Retain, Repair, Reinvest:
An international catalogue of precast panel refurbishment projects.

OFFICE

OFFICE is a not-for-profit multidisciplinary design and research practice based in Melbourne. Their projects span the intersections of built form, research, discourse and education. As a registered charity, the studio's operations, processes and outputs are bound by a constitution to make projects for the public good.

This research was produced with the generous assistance of the Alastair Swayn Foundation

Contents

Retain, Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

This document was created in the context of the Victorian government's plan to demolish all 44 high-rise public housing towers in Melbourne, citing the inability to be refurbished due to their construction methods.[1] These towers, constructed from precast panels in the 1960s, are home to 10,000 residents and will be demolished despite no public government documents detailing that refurbishment has been fully considered.[2] The purpose of this study is to demonstrate that this construction type can be brought up to contemporary standards, and that retrofitting is possible in a variety of social, political and economic environments.

The report catalogues 19 recently refurbished multi-residential buildings originally constructed using precast concrete. A variety of precast concrete construction arrangements have been investigated ranging from hybrid precast panel and in-situ systems, to purely loadbearing large panel systems. Each project demonstrates clear environmental, economic, and social benefits, primarily by avoiding demolition and upgrading building stock to meet contemporary standards. Given the scope of this investigation; further research into tenant satisfaction, energy assessments, and final cost disclosures would be necessary to fully evaluate the success of each refurbishment. Despite this, we see merit in starting with the identification of international case-studies and broadening the discourse.

The development of modern concrete technology, particularly since the 1940s, was primarily driven by the shortage of materials and labour caused by World War II. The use of which was accelerated due to growing demand for low-cost housing to accommodate large segments of the population. Due to its potential for standardisation and mass production the precast elements offered cost benefits, making it appealing for large-scale social housing projects with limited budgets. Projects emerged globally, employing precast panels and components to construct housing estates.

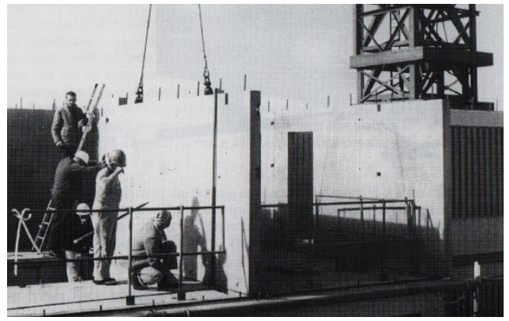
In 1964 the first high-rise tower in Melbourne was completed using the prefabricated large panel concrete technology produced at Holmesglen. The Holmesglen Factory was a concrete housing factory operated by the Housing Commission of Victoria from 1946-1962. The factory adopted a system of precast concrete building named the "Fowler" System[3] and produced a range of precast concrete homes from single storey dwelling to high-rise towers. All walls and floors were trucked to site and craned into configuration, allowing for efficiency in construction time. Wall panels are connected together via steel dowels and bolted connections, with floor panels welded together by steel tie bars.[4] While this approach offered efficiency of construction, the load bearing walls make any future alterations or spatial reconfigurations difficult. In total 42 high-rise towers were produced using this construction technique, which at its time were 'sophisticated and highly regarded in the industry'.[6] In 1969 with the completion of the Parks Tower in South Melbourne a 30-storey high tower was believed to be the tallest load-bearing wall panel building in the world.

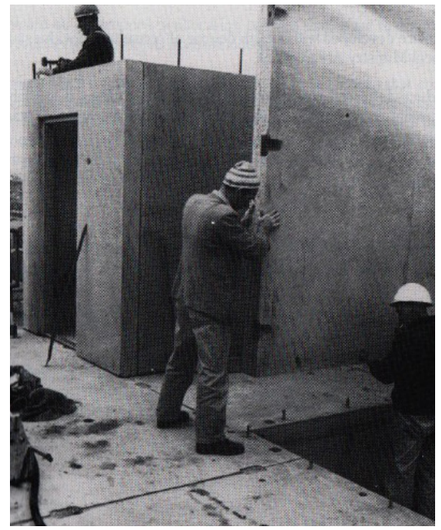
However, globally early precast designs resulted in repetitive and aesthetically uninspiring designs, leading to criticism regarding their impact on the urban environment. Some precast systems, particularly those relying on specific connection methods, faced structural issues and even failures, raising concerns about safety and long-term durability. From the early 1990s a large number of precast concrete buildings throughout Europe were demolished due to poor construction and antisocial behaviour attributed to the building typology. This negative image of postwar housing blocks have led to an international response to demolition rather than refurbishment.

It is acknowledged that precast elements create difficulties in altering the existing buildings and are in some instances unsafe for the occupants. However, this report sets out that proper assessments need to be undertaken prior to the commitment of demolition. Through involvement with residents, an engaged client and considerate design team innovative approaches to renewal can be undertaken.

In light of the arguments being made by the Victorian government, this catalogue documents 19 alternative examples. These case studies demonstrate practical and effective alternatives to demolition; which can inform strategies for the future retrofit of the 44 high-rise towers in Melbourne.

1. www.bighousingbuild.homes.vic.gov.au/frequently-asked-questions
2. Dexter, R. 2024. Judge may force release of secret documents detailing decision to raze Melbourne housing towers. The Age
3. W.P.Brown. 1963. Industrialised precast load bearing wall construction.
4. The High Rise at a Glance, A summary paper profiling Ministry of Housing and Construction Accommodation, page 10
5. 200 Dorcas St South Melbourne and Hotham Hill Estate North Melbourne are insitu concrete.
6. Ibid page 9

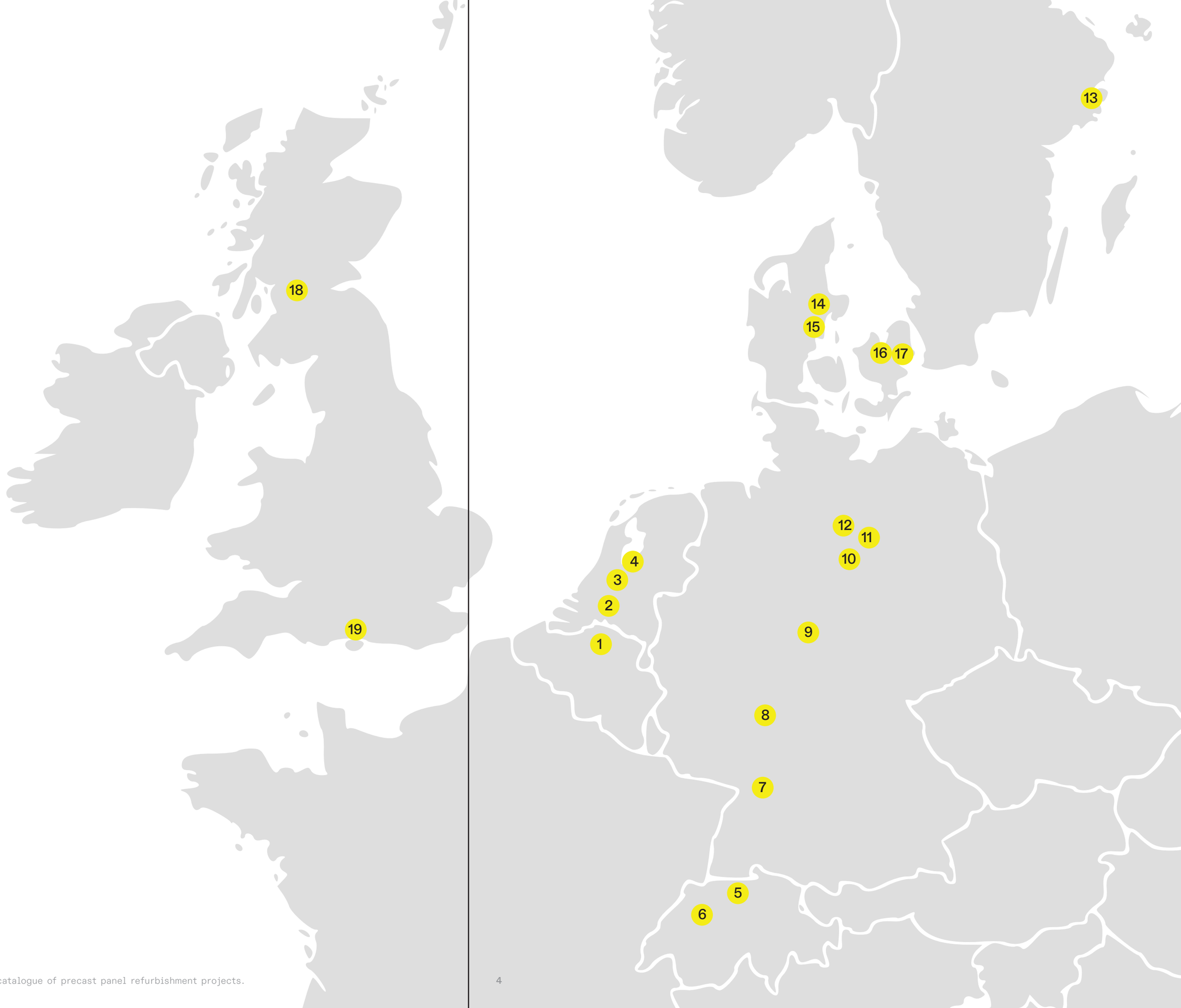




left-right. Concrete panels at the Holmesglen Factory. Placing a load bearing wall panel on site. Steel rod connectors can be seen at the top of the panel. Placement on top of the steel rods. Photos from 'High-rise at a Glance.'

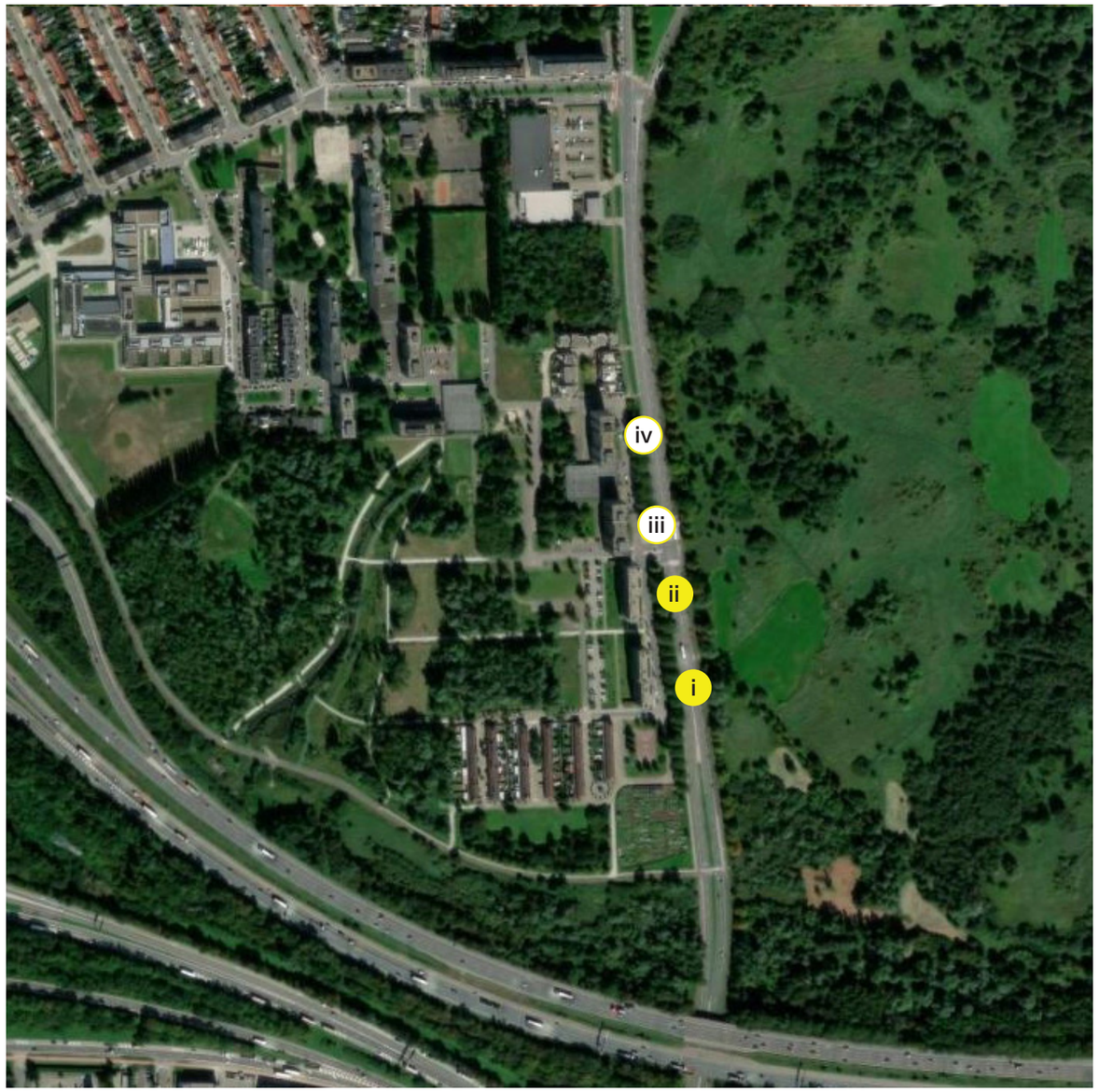
The existing 20 storey towers at Flemington Estate, Melbourne, are earmarked for demolition.

