embodied Carbon Flows

This diagram shows the flows of the main materials in the project, the size of the flows reflect the total embodied carbon in each material.



Carbon Footprint of Different Approaches

This diagram shows a comparison between the carbon footprint of demolition + new construction, conventional refurbishment with low carbon materials and refurbishment with reused materials.

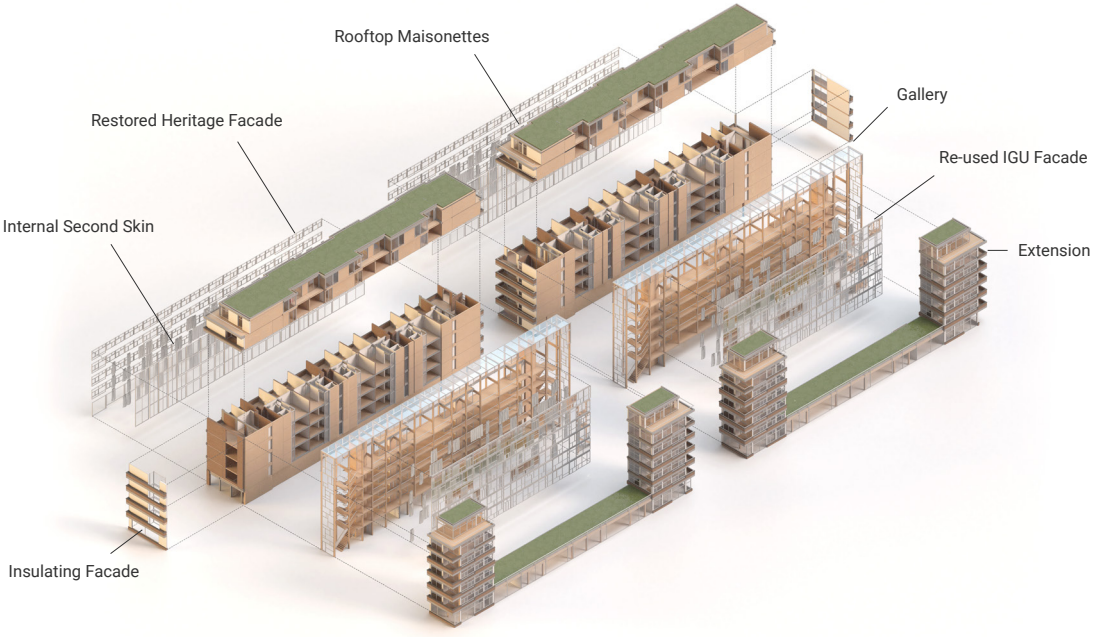


Integration of Disciplines

Diagram showing the integration of various concepts, including material re-use such as the re-used IGU facade and recycled concrete cladding. Climate design; including winter gardens, shading, green space, ventilation, and energy. Structural design using timber post and beam construction with hollow box ceilings. And the resulting spatial quality enjoyed by the apartments.

Exterior Isometric

Exploded view Showing Main Components



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