1.
Rozemai Estate,
Antwerp, Belgium
2.
Splayed Apartments
Rotterdam, Netherlands
3.
Urban Renewal Europarei
Uithoorn, Netherlands
4.
deFlat
Bijlmermeer, Netherlands
5.
Telli B and C
Aarau, Switzerland
6.
Tscharnergut Waldmannstrasse 39
Bern, Switzerland
7.
Gueterstrasse 30
Pforzheim, Germany
8.
Platensiedlung
Frankfurt, Germany
9.
Haus 1-7
Leinefelde, Germany
10.
Highrise Stieglitzweg
Berlin, Germany
11
Ahrensfelder Terraces
Marzahn, Germany
12.
Märkisches Viertel
Berlin, Germany
13.
Fittja People's Palace
Norsborg, Sweden
14.
Gellerup Block 4
Gellerup, Denmark
15.
Roesenhoj
Viby Syd, Denmark
16.
Ellebo Block 3 and Block 4
Ballerup, Denmark
17.
Messinavej
Amarger, Denmark
18.
Woodside Multi Storey Flats
Glasgow, Scotland
19.
Wilmcote House
Portsmouth, England



1.
Rozemai Estate, Antwerp, Belgium
Atelier Kempe Thill

i. Jef van Hoofstraat, Refurbished block
ii. Jef van Hoofstraat, Refurbished block
iii. Renaat Veremansstraat, Existing block
iv. Renaat Veremansstraat, Existing block



Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

1. see www.atelierkempethill.com/projects/0115-rozemaai-housing/

The Rozemaai housing estate, located in the far north of Antwerp between “Oude landen” landscape park and the A12 motorway, consists of four eight-storey prefabricated large panel buildings in a park-like setting. Built in the late 1970s, these buildings have suffered from various technical problems due to poor construction and deferred maintenance, leading to rapid deterioration. After extensive discussions the housing association, Woonhaven Antwerpen, decided to renovate two of the existing buildings. The decision to renovate was partly driven by the fact that demolishing the buildings would trigger a new planning overly, restricting new construction to a maximum of four stories. To avoid reducing the number of apartments, the housing association organised an invited competition in 2011, which was won by Atelier Kempe Thill.[1]

The Atelier Kempe Thill proposal looked to radically transform the two buildings to achieve contemporary apartment standards and better integrate them into the urban setting. The renovation strategy involved three steps:

- Removal of all façades, staircases and interiors.
- Removal of the abandoned parking garage to improve the connection with the park and address social issues.
- Introduction of a new volume to the top floor, balconies and façades to create a seamless connection between the interiors and the landscape.

The retrofit included adding a new volume to the roof and positioning staircases and lift cores at the ends of the buildings. This approach increased the density, and improved views from the apartments. While the original buildings lacked balconies, new prefabricated ones were added on the eastern side, providing a functional use as well as enhancing the buildings’ character.

An unrefurbished building on the estate.

Refurbished building with new glass balustrades and facade.

New apartments with private entries integrate the buildings to the ground plane.

2. Atelier Kempe Thill, Rozemaai refurbishment, Antwerp. Divisare.

The renovation addressed typical construction and performance defects of the 1970s and 1980s prefabricated buildings, such as poor heat, sound insulation, and numerous thermal bridges. The remediation measures included thermal separation of concrete components, adding insulation at connection points, and covering old concrete walls with insulation or new concrete slabs with intermediate insulation.

On the ground floor, larger family apartments with direct street access were created to boost social interaction, with ground-floor outdoor spaces relocated to the western side. The buildings were updated to meet 21st-century standards, the removal of concrete wind bracing created more spacious and flexible units including ones with wheelchair accessibility. Each apartment now features a full glass façade facing the balconies and views of the surrounding park, with horizontal windows and open kitchens adding to the spacious, bright, and adaptable living spaces.

The project deals directly with both the economic and sustainability benefits of retrofitting housing blocks. Modernist estates are often demolished due to the perceived high cost of updating them to new standards, leading to unsustainable demolitions. By transforming the Rozemaai buildings, significant CO2 emissions were avoided, and about 50% of existing materials were reused. The renovation cost (€ 895/m2) was about 75% of the cost of new construction while achieving nearly equivalent standards.[2] This project demonstrates the potential of renovating post-war estates for additional ecological and economic benefits.

Internal view out of a refurbished flat. Photo Atelier Kempe Thill

New access decks with glazed balustrades. Photo Atelier Kempe Thill

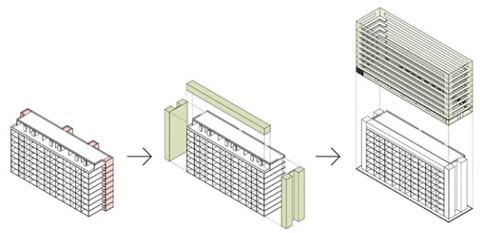


Diagram from Atelier Kempe Thill showing the addition of circulation and façades to the existing building.

New entries located at the end of the building with new lift and stair cores.

2
Splayed Apartments
Rotterdam, Netherlands
biq and Hans Van Der Heijen Architecten

i. Niels Bohrplaats, Refurbished block
ii. Einsteinplaats, Refurbished block
iii. Briandplaats, Refurbished block
iv. Albert Schweitzerplaats, Refurbished block

Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

1. Karakusevic, P. & Batchelor, A. 2016. Social housing: Definitions and design exemplars. RIBA Publishing. Page 58
2. Massey University. 2020. The Architecture of the Future: Sustainable design principles. Video.

The Ommoord residential district, where the Splayed Apartment Block project is located, is a park-like setting on the outskirts of Rotterdam. Built in 1968 as part of the post-war recovery, the district was designed by Bauhaus urban planner Lotte Stam-Besse to accommodate 35,000 people in buildings of varying scales and densities.[1] The denser part of the district featured high-rise slab blocks designed for a predominantly low-income community. The renovation project focused on four out of 15 similar eight-storey blocks that needed updating. The strategies adopted on these four sites can be applied to the other 11 buildings in the future.

Demolition was not considered due to the fact that many of the issues are the result of poor access to each building - in each block 176 dwellings share only two lifts and one entrance. Over the years, residents had adapted the area as best they could, but the estate's large scale and monolithic building footprints made meaningful interaction between the public spaces and buildings difficult.[2]

Architects biq and Hans Van Der Heijen Architecten understood early on that engagement with the residents was key to the project. The team quickly realised that managing the large number of residents posed a significant challenge. Each block contained 176 families, and with four blocks meaningful engagement with everyone was difficult: simply renting a room for discussions or sending newsletters was insufficient. As a result, they decided to host walk-in evenings, allowing residents to meet one-on-one with the architects. Two architects from the team, along with representatives from the housing association, were always present to answer

New ground floor flats with full height glazing and private entries.

3. Jones, A. (2019). Reviving the block: Urban renewal and the future of Australian public housing. NSW Government Architect.
4. HVDHA. (n.d.). Splayed apartment blocks. HVDHA. Retrieved February 8, 2025, from https://hvdha.com/en/splayed-apartment-blocks/

questions and provide direct information. Although this approach was labour-intensive, it proved to be highly effective. Residents felt respected and valued, and the team was able to gather useful feedback.

From these sessions a number of issues with the buildings became apparent, predominately around the communal areas, lack of lifts and limited entry points. Another issue was the change in demographic over time with older occupants now sharing the space with a more diverse and younger cohort.[3] The refurbishment of the blocks addressed some of these issues with two of the blocks becoming dedicated accommodation for the elderly. The accessibility was enhanced, community centre located within the building and new apartments added to the ground floor. A key move was the removal of the on ground car garages which occupied the ground floor of the blocks. These garages were replaced with apartments which formed a plinth connecting to the surrounding landscape - establishing a human scale, increased passive surveillance, and activation of the ground plane. This plinth respects the existing materiality of the concrete building, integrating seamlessly into the old.

The other two blocks were redeveloped under a mixed financial model similar to a right to buy scheme which allowed the residents to either buy their unit outright, buy the interior and still pay a lease on the shell, or simply keep renting.[4] For this model to work the circulation was altered, dividing the long external walkways of the slab typology into autonomously functioning segments all with their own entrances. New lifts and stairs were added to these blocks with all ground floor apartments having separate front doors.

New external lifts and stairs added with the use of glazing to create a visual connection and increase safety.

3.
Urban Renewal Europarei
Uithoorn, Netherlands
Atelier Kempe Thill

i-vi. Refurbished blocks
vii. Demolished blocks with new infill

Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

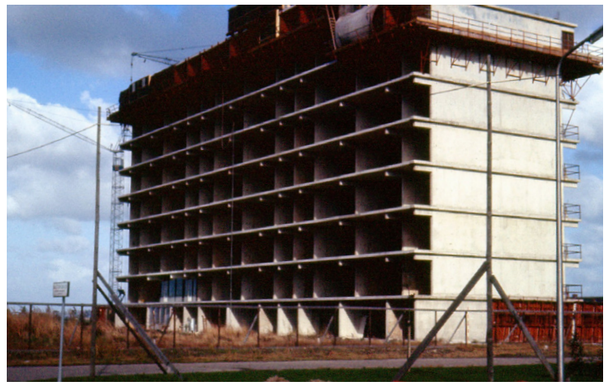
1. Breznak, V. 2016. Reestructuración de la vivienda social en Holanda: Caso Europarei, Uithoorn.
2. Reduce, Reuse, Recycle. Projekt 3.0. see. www.reduce-reuse-recycle.info

Europarei is a district located on the outskirts of Uithoorn near Schiphol airport. The neighbourhood was built to alleviate the increasing need for housing in Amsterdam and is an exemplar for its modernist sensibilities of high density blocks surrounded by open space. 30 years after the construction of nine slab blocks, the estate which accommodates 1000 rental dwellings, was in urgent need of refurbishment.

In 2000 the housing association, Eigen Haard Corporation (EH), and the municipality of Uithoorn established a number of initiatives to improve the estate and neighbourhood aspects through the introduction of programs, improve public amenity and safety, as well as the refurbishment of the existing homes. In 2004 a competition for the refurbishment was organised by EH with a brief to retain the existing structure while upgrading façades, entrances and renew services. It was planned that the refurbishment of the nine blocks was to extend the building's use of life by 15 years.

The inhabitants had long complained that the buildings no longer meet their needs, with poor energy performance, lack of ventilation, poor acoustics, and security issues. One of the most important factors of the works was ensuring the residents were involved with the plan and decision making.[1]

Atelier Kempe Thill won the competition with an ambitious proposal but it was only after further inspecting the building's structure (in-situ concrete frame with pre-cast floor panels) that it was deemed not viable due to technical reasons.[2] Due to the structural efficiency of the original design the building would not be able to withstand any additional loading, with any new interventions overloading the building's structural capacity. This would make the addition of acoustic façades, screeds or opening the ground floor up with new openings impossible. Any structural rectification works would be too substantial that undertaking the upgrades with residents still occupying the buildings was not possible.[3] Despite the refurbishment limitations, demolition of the buildings was logistically



Construction of one of the nine slab blocks at Europarei, 1967. Image Fam Rijnbeek

Retrofitted block of flats at Uithoorn, with new infill to the left.

3. AplusT. 2017, Kempe Thill urban renewal: Europarei, Uithoorn, The Netherlands. Density is Home.
4. Geo2. Determination of crane stability during the demolition of the Churchill apartment block, Uithoorn.

impossible for the housing association as they did not have vacant housing to relocate the residents during the new building. So a compromise of refurbishment strategies was developed.

The architect's approach to the renewal was to focus on the whole estate instead of individual buildings, improving the appearance of the precinct. The large expanse of open space and established landscape between buildings and the generous size of individual dwellings were retained while the buildings themselves were opened up and made more transparent. Key to the new appearance of the buildings was replacing the original metal sheeted balustrades along walkways with glass. On the ground, old dark entry foyers were opened up and new glass pavilions added. The use of glass, and facade cladding, a similar green colour to the trees, heighten the surrounding landscape as it is reflected by the buildings creating a coherent whole. While the long elevations with existing windows were all replaced higher performance glazing, the short ends were also insulated and wrapped in brick to match the existing appearance. In some blocks the first two floors were adapted for elderly with door widths increased and bathrooms adapted. Individual energy metres were introduced so the residents could pay exclusively for the energy they used. The realised design was undertaken with close resident engagement with all tenants remaining in the buildings during renovations.

The discussion of demolition was raised throughout the process despite the cost savings from trades refurbishing identical buildings. By 2010 six of the nine buildings were renovated and the common areas redesigned. It was then decided that the remaining three would be demolished and replaced with terrace housing. This would be avoided for some time due to the financial crisis but in 2019 demolition would begin, making way for 190 new homes.[4]

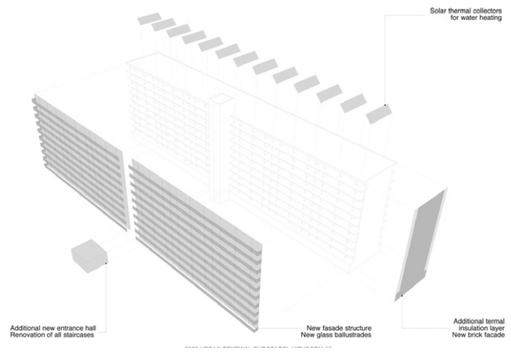
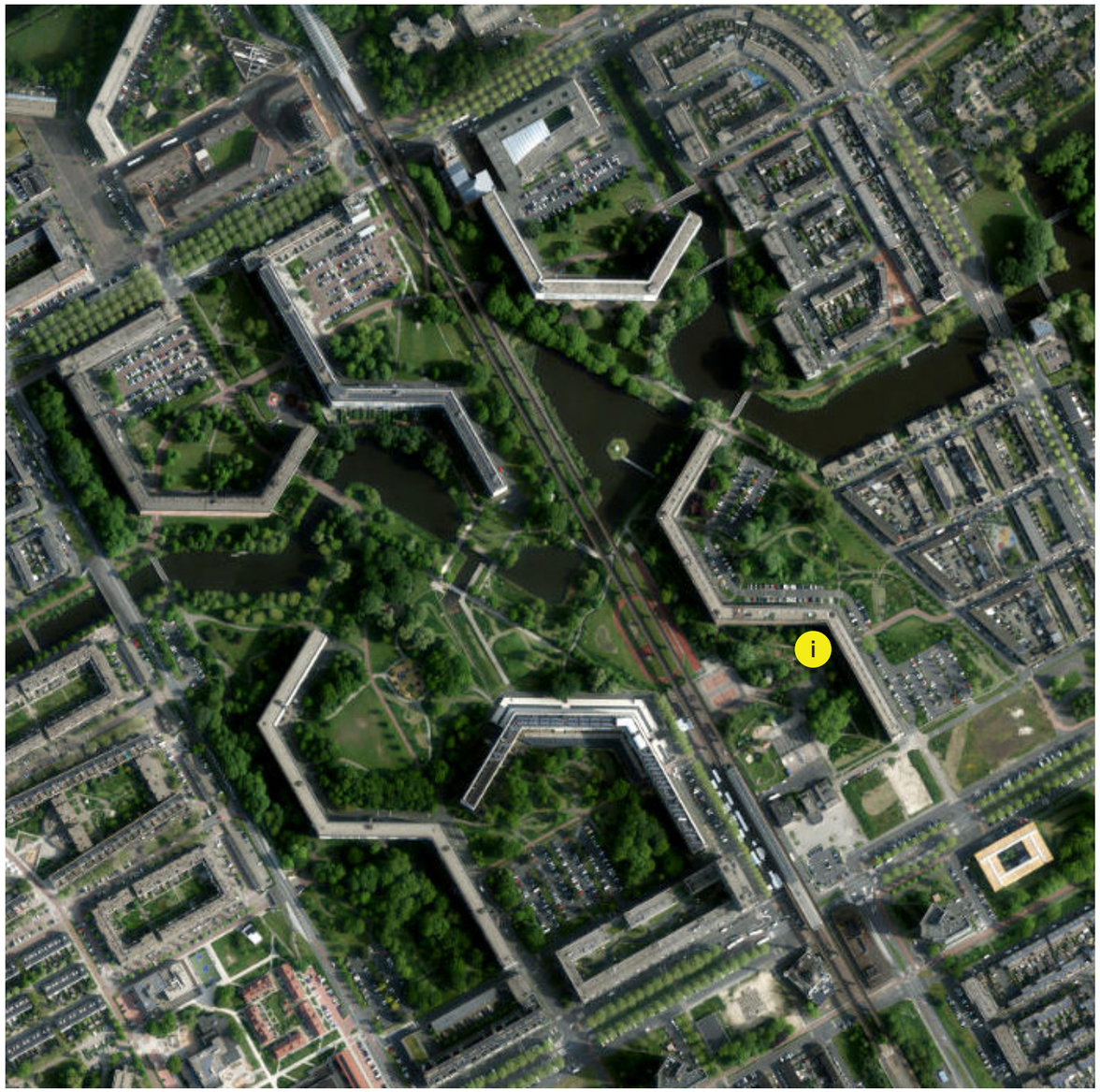


Diagram from Atelier Kempe Thill showing the elements that were added to the existing building.

New entrance to the stair and lift with pedestrian connection through to the other side.

4.
deFlat
Bijlmermeer, Netherlands
NL Architects with XVW architectuur

i. deFlat. Refurbished block



Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

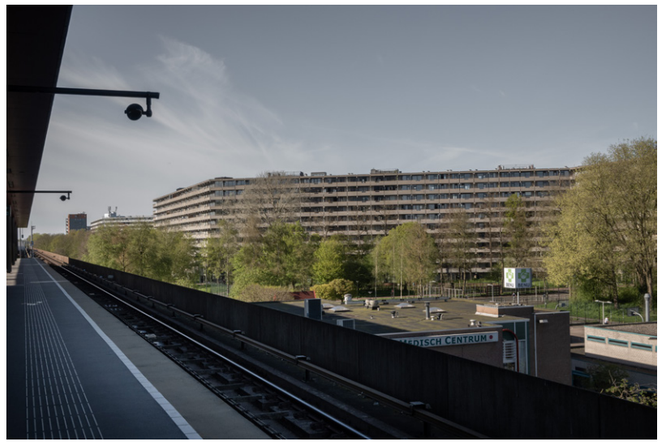
1. Stenberg, E. Mijanovic, J. KTH Arkitekturskolan. 2022. Studio housing: Mass housing catalogue. KTH Arkitekturskolan. Issuu.
2. Van Oorschot, M. 2021. Bijlmermeer estate by NL Architects with XVW Architectuur. The Architectural Review.
3. Kellerman, P. 2017. Back to the future in Amsterdam's Bijlmer Estate. Failed Architecture.

Located to the south east of central Amsterdam, Bijlmermeer Estate is a collection of postwar slab buildings. The estate was built between 1966-1975 and was intended to help with the housing crisis at the time with 70% of the 36,000 units allocated to the working class. The housing blocks were constructed largely of prefabricated concrete panels (EBA System).[1]

In 1974, due to lack of amenity and high rental prices 30% of the residents had moved out. This high vacancy rate along with a large population of recent immigrants and the urban poor gave the area a reputation of poverty and crime.[2] In the early 1990s, the municipality and housing corporations launched a major regeneration project to improve Bijlmer's urban environment. As part of this effort, the proportion of high-rise buildings in the estate was reduced from 95% to 45%, concrete underpasses and alleyways were removed, while additional amenities were introduced for residents.

In 2010 after lengthy decisions around the demolition of one of the biggest blocks, the Kleiburg, local protest encouraged a consortium of developers to propose that the buildings could be refurbished for a fraction of the price and reconfigured for the market.[3] The proposal was to renovate the main structure and services such as the lifts and communal spaces but to leave the apartments as an empty shell with no joinery, fixtures of fittings - these would be installed by the residents. This would minimise the initial investments and as such create a new business model for housing in the Netherlands. The remaining alterations conducted were intended to reintegrate the building with its surroundings.

Three external lift shafts which were added



View from the train station back at the block of flats.

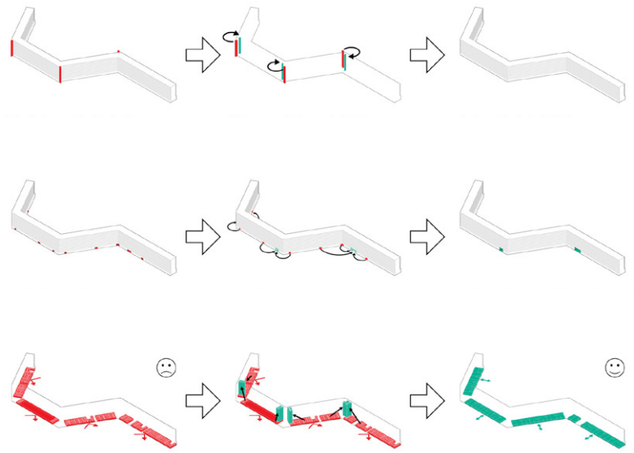


Diagram from NL Architects demonstrating approach to refurbishment.

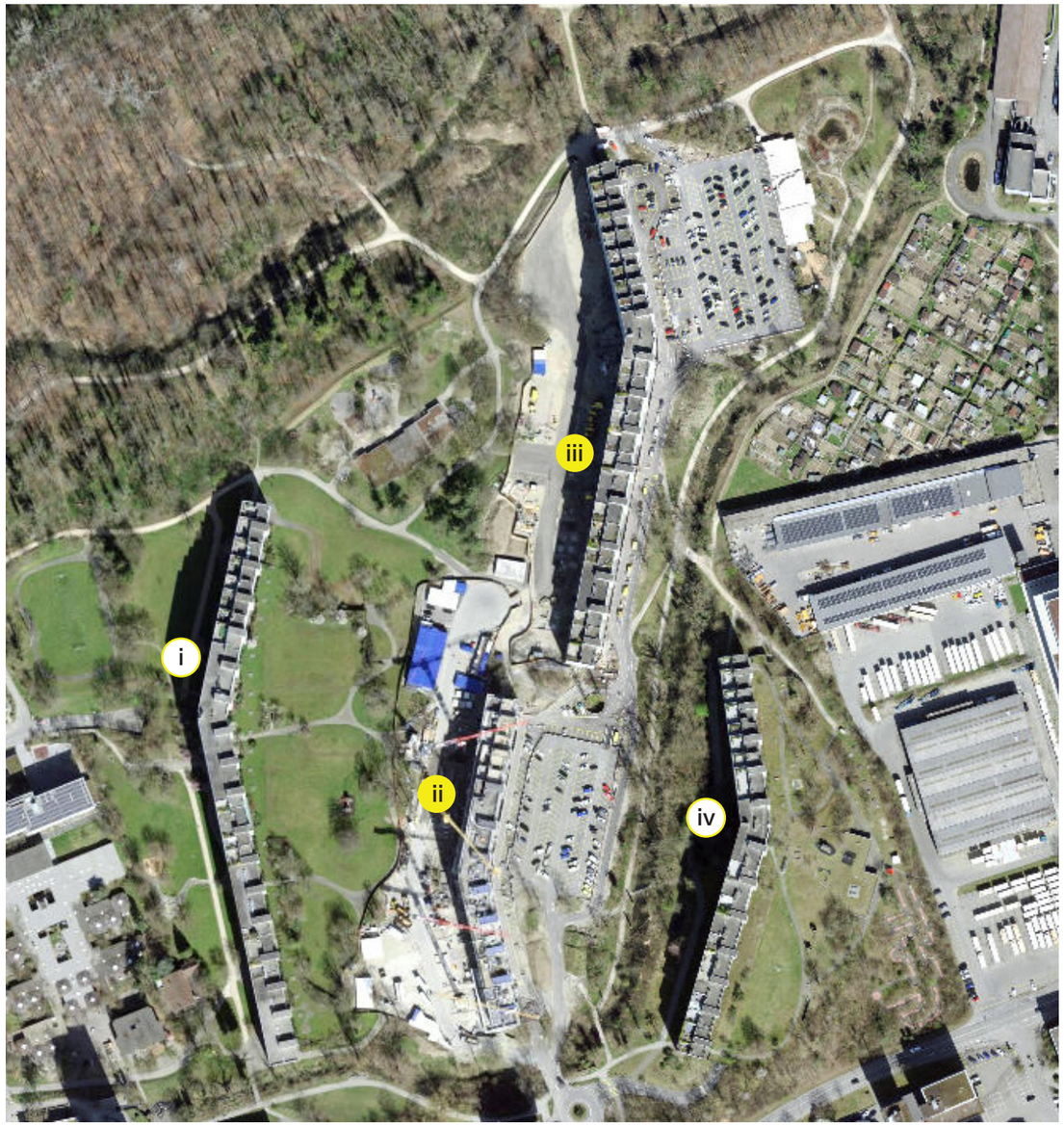
in the 80s were removed and new lifts reintroduced internally into the existing shafts. The original ground level was almost entirely storage units which created an impenetrable base to the building. Through retrofit, these areas were converted into shop fronts for businesses, ground floor units and bike lockers, with the storage units re-located to the upper levels. This allowed for a freeing up of the ground plane and more dynamic forms of occupation. The inclusion of ground floor units increased the total unit number to 500.

The exterior of the building was relatively unchanged except for the replacement of solid panels with glazing to rooms facing the external walkways, increasing natural light to those units. Paint which had been applied to the building over time was removed and the concrete which was in relatively good condition was left exposed.

Internal view from a refurbished ground floor flat.

5
Telli B and C
Aarau, Switzerland
Meili, Peter & Partner Architects

i. Block A. Existing block
ii. Block B. Refurbished block
iii. Block C. Refurbished block
iv. Block D. Existing block



Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

1. www.alts.axa-im.com/responsible-investing/esg-strategy/telli
2. www.meilipeterpartner.ch/
3. www.walo.ch/en/projects/energy-refurbishment-telli-aarau

The Telli Housing Estate, consisting of four residential blocks, a shopping centre, office tower, and community centre, began construction in 1971. Rows A, B, and C were completed by 1980, while Row D was finished later in 1991.

The estate is made up of four linear residential blocks, totalling 1,258 apartments. The buildings vary in height, with six to eight floors at the ends, stepping up to 19 floors in the middle. In 2015, AXA began the refurbishment of Rows B and C, which include 581 apartments.[1] The decision was driven by the buildings' poor energy efficiency, outdated gas heating, and inadequate thermal qualities. The goal was to extend the buildings' lifespan by 40 years. Architects Meili, Peter & Partner[2] were engaged to address the challenges posed by the estate's unique construction, which combines in-situ concrete load-bearing shear walls with large panel concrete floor slabs. The renovation was planned with minimal disruption to residents, ensuring that they could remain in their homes throughout the work.[3]

The Telli Housing Estate was under municipal ensemble protection, which required preserving the uniform appearance of the settlement while allowing for flexibility in improvements.

AXA set three key objectives for the renovation:

- Improve the buildings' energy performance and reduce consumption.
- Achieve a Swiss sustainability certificate for the project.
- Carry out the renovation without displacing residents.

Switzerland Housing Development Telli, 1972. Photo by Stinger.

New prefabricated balconies and service risers.

4. www.axa.ch/en/ueber-axa/blog/trend/telli-aarau-renovation-sustainability.html

The Telli Quarter, though not a protected monument, holds cultural significance for Aarau. The renovation approach was subtle, replacing façades with new balconies and wall linings that mimic the original design. Floor plans mostly stayed the same, with changes made only to the top-floor apartments. Despite modest ceiling heights (2.38m), the well-proportioned rooms and natural light improved functionality, maintaining affordable rents with only a slight increase.

Insulation improvements were made to the non-load-bearing outer walls, as the existing thermal insulation was much less effective. On the west facade, old balconies were replaced with larger prefabricated units, improving insulation and eliminating thermal bridges. These new balconies also house service risers for an exhaust system. All windows were replaced with triple glazing, reducing heating demand by 70%. Structural upgrades for earthquake resistance were undertaken with steel plates added to all floors to prevent the cores from disconnecting from the rest of the building. Fire safety upgrades were also required to meet current codes, including the installation of new alarm systems, emergency lighting, and smoke extraction systems.

The renovation focuses on minimal intervention. Although heat recovery was initially considered, a life cycle assessment showed no significant gains in overall energy efficiency. Overall, the building envelope improvements and shift to renewable energy are expected to reduce the estate's annual CO2 emissions by 1,000 tons.[4] In addition to energy savings, AXA aims to enhance the economic and social aspects of the buildings, ensuring compliance with the Swiss Sustainable Building Standard.

The renovation works were scheduled in two-hour increments, with affected residents relocated for ten days while the new balconies were installed and rectification works took place. The installation process was carried out sequentially, affecting four apartments at a time across the two buildings. The schedule was also used during the tendering process to ensure that builders understood the scope of work and potential risks. Residents impacted by the works were offered the option to temporarily leave the estate or be relocated to one of 35 fully equipped temporary apartments available on-site.

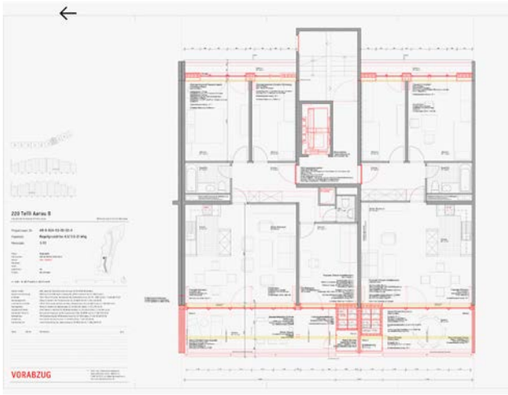
Renovation of Telli housing development in Aarau with 581 apartments in total across blocks B and C. Image by AXA

Installation of the prefabricated balconies. Photo by Fabien Schwartz, Karin Gauch

When the retrofit began, it was estimated that four balconies could be delivered and assembled in a single day, with the old balconies removed and recycled. Over the following eight days, rectification work was carried out both internally and externally, with teams focused on protecting residents' furniture and valuables while they remained in their apartments.

After the renovation, greenhouse gas emissions were reduced by 82%, and heating requirements dropped by 63% compared to the winters before the renovations. Although there was a rent increase for the residents, this was offset with significant reduction in energy costs with a reducing heating demand by two-thirds.

The continuous support provided to residents before and during the construction phase played a crucial role in the success of the project. Open communication and direct engagement with the residents were key to ensuring the smooth execution of the retrofit. Despite construction, three-quarters of rental contracts remained unchanged, demonstrating the project's success in retaining residents and maintaining community stability.



Plan of the proposed works (red). New balcony with integrated service risers to the bottom of the page.

6
Tscharnergut Waldmannstrasse 39
Bern, Switzerland
Matti Ragaz Hitz Architekten and Rolf Mühlethaler

i. Waldmannstrasse 39. Refurbished block
ii. Waldmannstrasse 25. Refurbished block
iii. Fellerstrasse 30. Earmarked for demolition

Built between 1958 and 1966 in Bern, the Tscharnergut estate consists of five high-rise buildings, eight slab buildings (Scheibenhäuser), and two rows of single-family homes. The buildings were constructed using a hybrid system combining prefabricated floor-high load-bearing facade panels by Element AG[1], brick load-bearing partition walls, and concrete floors. The variety of building types was designed to reduce monotony and create distinct outdoor spaces between the buildings. The estate includes various community facilities, such as play areas, sports facilities, a shopping centre, a prominent neighbourly square, and a restaurant. Covering 125,000 m^2, the estate houses up to 5,000 residents in 1,182 flats.[2] Due to its architectural significance, the buildings were granted heritage status, limiting the types of renovations that could be carried out.[3]

As the buildings neared the end of their 50-year service life, the FAMBAU Cooperative, the largest owner in the estate, initiated an architectural competition in 2006 to explore options for renewing the estate. The goal was to determine the best approach for renovating the Scheibenhäuser.[4] Matti Ragaz Hitz Architekten and Rolf Mühlethaler won the competition, and the owners decided to proceed with a pilot renovation of Waldmannstrasse 39 to model future upgrades. A round-table process involving all owners and relevant authorities led to a planning agreement aimed at streamlining future renovation approvals.

A thorough investigation of the building's structure revealed that many elements required extensive repairs. For example, the west-facing façade elements were poorly anchored and at risk of collapse, necessitating a full replacement. Although the heritage department initially opposed major changes, a compromise was reached, involving a 3-meter extension and the complete replacement of

1. www.mrh.ch/projekte/tscharnergut-waldmannstrasse-39-bern
1. System Serie. Element AG. System Serie - www.system-serie.ch/element-ag.html
2. Schär, M. (2022). Community centres in increasingly diverse neighbourhoods: Policies and practices of community building in post-war housing estates in Switzerland.
3. www.fellerstrasse30.ch/de/medienmitteilung
4. Chen, Z. 2008. Good life in the city: In search of strategies and solutions in high-density housing.

Historical image of Tscharnergut in the 1960s. Image studentlodge.ch

Construction works to the existing building. Image Fellerstrasse30

5. www.fellerstrasse30.ch/de/medienmitteilung

the vertical access towers. On the western façade, the living rooms were extended by 3 meters, increasing the floor area of all apartments. The eastern side of the building was largely preserved, with the stair cores replaced to create barrier-free access and incorporate new lifts. The renovation also included an earthquake upgrade, thermal improvements such as new windows, roofs, and insulation, and the renovation of wet rooms and kitchens—all while the building remained occupied.

Following the completion of the renovation, FAMBAU publicly released a detailed assessment of the refurbishment, responding to the Heritage Council and City's stance on preservation.[5] They also submitted an application for the demolition and new construction of the building at Fellerstrasse 30.

FAMBAU now faces challenges due to the high costs and difficulties of renovating the remaining slab buildings, with the existing building fabric no longer meeting current material standards. The structural condition of the buildings made it impossible to meet legal requirements or implement necessary improvements, such as sound insulation. The civil engineer's assessment confirmed that the building could not support additional weight, forcing the abandonment of planned sound insulation upgrades. Additionally, the apartment partition walls and ceiling structure were inadequate, further complicating the renovation process. The inability to modify the building's access or ensure compliance with safety and accessibility standards also presented significant challenges.

In light of these difficulties, FAMBAU is now pushing for the demolition and redevelopment of the remaining slab buildings, particularly focusing on Fellerstrasse 30. However, they are encountering resistance from the Federal Commission for the Preservation of Monuments and the Municipal Monument Preservation Department, which emphasise the high level of protection for the estate. FAMBAU argues that the existing buildings no longer meet the standards required for modern living and that heritage controls are limiting their ability to provide more suitable housing for tenants.

Internal images of the refurbished flats.
Photos by Alexander Gempeler.

With respect to the existing heritage of the building the architect's treatment to the new facade and balconies integrate seamlessly into the estate.

7
Gueterstrasse 30
Pforzheim, Germany
Freivogel Mayer Architekten

i. Gueterstrasse 30. Refurbished tower

Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

Located near the Pforzheim train station, this nine-storey residential block, built in the 1970s, recently underwent extensive refurbishment to meet contemporary standards and achieve nearly zero-carbon emissions. Originally owned by Deutsche Bahn, the building was primarily occupied by long-term residents, some of whom had lived there for over 40 years. It was initially constructed as a high-rise for senior railway officials, featuring 16 apartments, each 80-90m2 in size. In 2009, the property was acquired by housing provider Pforzheimer Bau und Grund GmbH.

The project was one of 20 funded by the German Energy Agency's "Zukunft Haus" program, which aims to promote carbon-neutral construction and renovation.[1] This initiative focuses on innovative residential projects that go beyond conventional standards, showcasing ground-breaking solutions for the future. Despite the technological advancements in the refurbishment, the architects ensured that the building's classic urban form remained intact and was not overshadowed by the modern updates.

The existing building was in relatively good condition, though it had issues such as leaks in the facade and windows, outdated bathrooms, and extremely high energy consumption and operating costs. The retrofit aimed to achieve a high-performing, insulated building envelope, new decentralized ventilation systems, and more generous private outdoor spaces.

The building envelope was upgraded to meet passive house standards, significantly enhancing resident comfort. Triple glazing, high-performing insulation, and thermal bridging prevention were key components of the upgrade. An additional level of apartments was added, increasing the number of units and improving the building's proportions. Existing balconies were replaced with larger outdoor living spaces, and the new facade seamlessly

1. Power, A. 2008. The German Zukunft Haus pilot program: Energy-efficient retrofitting of multi-family dwellings. Energy Policy.

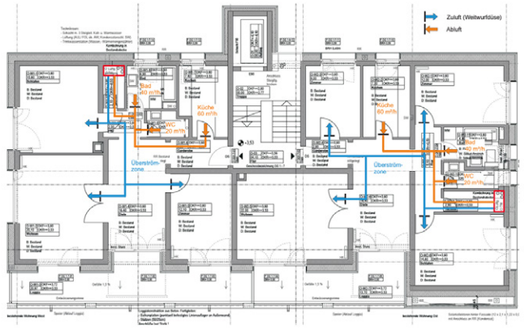
Before and after of the building. Image Freivogel Mayer Architekten

2. www.transsolar.com/projects/refurbishment-high-rise-residential-building

integrated the extension with a timeless design. Parapets were extended past the roof-line to conceal photovoltaic cells, preserving the building's urban character.
Old electric heaters and hot water boilers were replaced with a combustion-free HVAC system. The new facade with integrated capillary absorbers, combined with a heat pump, generate hot water for both heating and domestic use. An ice storage tank under the adjacent parking lot serves as seasonal energy storage. The building operates as a low-energy house, with low supply and return temperatures, necessitating the use of ceiling-mounted panel radiators. Due to the building's high airtightness, mechanical ventilation was also installed. Flaps were added next to windows on the north and west sides to accommodate the ventilation units, which include fans, a heat exchanger for waste heat recovery, and a control unit. The ventilation system is concealed by a suspended ceiling, with air being supplied to rooms via new outlets above door lintels. The air exchange rate is low, so forced ventilation was not necessary in living rooms and bedrooms; instead, air escapes through door gaps, while the kitchen and bathroom feature extraction systems.

Renewable energy systems, including photovoltaic panels and a wind turbine, generate enough electricity to power the building, with excess energy being fed back into the public grid.
The renovation work was carried out while residents remained in the building, which meant interventions within the apartments were kept minimal. To reduce on-site labour, extensive prefabrication was employed. The new facade was re-clad with pre-cast stone panels, while the concrete balconies and structure were delivered prefabricated.

The energy consumption of the building is now significantly lower, and the reduced energy costs have offset the rent increase for residents, greatly enhancing their comfort and well-being. Carbon emissions have been reduced by 95% compared to the building's previous performance.[2]

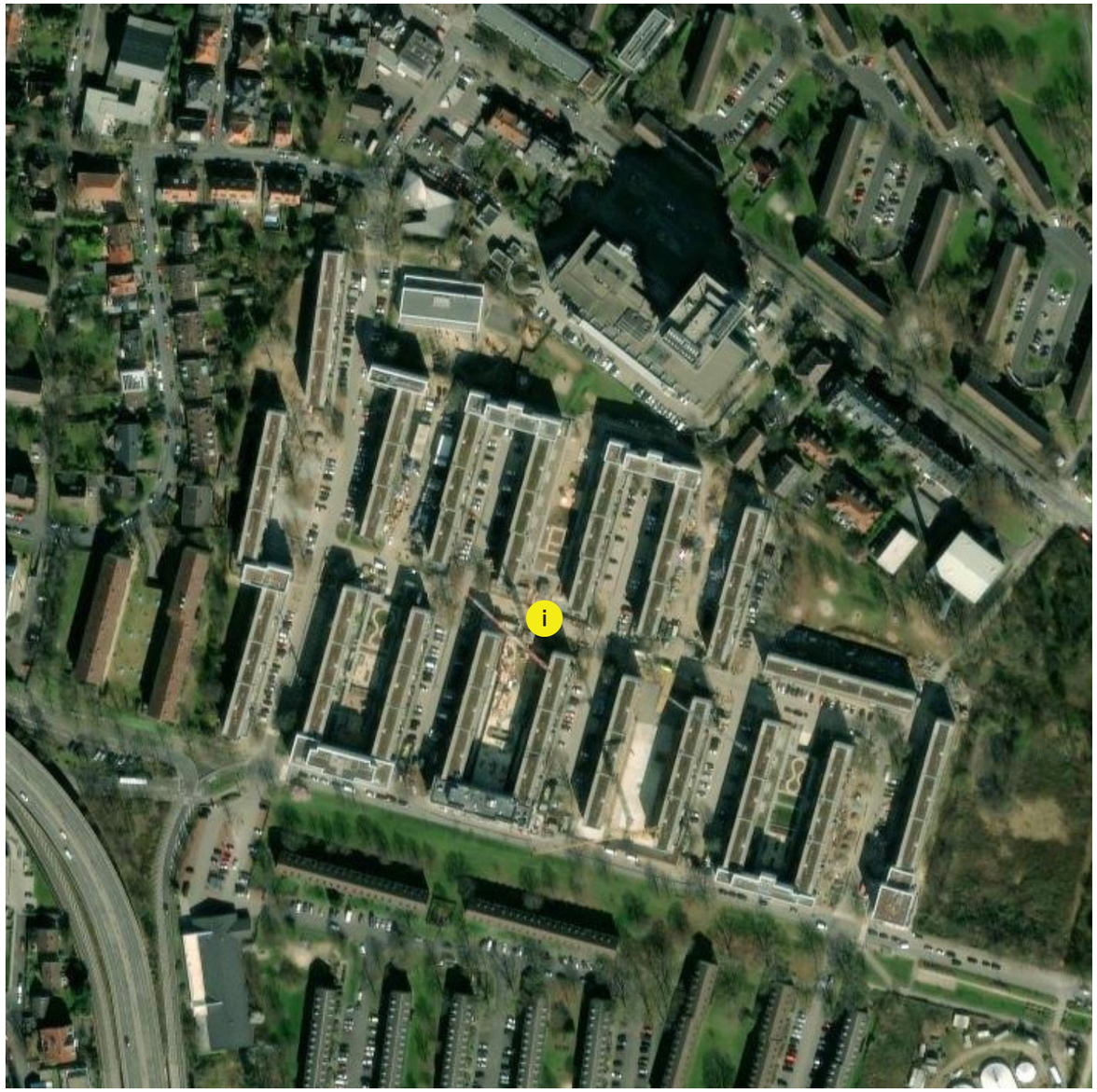


Proposed plan showing the added insulated facade, balconies and services.
Freivogel Mayer Architekten

The treatment to the new facade and balconies integrate the building into its context, located directly across from the train station.

8
Platensiedlung
Frankfurt, Germany
Stefan Forster Architekten

i. Platensiedlung. Refurbished blocks and infill



Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

1. www.sfa.de/de/
2. Mauritz,A. SFA. (2016). Mietermagazin: Platensiedlung.

The Platensiedlung is a housing estate in Frankfurt's Ginnheim district, originally built in the 1950s to house US Army soldiers and their families. After the American Military's withdrawal in the 1990s, the estate was sold to the German government and later to local developer ABG Frankfurt Holding, which has owned it since. The estate is split into northern and southern sections by Platenstrasse, located about three kilometres north-west of the city centre. In recent years, the Platensiedlung had made headlines in the Frankfurt newspapers, as a "problem district".

Architect Stefan Forster was tasked with developing a strategy to refurbish the existing buildings and increase density by adding new buildings to the Platensiedlung estate.[1] Construction began in 2017 and was completed in three phases, starting with the renovation and extension of the existing buildings through locating prefabricated units on top of the existing buildings and the addition of 15 new infill blocks.[2] Through this approach the housing stock in the area nearly tripled without ABG needing to build on new land or acquire costly property.

The project initially focused on the northern section, which consists of 19 three-storey linear buildings with pitched roofs. The densification of the northern part of the settlement involved strategic interventions in the existing buildings. In the first phase, the roofs of the row houses were removed, and the buildings were increased from three to five stories through modular wooden construction, allowing residents in lower floors to stay in their homes during the work. The foundations of the houses had to be strategically strengthened before the storeys were added using a high-pressure injection method (HDI), this method also allows the static properties of individual parts of the building to be subsequently improved without having to replace them. The new additions connect into existing pipes for heating and wastewater and the existing stairwells were extended by stairwells in solid wood construction for the addition. To accommodate the new floors, old gable roofs were removed and replaced with strengthened flat roofs, prepared for the additional floors with

Aerial image shows the refurbishment work to the existing buildings. Image from SDG21

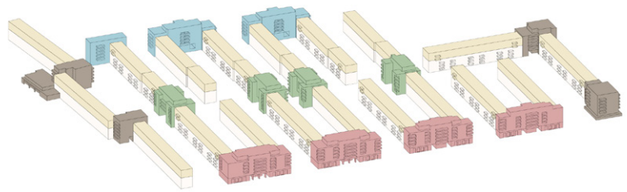


Diagram shows the addition of two floors on the existing buildings and infill housing to the site. Stefan Forster Architects

Semi-private squares are created through the new infill housing.

3. SDG21. 2019. Platensiedlung in Frankfurt-Ginnheim. SDG21.
4. ABG Frankfurt Holding. Platensiedlung. Die Platensiedlung hat ein neues Gesicht.
5. Dach Holzbau. 2021. Aufstockung der Platensiedlung in Frankfurt. Dach Holzbau.
6. Mauritz,A. 2016. Mietermagazin: Platensiedlung. SFA.

a ring anchor. Bitumen membranes were applied for moisture protection.

All 342 existing apartments were retained and upgraded with new windows, insulation, and redesigned façades to create a unified appearance. Additionally, entrances, stairwells, basements, heating systems, and outdoor areas were modernised. The redevelopment also addressed the estate's lack of essential amenities such as shops, medical offices, cafés, and childcare facilities, adding new community spaces. In addition, 370 new parking spaces were created in five underground garages. Once complete, the project added 26,525 m^2 of living space and installed 1,102 modular units, increasing density on the existing land without demolishing any buildings.[3] The tenants were able to stay in their apartments during the construction work.[4]

The Platensiedlung expansion includes six-storey end buildings (gatehouses, bridges, and end houses) that transform the estate into a more urbanised space. This architectural approach creates clearly defined urban spaces, enhancing the typology of the urban block. The project balances increased housing density with the preservation of open, green areas. Filling in the ends of the existing blocks added private gardens and created a clear built edge along Platenstrasse, with new shops and cafés. The communal areas are more defined, and the expansion combines private, communal, and public spaces. In addition to housing, the redevelopment introduces nine shops, two daycare centres, and a tenants' meeting space. Underground parking beneath the open spaces allows level access to ground-floor apartments, while also raising the open-air areas.

Innovative processes, like the mass prefabrication of timber structures on existing buildings, help reduce construction costs. Throughout the renovation, existing residents remained in their apartments, allowing the construction management to contribute to maintaining a stable, intact community.

The CLT wooden modules for the extension were assembled in a temporary "field factory" in Frankfurt, located five kilometres from the site.[5] After the Frankfurt projects, the field factory will be relocated based on future needs. The field factory's proximity to the construction site reduces transportation time, and minimises on site noise and dust.. With high prefabrication, 20 apartments can be added in just 20 weeks. The extension process works on multiple buildings simultaneously, significantly shortening the overall project time-line. Once the modules are in place, the roofs are double-insulated, sealed, and greened to meet energy standards and improve rainwater retention. This modular approach provides a cost-effective, sustainable solution for urban densification, creating affordable housing and easing pressure on the housing market.

All tenants will remain in their apartments during construction,[6] with no structural changes except for window replacements. As part of an ongoing tenant dialogue, detailed information is provided about the upcoming work, schedules, and gather their suggestions and preferences. This close engagement with tenants is standard practice at ABG. An on-site information office was available, ensuring a direct contact person for any questions. Tenants could also actively participate in the design of the courtyards through that dialogue. During this core construction period, when it can inevitably get loud and dusty, we will reduce the rents in the affected apartments.

The "Platensiedlung" project demonstrates the potential for high-quality, value-added urban development through complex densification by a municipal housing company. It could serve as a model for similar projects across Germany as well as Europe and internationally. A study by the Technical University of Darmstadt highlights the project's promise, revealing that the addition of storeys and conversions of existing buildings could create up to 1.5 million residential units nationwide, focusing on residential buildings from the 1950s to the 1990s. Including non-residential buildings, the potential increases by over one million units.

Communal areas above the below-ground carparks are landscaped carefully to blur the public and private edge.

9
Haus 1-7
Leinefelde, Germany
Stefan Forster Architekten

i. Haus 1. Refurbished block
ii. Haus 2. Refurbished block
iii. Haus 3. Refurbished block
iv. Haus 4. Refurbished block
v. Haus 5. Refurbished block
vi. Haus 6. Refurbished block
vii. Haus 7. Refurbished block

Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

1. Architectural Review Australia, 2004. Issue 088.
2. www.world-habitat.org/world-habitat-awards/winners-and-finalists/zukunftswerkstadt-leinefelde/
3. www.sfa.de/de/

Located in the former East German region, the reunification of Germany in 1989-1990 fundamentally affected the small industrial town of Leinefelde leading to the collapse of the textile industry and destroying its economic base.

With growing unemployment rates, many inhabitants left for other more prosperous regions in Germany, leaving their flats empty. The plattenbau[1] are low-quality, standardised prefabricated units, which made up the bulk of the housing stock. These were unappealing in the developing competitive housing market and those tenants with a higher income began to move out.

Demand for rental flats in the Südstadt district of Leinefelde fell to 50% of the supply, with little or no economic possibilities for the remaining flats.[2] A Europe-wide architectural competition announced in 1996 was designed to develop new ways of dealing with the prefabricated housing. After winning second prize, Stefan Forster[3] implemented the Lessingstrasse 10-32 project, the conversion of 120 prefabricated housing units. In contrast to previous approaches to the “slab,” their goal was to fundamentally transform the building’s appearance and integrate the units into the ground plane. Foreste stated “After the renovation, the building should evoke a sense of openness, freshness, and optimism.”

Over eight years Stefan Forster completed seven refurbishment projects Haus 1 - 7 using similar renewal strategies and principles.

<u>Haus 1 - 1999</u>
Haus 1 completed in 1999 was the start of a number of projects architect Stefan Forster would undertake on the collection of large-panel-system concrete buildings on the estate. The projects explore ways of reducing the visual severity of the blocks while mediating the ground conditions.

In Haus 1 the perimeter masonry wall gives the building a new base mediating between public and private while also creating private gardens for the residents on ground floor and defining

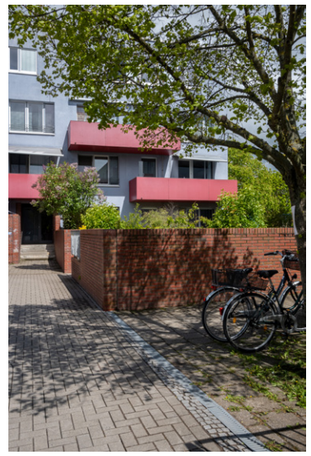
The removal of panels reduced apartment numbers to deal with the vacancy rate, while also creating a new identity for the buildings and residents that live there. Image Stefan Forster

a new entry for the building. Colour is added to the façades with new glass balustrades to the existing balconies and roof terraces added to the south and west façades increasing each unit's footprint and allowing more natural light and ventilation within.

Haus 2 - 2001
Several measures were taken to transform the building into a more diverse and human-scaled residential building. Reducing the height to four floors by removing the top two storeys addressed challenges with hard-to-let upper levels and enhanced privacy, with only eight apartments per stairwell. A continuous perimeter masonry wall divides the space into private, communal, and public areas while creating protected entrance zones. This wall also serves as a unifying element, providing structure and organisation to the complex. The façades feature small red balconies on the street-facing side contrasting against larger, staggered balconies overlooking the garden. Internally, all fixtures were removed, and three distinct floor plans were introduced, developed in collaboration with residents.

Haus 3 - 2002
Following the principles of Haus 2, the building has been reduced from six to four storeys, decreasing the number of apartments per stairwell and improving privacy. A masonry base visually anchors the building to the outdoor spaces, fostering a cohesive connection between them. A single standardised floor plan has been adapted to create a variety of apartment types. On the street-facing side, lower enclosures establish a distinctive rhythm, punctuated by building entrances, while compact balconies aligned with these entrances provide balance. Ground-floor apartments benefit from spacious, sheltered gardens, while an arrangement of balconies in varying designs and sizes brings structure and visual interest to the façade above.

Haus 4 - 2003
This relatively compact panel-system block, originally containing just 20 apartments, underwent significant refurbishment to enhance both functionality and aesthetics. The redesign prioritised creating open spaces for residents, offering private gardens for ground-floor units, balconies for the middle floors, and rooftop terraces at the top. To achieve this, two storeys were removed, and a continuous masonry wall was constructed around the plot, visually grounding the building. Roof terraces, carved from the upper floor, provide expansive outdoor areas while adding a sculptural element to the structure. The façade is further accentuated by bright red, elongated balconies that enhance its visual identity.



Haus 5 - 2006
This refurbished concrete panel high-rise now defines the north-western boundary of this section of Leinefelde, serving as a transition from the estate to the surrounding countryside. Originally five storeys, the building was reduced to three, with a central section removed to create two separate, aligned blocks. A continuous balcony added to the west side, with a subtle colour transition, visually marks the estate's edge. The redesign focused on enhancing openness and privacy—interior walls were removed to introduce open floor plans on the top floors, while ground-floor apartments benefit from private gardens.

Haus 6 - 2007
This building takes the theme of reduction—central to Leinefelde's urban redevelopment—even further by introducing both horizontal and vertical changes. The structure was shortened by removing two segments at each end, while two storeys were eliminated to reduce its height. L-shaped subtractions create a striking sculptural effect, with stepped levels on the south side adding a dynamic, playful quality to the tower and end sections.

Generously sized roof terraces on the upper floors enhance the living experience, offering new outdoor spaces for residents. At ground level, a continuous brick base— a signature element of Leinefelde's regeneration—anchors the building within its surroundings, providing a clear boundary between the public space and the private gardens of ground-floor apartments.

Haus 7 - 2004

The “Haus 07” town villa, completed in 2004, represents the most radical transformation among the seven projects in Leinefelde’s urban redevelopment. A 180-meter-long prefabricated building was re-imagined as a series of individual houses by removing seven segments and one entire floor. This transformation resulted in the creation of the “Stadtvilla”—a small, multi-storey apartment building with a square floor plan, introducing a new typology to the area. Despite the high renovation costs, the architect argues that this approach is still more cost-effective than constructing a new building of similar quality.

Internally, the houses were extensively modernised based on resident feedback. Stefan Forster introduced five different floor plan variants, moving away from the standardised three-room typical layouts, which were common in Leinefelde. Kitchens and bathrooms, previously enclosed, now benefit from direct daylight through enlarged windows, while alternating 1.80-meter-deep balconies on the south and west sides further enhance the living spaces. A notable innovation is the introduction of four maisonette apartments on the ground floor—achieved by removing two ceiling panels to create vertical connections. These apartments follow a classic terraced house typology, with a kitchen, living room, and guest toilet on the ground floor, and a bedroom and bathroom on the upper floor. The direct connection to private gardens makes them ideal for families with children, highlighting the potential of adapting prefabricated buildings for contemporary living needs.

As part of the broader master plan, over 1,700 apartments were demolished—four years ahead of schedule—while 2,500 apartments were refurbished, with more than 1,630 now featuring private green spaces. This significant investment in housing upgrades has drastically reduced vacancy rates to just 10% overall, with only 3.5% of refurbished units remaining unoccupied. Beyond housing improvements, all educational and social facilities in the area have been renovated or re-purposed for public use, contributing to the communities revitalisation.

During demolition, innovative methods were employed to maximise the reuse of prefabricated concrete slabs for both new construction and landscaping. The refurbished units are now primarily managed by community housing providers, with potential opportunities for private ownership. The low vacancy rates have enabled these housing providers to consolidate and grow, ensuring the project’s long-term sustainability. A strong partnership between the housing provider and residents has been key to the project’s success, with ongoing communication facilitating scheduling, planning, and relocations.

Haus 7 with its ‘town villa’ typology, new openings and balconies allowing views, natural light and ventilation from all sides.

10
Highrise Stieglitzweg
Berlin, Germany
Blumers Architects

i. Highrise Stieglitzweg. Refurbished tower

Gropiusstadt, located in Berlin Neukölln, was developed in the 1960s as a satellite town by architect and Bauhaus founder Walter Gropius. The plan aimed to create 18,000 apartments for 50,000 residents within ten years, with 90% designated as social housing.[1] The project included four underground railway stations, a swimming pool, a shopping centre, schools, and nurseries, along with the planting of 15,000 trees.

From 2016 to 2018, Blumers Architects[2], commissioned by GEHAG (now part of Deutsche Wohnen), undertook the complete renovation of a 14-storey high-rise residential building in Stieglitzweg, part of the Gropiusstadt estate.[3] The project aimed to address the building's poor energy performance by upgrading its thermal envelope, all while ensuring residents could remain in their homes during the renovation. Despite varying opinions on high-rise buildings and large housing estates, many residents of Deutsche Wohnen in Gropiusstadt enjoy living there. The apartments are well-designed, spacious, and filled with natural light from large windows. The community remains vibrant, with many original tenants still living in the area, enjoying the neighbourhood's sense of liveliness.

The renovation of all 84 apartments in the high-rise building included redesigning the entrance area, corridors, and stairwells, along with a complete facade upgrade. The new facade, a rear-ventilated Alucobond system, gives the building a modern, striking appearance. Graphic patterns inspired by abstracted city plans are applied to the panels, alternating with silver-colored elements for a dynamic effect.

1. Systea Systems. Project report: Stieglitzweg.
2. www.blumers-architekten.de
3. www.deutsche-wohnen.com/en/living/our-neighbourhoods/gropiusstadt

Historical photo of the building. Image Blumers Architects

The newly refurbished tower, over-clad in a Systea composite panelling.

The facade not only enhances the building's aesthetic but also serves ecological, economic, and social functions. To achieve a highly efficient thermal design, the planners selected a proven, thermal bridge-minimized substructure system from SYSTEA. This system features passive house-certified, L-shaped stainless steel wall brackets and the ALWI-S profile system, with horizontal hat and Z-profiles for secure and cost-effective attachment of the facade elements. Thermostop elements were used to minimize thermal bridges, ensuring the facade is both high-quality and sustainable.

Deutsche Wohnen is the owner of 16 high-rise buildings in Gropiusstadt, which were extensively refurbished between 2016 and 2021. The renovation of the tower is intended to serve as a model for the entire settlement not only providing more energy efficient homes but giving the buildings a new identity.

New landscape works around the buildings with spots to sit and interact with other residents,

Newly refurbished towers can be seen throughout the neighbourhood.

Bike shelters and community infrastructure is located next to the entries.

11
Ahrensfelder Terraces
Marzahn, Germany
Degewo

i-iv. Ahrensfelder Terraces. Refurbished blocks

Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

1. www.c20society.org.uk/building-of-the-month/marzahn-housing-development-berlin
2. www.//www.visitberlin.de/en/ahrensfelder-terraces

Marzahn, a district in East Berlin, was established in 1979 as part of a rapid construction initiative by the German Democratic Republic, resulting in tens of thousands of prefabricated apartments built in just a few years.[1] After German reunification, the appeal of Marzahn's large prefabricated high-rise estate declined, leading to many residents moving away. By the early 2000s, Degewo, the municipal housing company, faced a vacancy rate of around 30%, with Ahrensfelde, in the northern part of Marzahn, particularly affected.[2] Despite being built in 1987, the eleven-storey prefabricated buildings were already in poor condition, prompting the Berlin Senate to consider demolition due to insufficient funds for renovation.

However, the demolition plan faced strong opposition from tenants, the housing association, and local representatives. This led to a meeting between the Urban Planning Office, the Resident Advisory Board, Degewo, and the Senate Department for Urban Development, resulting in a consensus on a bold vision: a major urban redevelopment project to reduce the number of apartments while improving their quality, transforming Ahrensfelde into a model of sustainable urban development.

Rather than demolish, the plan was to transform the existing prefabricated buildings. Between 2003 and 2005, Degewo, with support from local housing company WBG Marzahn, restructured 16 eleven-storey blocks into three- to six-storey buildings, creating the Ahrensfelder Terraces. The modular design of the buildings allowed for easy dismantling, as the large panels were removed.

The transformation introduced modern amenities, such as larger kitchens, upgraded bathrooms, balconies, and tenant gardens. Degewo also redesigned the floor plans, offering 39 layouts ranging from 48 to 102m² to meet diverse needs. The unpopular existing

Existing unmodified blocks can still found in the district.

The undulating roof-line follows the modular panel dimensions as parts were removed to reduce the scale and appearance.

3. www.visitberlin.de/en/ahrensfelder-terraces

large five-room apartments were divided into smaller, more desirable units. Energy efficiency was enhanced with new thermal insulation and windows. Additionally, 22 prefabricated buildings were completely removed to create more green space.

In under two years, 1,689 deteriorating prefabricated units were transformed into 447 high-quality apartments, making the Ahrensfelder Terraces a success. Vacancies quickly disappeared, and 38 of the newly refurbished apartments were sold to private owners. Urban development experts from across Germany visited Marzahn to study this innovative transformation.

Today, the Ahrensfelder Terraces stand as a flagship project in the Marzahn-Hellersdorf district, demonstrating successful urban redevelopment. However, with a total cost of over €30million,[3] this transformation is not easily replicable on a larger scale across similar housing estates.

External lifts retrofitted to the existing buildings.

Through the removal of panels from the existing buildings a new identity and scale is achieved.

12
Märkisches Viertel
Berlin, Germany
GESOBAU

Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

1. www.wernerduettmann.de/en/karte/wohnbauten-im-maerkischen-viertel
2.Stenberg, E. Mijanovic, J. KTH Arkitekturskolan. 2022. Studio housing: Mass housing catalogue. KTH Arkitekturskolan. Issuu. page 83.
3. www.use.metropolis.org/case-studies/deutschlands-grosste-niedrigenergiesiedlung-das-markische-viertel#casestudydetail
4. ibid

Märkisches Viertel, located in West Berlin, is a neighbourhood home to 35,000 residents and characterised by high-rise buildings constructed in the 1960s. It is one of many large housing estates built on the outskirts of Berlin following the post-war restructuring of the city centre. A total of 25 architects, including Karl Fleig, René Gagès, Georg Heinrichs, Chen Kuen Lee, Ludwig Leo, Oswald Mathias Ungers, and Astra Zarina, collaborated on the design and realisation of the buildings.[1] With 16,400 units in total the construction of the buildings was done primarily by state-owned construction and housing company Gesobau acted as the landlord and construction company. Around half of the buildings were built using the concrete large panel system.[2]

Over time a large proportion of the estates population were unemployed or relied on social assistance, especially migrants and young adults. Due to the rise in social issues the neighbourhood was included in West Germany's national Urban Restructuring program in January 2009, which allowed public funding for the restoration of social infrastructure and public spaces.[3] The redevelopment project aimed to improve housing quality, the residential environment, and social infrastructure by upgrading both structural and aesthetic elements of the district. It was then that GESOBAU, one of Berlin's municipal housing societies, began an extensive energy-efficient renovation of over 13,500 apartments in Märkisches Viertel. An exhibition in 2009 informed residents about the program's objectives and transformation plans, with further updates provided in 2013 to showcase progress.[4] Local residents were actively involved in the planning process through regular consultations and feedback opportunities.

The Urban Restructuring program also included the development of green areas, new sports facilities, and the renovation of public buildings, such as schools and youth centres. New entrances and the redesign of common areas improved the neighborhood's visual appeal and accessibility. Security was increased through the

Historical photo of Märkisches Viertel residential buildings in the 1960s.

The refurbished buildings use colour to create a vibrant skyline amongst the established gardens.

5. www.use.metropolis.org/case-studies/deutschlands-grosste-niedrigenergiesiedlung-das-markische-viertel#casestudydetail

installation of video cameras in key areas, and several ground-floor spaces were transformed for practical purposes such as bike storage and electric wheelchair charging stations. One key goal of the renovation was to change the neighbourhood's image from a "concrete jungle" to a more welcoming and visually appealing place. Design elements such as seating, lighting, and decorative touches have been used to improve the residential entrances.

The renovations include comprehensive updates to the apartments, roofs, façades, and building services, alongside the introduction of energy-saving measures. Modernised plumbing systems, energy-efficient heating distribution, and the installation of composite facade systems to reduce heat loss were incorporated into the works. Additionally, new windows, heat-insulated roofs, and basement ceilings contribute to energy conservation. Smart meters have been installed to allow residents to track their heating and water consumption, helping them incorporate more sustainable habits. Water-saving systems, modernised bathrooms, and the replacement of outdated waste disposal methods further improve sustainability. The refurbishment also includes various apartment-specific improvements such as widened doors, floor-level showers, stable handgrips, shower seats, and barrier-free balconies with lower thresholds. Green spaces were expanded, and rainwater harvesting systems introduced for toilet flushing and irrigation.

During the renovations, GESOBAU ensured support for residents, particularly vulnerable groups such as the elderly and pregnant women. Alternative accommodation was provided for approximately 23,500 people from 9,450 apartments during construction, though some residents chose to stay, enduring noise and dust.

The Urban Restructuring program funded the energy-efficient conversion of public facilities, with GESOBAU investing around €480 million into the project, averaging €35,000 per apartment. The energy-efficient transformation was completed by 2016, reducing CO_2 emissions by 75%, which equates to an annual saving of approximately 39,000 tons of CO_2.[5] The conversion of the neighbourhood's heat and power systems to biomass has made the district's heating system nearly CO_2-neutral. Heating costs have been significantly reduced in most buildings, offsetting rent increases due to the renovations, and the vacancy rate has decreased as new residents move in.

The Märkisches Viertel refurbishment is considered a best-practice example of sustainable urban redevelopment, showcasing successful collaboration between energy suppliers, housing companies, and government authorities. This integrated approach, combined with active citizen participation, has made the project a model for energy-efficient and socially responsible urban development.

The removal of roads and establishment of gardens and landscape situates the estate and the large buildings in a park-like setting.

13
Fittja People’s Palace
Norsborg, Sweden
Spridd and NCC

i. Fittja People’s Palace. Refurbished tower

The Million Programme was a significant public housing initiative in Sweden, carried out between 1965 and 1974, aiming to build one million new homes within a decade: a goal it successfully met. However, like many modernist housing estates, the buildings constructed under this program now require extensive renovations to meet current living standards. With such a large population living in these buildings a key challenge is how to renovate them without the relocation of existing residents. The public sector is facing a major challenge where hundreds of thousands of apartments need to be renovated all over the country.

In 2012, the Nordic Built initiative was launched to promote sustainable building concepts, leading to the Nordic Built Challenge in Sweden.[2] The winning proposal, Fittja People’s Palace, was developed by local architectural practice Spridd[3] and construction company NCC to address the renovation needs of aging Million Programme buildings.

Fittja, a 1972 neighbourhood designed by architects Höjer and Ljungkvist, exemplifies Sweden’s post-war welfare architecture, built to provide affordable housing. While innovative at the time, the area now requires urgent renovations. Botkyrkabyggen AB, the public utility real estate company, sought a solution to resolve technical issues, limit rent increases, and support the area’s long-term development.

Undertaken as a pilot project, Krögarvägen 2 in Fittja, 72 apartments were renovated with a focus on sustainability and minimal disruption for residents. The renovation prioritised tenant involvement through ongoing dialogue. A key element of the project was leveraging the area’s potential and engaging residents, local business owners, politicians, and organisations in a transparent process. Early efforts included gathering feedback from residents and mapping local networks to establish connections. A former storage space on the ground floor of the building was transformed into K2, an exhibition hall and meeting place, where the project and future

1. Stenberg, E, KTH Arkitekturskolan. 2013. Structural systems of the Million Program Era. Issuu.
2. www.nordicinnovation.org
3. www.spridd.se

Large prefabricated panels being installed at Fittja. Image Spridd.

The refurbished People’s Palace on the right demonstrates the ability of a ‘light touch’ to bring the building up to contemporary standards.

4. Byggtjänst. 2017. Samtal runt köksbordet avgörande i nominerad renovering. Byggkoll.
5. www.spridd.se

developments were discussed with tenants. This “kitchen table model” of engagement enabled quick tenant approval, with all approvals completed in just two months. The renovations took place while residents continued to live in their homes, which was crucial for both planning and execution.

The light touch approach to renovation includes technical upgrading, energy enhancement and improvement of common spaces and safety. All works were undertaken with the tenants staying in their apartments. By respecting the residents’ interests while at the same time providing simple and practical solutions a series of smaller strategic solutions together enabled a well-thought-out and cost effective renovation.[4]

The works to the building included replacing windows, repairing facade joints, adjusting ventilation and heating systems, new elevators, additional insulation and replacing the roof membrane. Other measures included a strategy to replace and clean, with the façades washed and the common areas tidied up. Safety was a big concern for the residents with all steel doors to the stairwell removed and replaced with glazed doors with overhead and side lights. Glazed doors and walls were also introduced to parts of the communal space on the ground floor, allowing for transparency and greater security.

A key requirement for the design team was to limit the rent increases that refurbishment will bring to the tenants to a minimum. This was achieved with an average increase of 19% across the building.[5] As a pilot project further efficiencies could be achieved across Botkyrkabyggen’s remaining stock in Fittja. Keeping tenants satisfied during and after the renovation is crucial. While staff costs were higher due to extensive, resource-intensive communication with tenants, it was that prioritising and investing in communication which ensured project success.

Solid doors are replaced with glazing for transparency and greater safety.

1:1 scale model for community consultation. Image Spridd.

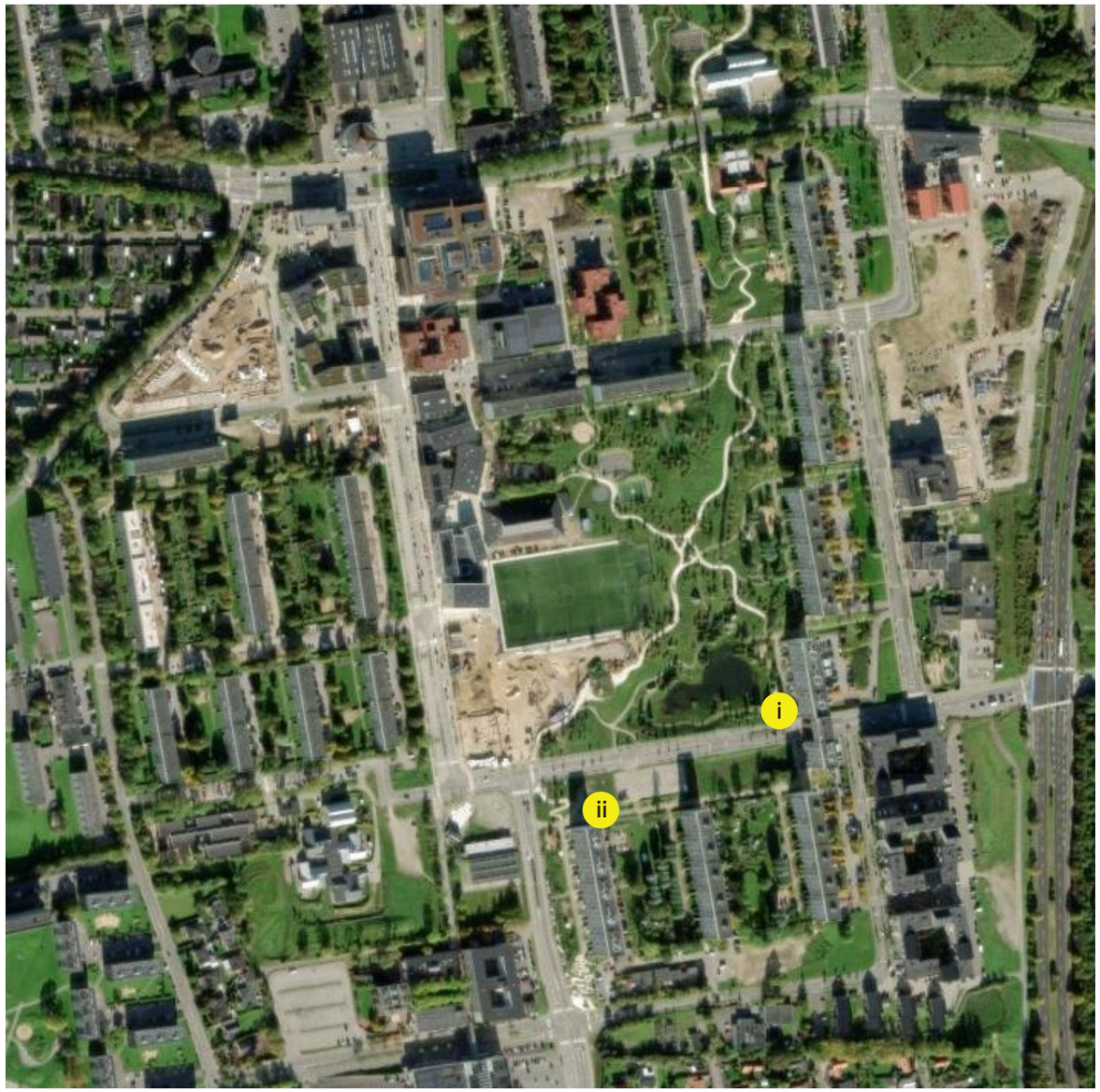
The People’s Palace on the far right is one of many identical buildings on the estate, It is hoped that a similar refurbishment will be undertaken on the others.

Operable glazed openings at the ends of corridors bring light and ventilation in.

Established gardens and landscaping works soften the buildings into the estate.

14
Gellerup Block 4
Gellerup, Denmark
Vandkunsten and Transform

i. Block 4. Refurbished block
ii. Block 7. Refurbished block



Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

1. Johansen, M. 2010, Gellerup said yes to the master plan. Jyllands-Posten.

Gellerup constructed between 1968 and 1972, was developed to address the housing shortages of the time. Designed by architects Knud Blach Petersen and Mogens Harbo, the plan encompassed 2,448 apartments spread across two neighborhoods: Gellerupparken and Toveshø. In addition to the housing, the area featured a range of community amenities, including schools, library, hotel, shopping mall, sports hall, and extensive open spaces. The development embodied an ideal of urban planning and housing inspired by modernist principles. Built using a large panel concrete system, it became the largest housing project in Denmark.

Over time, widespread and costly issues with the concrete construction became apparent shortly after the buildings were completed. These problems, coupled with the growing presence of lower-income residents, led to the area becoming associated with a range of social challenges. Despite these issues, the buildings remained structurally sound, and many of the modernist planning principles were deemed worth preserving for the future.

As early as 1991, demolition was proposed as a cost-saving measure, but instead, renovation was pursued. In 2007, the “Masterplan” was introduced to address the social decline in the Gellerup area.[1] The project’s goal was to transform Gellerupparken and Toveshøj from disadvantaged residential neighborhoods into an attractive and vibrant urban district.

In 2011, the Aarhus City Council and BBBO agreed upon a masterplan for the Gellerup area. The plan aimed not only to upgrade the building fabric but also to address social challenges by implementing various initiatives. These included the creation of new jobs, enhancing cultural activities, implementing social programs, and improving safety throughout the area. `he redevelopment process involved extensive stakeholder and user engagement to ensure that the community’s needs were met.

Before and after of the refurbishment and landscape works. Image

Two-storey dwellings occupy the ground plane with new entrances to the building.

2. www.pluskontoret.dk/projekter/gellerupparken-og-toveshoej-brabrand-boligforening/
3. Strandholdt Bach, J. 2019. “Demolition Blues. Resistance Against Demolition Plans in a Danish Disadvantaged Affordable Housing Estate, AAM - Archéologie et Anthropologie de la Méditerranée

Construction included the creation of new roads and streets, the demolition of several apartment blocks to make room for new buildings, and the extensive refurbishment of the existing housing stock. The combined approach of physical and social improvements aimed to revitalise Gellerup and create a more sustainable and thriving community for the future.[2]

The project sparked controversy, particularly regarding the demolition of housing blocks and the perceived lack of involvement of the residents directly affected by the changes. This led to public protests and significant criticism from Brabrand Housing Cooperative, highlighting concerns about the approach to redevelopment and the impact on the community.[3]

Despit this two pilot projects for the refurbishment of the existing housing blocks were carried out at Gellerupparken, B4 and B7. It is planned that lessons learnt from the refurbishment of these blocks will be used on the remaining flats in the area.

B4
Block B4 was completed first and marked not only the begin of the refurbishment of the existing buildings but a new identity for the area. Symbolically and structurally forming a new gateway to the neighbourhood a large opening was made through the centre of the building with a new road running through it. On top of the existing structure new additions were located with 3 storey homes. The lower floor apartments were all renovated and updated to modern standards. Works carried out in an interaction between Brabrand Housing Association, Aarhus Municipality and a large number of private stakeholders and investors. One of the key goals of the pilot projects is to explore ways of activating the edge zones of the buildings to foster greater interaction between the structure, residents, and the surrounding area. Walkways have been removed, and the homes have been extended down to ground level, allowing for private outdoor spaces. These two-storey terraced homes feature their own entrances, along with small front and back gardens. In pilot project B7, small coverings for the terraces have proven effective in creating secure outdoor spaces that offer a degree of privacy

B7
The B7 block is located as the first apartment block upon arrival at Gellerupparken from Silkeborgvej. Issues with the ground floor were resolved similar to B4 with 10 new two storey apartments integrated within the lower floors with each town house having its own front door. These new dwellings are clad in brick defining a base to the building at human scale with the reddish and brown tones are repeated in the new windows and doors. The existing units were retrofitted with new bathrooms, façades and ventilation systems. In addition to the general refurbishment, accessible housing was also established in parts of the block.

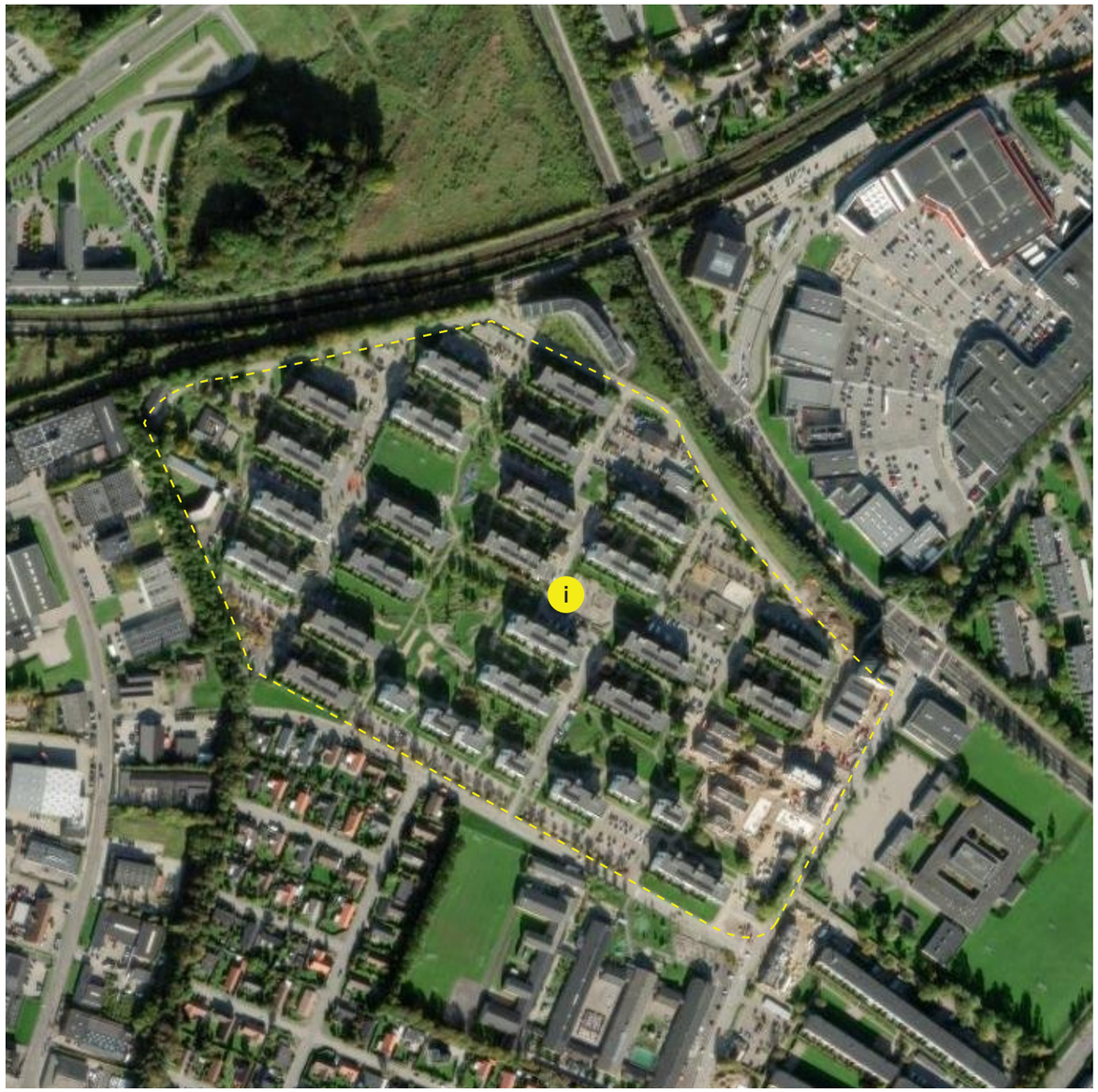
The construction company NCC has recently been commissioned to fully refurbish a further five residential blocks in Gellerup. The two pilot projects B4 and B7 were conducted to evaluate various options, explore innovative solutions, and identify potential challenges. The insights gained from these pilots will enable the team to execute the refurbishment as efficiently and successfully as possible. The refurbishment will include upgrades to internal finishes, bathrooms, roofs, and new ventilation systems. Façades, windows, and doors will also be refurbished, while selected units will undergo remodeling, with a few adapted to enhance accessibility. In addition, outdoor spaces will be improved to provide a safe and functional living environment. These upgrades will help maintain the appeal of the residential and outdoor spaces for both current and future residents. At the same time, the project will preserve and enhance the architectural character and housing quality of the modernist-inspired apartment blocks. It is expected to be completed by 2029.

A large portion of the building was removed with addition dwellings on top, forming a new ‘gateway’ to the estate.

Newly refurbished B7 follows the some approach as B4.

15
Roesenhøj
Viby Syd, Denmark
Effekt and Arkitema

i. Roesenhøj. Refurbished blocks and infill



Rosenhøj is a public housing project in Viby J, a southern district of Aarhus, Denmark. Rosenhøj was built with 27 identical large panel concrete apartment blocks, with a total of 808 units built from 1967-1970. The planning of the estate was arranged in rows of apartment blocks placed back-to-back surrounded by large open space. Over the years, the area has been marked by social challenges, insecurity and a deteriorating reputation. The social housing association had difficulties renting out the homes and the residents were unable to develop a vibrant community.

In 2014 extensive transformation of the estate was undertaken in close collaboration between the Aarhus municipality, residents and consultants. Prior to the residents voting on the project, the housing association carried out targeted resident involvement with, among other things, written information, general meetings, city walks, and individual meetings were held with the families whose homes were to be demolished if the project went ahead. The residents gave overwhelming support to the renovation, with more than 41% of households voting and 91% agreeing to renovation.[1] Several of the residents also became an active part of the construction, where the contractors in collaboration with the housing association created internships and apprenticeships. Through this, 42 residents were employed during the renovation, and 16 are still involved today.

The ambitions of the renewal was to open up the estate to the surrounding neighbourhood through a series of careful and well considered architectural and infrastructural interventions. This was done by strategically demolishing sections of existing blocks and inserting new infill typologies to introduce variation and vibrancy to the once monotonous forms.

1. www.renover.dk/projekt/nyt-rosenhoej/

Historical image of the estate. Image from Effekt.

Diagram from Effekt showing the proposed masterplan for the estate.

2. www.troldtekt.com/references/housing/rosenhoej/
3. www.danskeark.dk/content/nyt-rosenhoej-0
4. ibid

These key moves have improved the physical layout and appearance of the estate while also integrating the built form with the surrounding city.

By working with the existing rather than complete demolition the project has re-established a sense of community. The neighbourhood was integrated with the wider urban fabric through the addition of new infrastructure and two internal roads, breaking the large area into smaller sub-communities. The 27 original blocks were divided into 11 neighbourhoods each consisting of two apartment blocks, two newly built terraced houses and reorientated around a shared garden space.[2] This assisted with a visual connection through the estate. Large areas between buildings were activated and transformed into functional shared spaces. The existing parking lot was converted into a shared park, further enhancing green areas. Inner courtyards were redesigned with furniture and play equipment.

The new façades incorporated a variety of designs and materials, adding visual interest and creating a distinct sense of place. Some of the longest blocks had entire stairwells removed to open up the buildings and establish new pathways and road systems. Other blocks received targeted modifications, such as new windows and balconies on previously closed sections, enhancing openness and vibrancy.

The apartment blocks have been clad in four different facade types with new windows to emphasise diversity and an improved image of the buildings while also improving the thermal performance. All previous thermal bridges, which the large panel buildings suffer from, have been eliminated. The added insulation and new ventilation systems has improved the indoor climate and reduced energy usage for the residents. Today, up to 85-90% of the excess heat in the buildings is recycled.

Rosenhøj's total energy consumption has been reduced by 50%.[3] Solar cells have been installed on the roofs allowing each block to continuously consume the energy produced itself.

New lifts were added to around a quarter of the existing blocks in response to residents' accessibility needs with associated renovation of bathrooms and new wider doors. Together with the construction of 22 new terraced houses, the department now offers a varied range of up-to-date social housing.

Results from Rosenhøj's Social Housing Annual Report 2017, prepared by the Social Housing Joint Secretariat, shows a significant positive improvement in the area's profile. In 2017, the proportion of insecure residents has halved and the proportion of residents who trust their neighbours has increased by 37% compared to 2008. The share of young people who do not have or are in the process of an education has fallen by 62% since 2013 and the amount of unemployed adults by 19% since 2006.[4]

Existing building are re-clad, new openings made and balconies retrofitted.

New lifts were externally retrofitted to the existing building.

Community infrastructure is located near entries creating vibrancy.

16
Ellebo Garden Room (Block 3 and Block 4)
Ballerup, Denmark
Adam Khan Architects

i. Block 3. Refurbished block
ii. Block 4. Refurbished block
iii. Demolished block. Infill housing
iv. Demolished block. Infill housing
v. Infill Housing

Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

1. Building Centre. (2024, February 8). Ellebo Garden Room, Copenhagen and Pembury, Hackney. The Building Centre.
2. www.nordicinnovation.org
3. www.adamkhan.co.uk/projects/ellebo-garden-room/
3. Jensen, M. 2020. Garden dreams: Ellebo social housing in Ballerup, Denmark by Adam Khan Architects. The Architectural Review.

Ellebo is located in the working-class suburb of Ballerup. The estate which was completed in 1964 is made up of four four-storey blocks situated around a large public space.[1] The estate like many around the world was Denmark's attempt at postwar economic growth but while the typology was intended for the middle class workers they became quickly stigmatised and the detached housing typology quickly adopted.

In 2013, the Nordic Built initiative[2] was launched to showcase sustainable building concepts, with a focus on projects like retrofitting existing structures. They reached out to the Danish social housing administrator Københavns Almindelige Boligselskab (KAB) to find a suitable site for an international competition. The Ellebo estate, owned by the housing association Ballerup Ejendomsselskab and managed by KAB, was selected. Its forward-thinking residents played an active role in shaping the comprehensive renovation plans, which included universal design and sustainability measures.

Adam Khan Architects[3] (AKA) were awarded the project after winning a competition in 2013. Their proposal was to add new façades, additional units on top of the existing buildings and internal work which reorientated the apartments around a shared central garden. The new façades were to be made from pre-cast concrete and added to the front and rear of the existing building - this gave the blocks a new identity, increased thermal performance as well as increasing private open space for the residents. New lifts and stairs were retrofitted and large family apartments added to the roofs, providing both an increase and diversity of housing stock. With the removal of the studio apartments all flats become dual-aspect with the widening of doors, enlarging bathrooms for access, expand the balconies and the introduction of a shared garden at the heart of the estate.[4]

The proposal uses a number of sustainable measures that reduce operational costs, energy consumption and CO_2 emissions. A highly insulated envelope and triple-glazed panels reduce thermal bridging, which ensures that

Historical photo of Ballerup with the modernist housing blocks arranged around a central open area. Photographer Sylvest Jensen Luftfoto / Det Kgl. Bibliotek

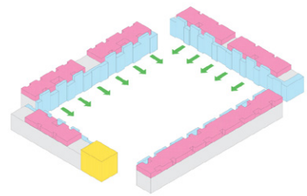


Diagram from AKA showing the additional units on top, new balconies and an ambition to retain the large central area.

The new infill development to the right. This is where the communal garden was originally proposed.

3. Karakusevic, P., & Batchelor, A. (2016). Social housing: Definitions and design exemplars. RIBA Publishing.
4. Jensen, M. 2020. Garden dreams: Ellebo social housing in Ballerup, Denmark by Adam Khan Architects. The Architectural Review.

the building's required energy consumption is low with operable windows facilitating summer cross-ventilation and stack effect heat purging. Additionally, key components of a passive environmental strategy are the winter gardens, which reduce the heat loss of the flats in the winter and extend the outdoor period in spring and autumn. The shared garden would evolve over time, fostering overlapping activities and increased public interaction. Through resident engagement, the landscape will transform from a barren space into a diverse set of gardens, with reduced car presence as parking is relocated to the outskirts. It was proposed that existing residents can stay in their homes during the process, as the prefabricated façade panels are replaced in just two to four days.[3]

The rear facade of Block 4 with private access and gardens.

Despite the supported proposal it would only be realised on Block 3 and partial works to Block 4 with minimal refurbishment. Block 1 and 2 which were integral to the Garden Room proposal were demolished due to issues upon inspection by the engineers where construction faults were identified and the buildings deemed not structurally viable. The tenants were evacuated and the blocks demolished. This demolition triggered the contractor agreement to be dissolve and a large fee paid, to recoup this money the housing provider would eventual increase in floor area ratio of the site and sell one of the sites to private developers significantly altering the masterplan developed by AKA.[4] This change in approach saw a higher density than the residents had agreed to and a loss of much of their public open space.

While the full proposal may not have been realised lessons can be learnt from the blocks that were refurbished and the residents that were able to remain on the estate.

On Block 2 the facade was wrapped in cladding and insulation rather than extended with precast concrete as in the original design.

Communal gardens are now forming on the opposite side of the proposed central square with residents of Block 3 having direct access and outlook.

The new facade fabricated from precast concrete extends the living area, activating the facade with individuality.

17
Messinavej
Amarger, Denmark
NORD Architect

i. Messinavej. Refurbished block
ii. Undergoing refurbishment
iii Undergoing refurbishment
iv Undergoing refurbishment
v. Undergoing refurbishment

Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

1. www.messinagaarden.probo.dk
2. www.nordarchitects.dk/projects/messinavej/

Messinagården A/B, founded in 1962 and converted into a cooperative housing association in 1995, consists of 207 shareholders, including 4 commercial leases. The association owns several ageing residential buildings, and one of these, a typical 1960s large panel concrete structure, was selected for refurbishment.[1] What began as a minor renovation evolved into a significant project aimed at addressing structural issues, improving energy performance, and adding balconies. This building became a pilot for future upgrades to the entire complex.

Nord Architects were commissioned for the project with the refurbishment focusing on enhancing thermal performance, energy efficiency, and resident comfort.[2] A new façade was added to the building with 150mm insulation and retrofitted balconies, allowing for larger windows to the units increasing natural light, ventilation, and provide private outdoor space. These improvements have led to better indoor temperatures and reduced energy consumption. The copper façade, with its greenish hue, develops a natural patina over time, creating visual interest with subtle relief and shadow effects. Frosted glass railings on the balconies allow light to filter into the apartments.

The newly retrofitted building with balconies and facade. This project is the pilot for the upgrades to others.

The surrounding large panel concrete buildings awaiting to undergo refurbishment.

The north-facing galleries were expanded from 1 to 1.3 meters, and window openings were enlarged to bring in more daylight. Although the balconies are private, their connection to the large communal courtyard has fostered a greater sense of community. The improved relationship between the indoor and outdoor spaces has enriched the residents' experience. Wire mesh on the balcony sides encourages climbing plants, adding greenery to the facade.

New triple-glazed windows have improved the indoor climate, reducing mold risks and increasing daylight, which has noticeably enhanced the quality of life for residents. The upgraded outdoor spaces and improved views further contribute to a positive living environment. While accurate measurements of energy savings are still pending, residents have already noticed significant improvements.

This renovation serves as a model for the other apartments owned by the cooperative. The project, with close collaboration between the client and consultants, aims to balance finances, operations, architectural values, and housing quality. The success of this refurbishment could inspire similar energy-efficient renovations in other housing developments, offering a sustainable solution to address challenges in construction, aesthetics, and modern living requirements.

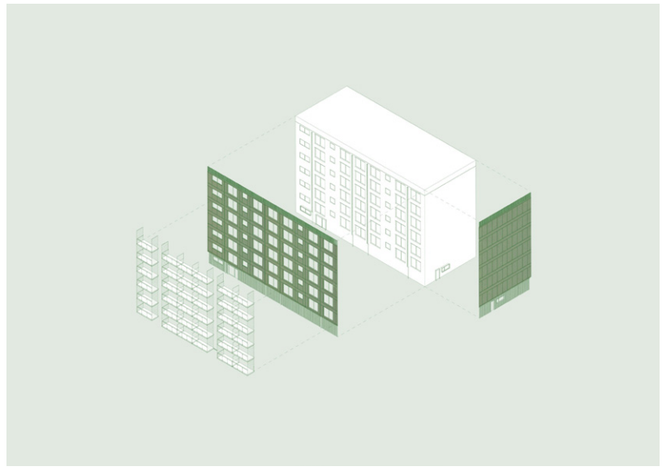


Diagram showing the existing building with new facades and balconies retrofitted. NORD Architects

New facades were being retrofitted to the other buildings on the estate, 2024.

The new facade and glazed balconies create a contemporary appearance while also improving comfort for residents.

New balconies are attached and hung from the existing concrete structure.

18
Woodside Multi Storey Flats
Glasgow, Scotland
Collective Architecture

i. 104 Cedar Court. Refurbished tower
ii. 65 Cedar Court. Refurbished tower
111. 9 Cedar Court, Refurbished tower

Retain,Repair, Reinvest: An international catalogue of precast panel refurbishment projects.

1. Cole, B. 2023. Getting warmer: Collective Architecture upgrades Glasgow tower blocks.
2. www.collectivearchitecture.co.uk/projects/woodside-multi-storey-flats

Designed by Boswell Mitchell and Johnston (BMJ Architects) in the 1960s, the three 23-storey towers—Torridon Court, Lorne Court, and Katrine Court—are located in the Red Road Estate in the northern part of Glasgow. These towers were part of Phase 1 of the Woodside Comprehensive Development Area and, like Red Road, were constructed using large pre-cast concrete panels from Bison Manufacturing.[1] Later renamed Cedar Court, the towers became a prominent gateway to the city. While the original duplex apartments featured thoughtful designs, the prefabricated structural frame resulted in poor insulation and inadequate soundproofing due to thin internal partitions.

As time passed, the buildings' exterior deteriorated, and all three towers were eventually marked for demolition, reflecting a broader trend in Glasgow, where nearly a third of the city's tower blocks were demolished over the past 15 years. However, the decision to demolish the Cedar Court towers was reversed as the city adopted a more progressive approach to its high-rise housing. After years of neglect, the estate was transferred to Queens Cross Housing Association, which then engaged Collective Architecture[2] to conduct a study on the future of the towers, with a focus on resident input.

The refurbishment plan included entrance and ground-level improvements, enhanced energy efficiency, and minimal disruption to existing residents. Collective Architecture held community workshops and interviews to develop a detailed report proposing a retrofit solution. Residents expressed concerns about security, fuel poverty, poor lighting, inadequate play areas for children, and the need for better social spaces. The construction was carried out using a design-and-build procurement model, with Collective Architecture working closely with the appointed builder after being novated.

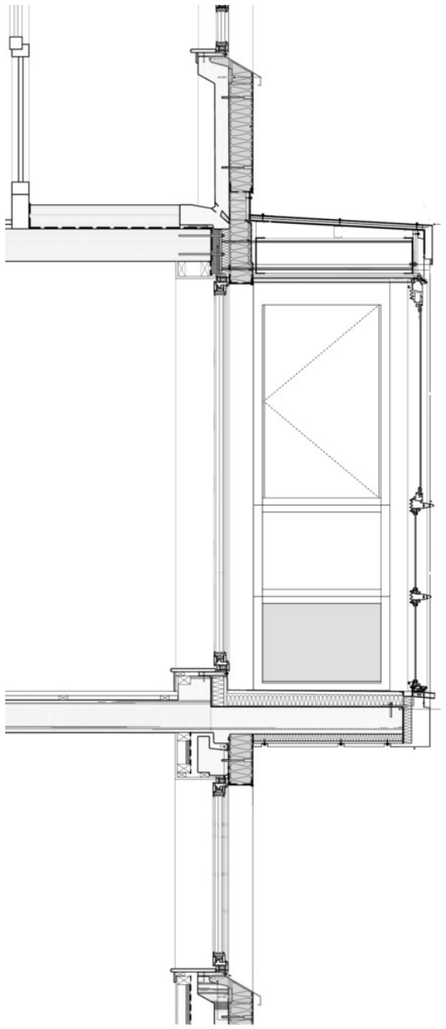
Historical photo of the towers being constructed in 1966.
Image John R Hume.

3. Passivhaus Trust. 2024. New guidance on Passivhaus and Retrofit. Passivhaus Trust.
4. Mackenzie, A. 2024. Getting warmer: Collective Architecture upgrades Glasgow tower blocks. The Architects Journal.
5. Scottish Design Awards. 2021. Woodside multi-storey flats. Scottish Design Awards.

Prior to the project commencing a structural investigation of the existing towers was undertaken to ensure the buildings could remain structurally sound for at least another 30 years. Structural engineers, Cundall, conducted an assessment, both visual and intrusive investigations, alongside analysing archive data, of their structural integrity and found that the concrete crosswall construction was in good condition.[3] While there were some signs of structural deterioration, such as cracking and spalling, were observed, particularly on exposed elements. None of these were deemed to be beyond repair and, overall, the towers were in good structural condition given their age.[4]

With this assessment complete, Collective Architecture moved forward with an energy-efficient retrofit aimed at achieving EnerPHit certification. The retrofit strategy included enclosing balconies into winter gardens, adding insulation, and eliminating thermal bridging. New entrances with dual access were added at the base of each tower, along with internal gardens, community meeting rooms, children's play areas, and art studio spaces. New lifts were also installed. Externally, the buildings were wrapped in Rockwool mineral wool insulation for its economy, efficiency, and fire resistance, with a self-cleaning render to improve the façade's appearance. Existing windows were replaced with triple-glazed units. The retrofit, guided by Passivhaus principles, achieved an 80% reduction in heating demand, and significantly reduced fuel poverty for 1,000 residents.[5] The towers now feature improved low-energy lighting, modern controllable heating and hot water systems, and triple-glazed windows, giving them a fresh identity while enhancing their energy performance.

Throughout the retrofit, the towers remained occupied, which required careful scheduling and site management to minimise disruption.



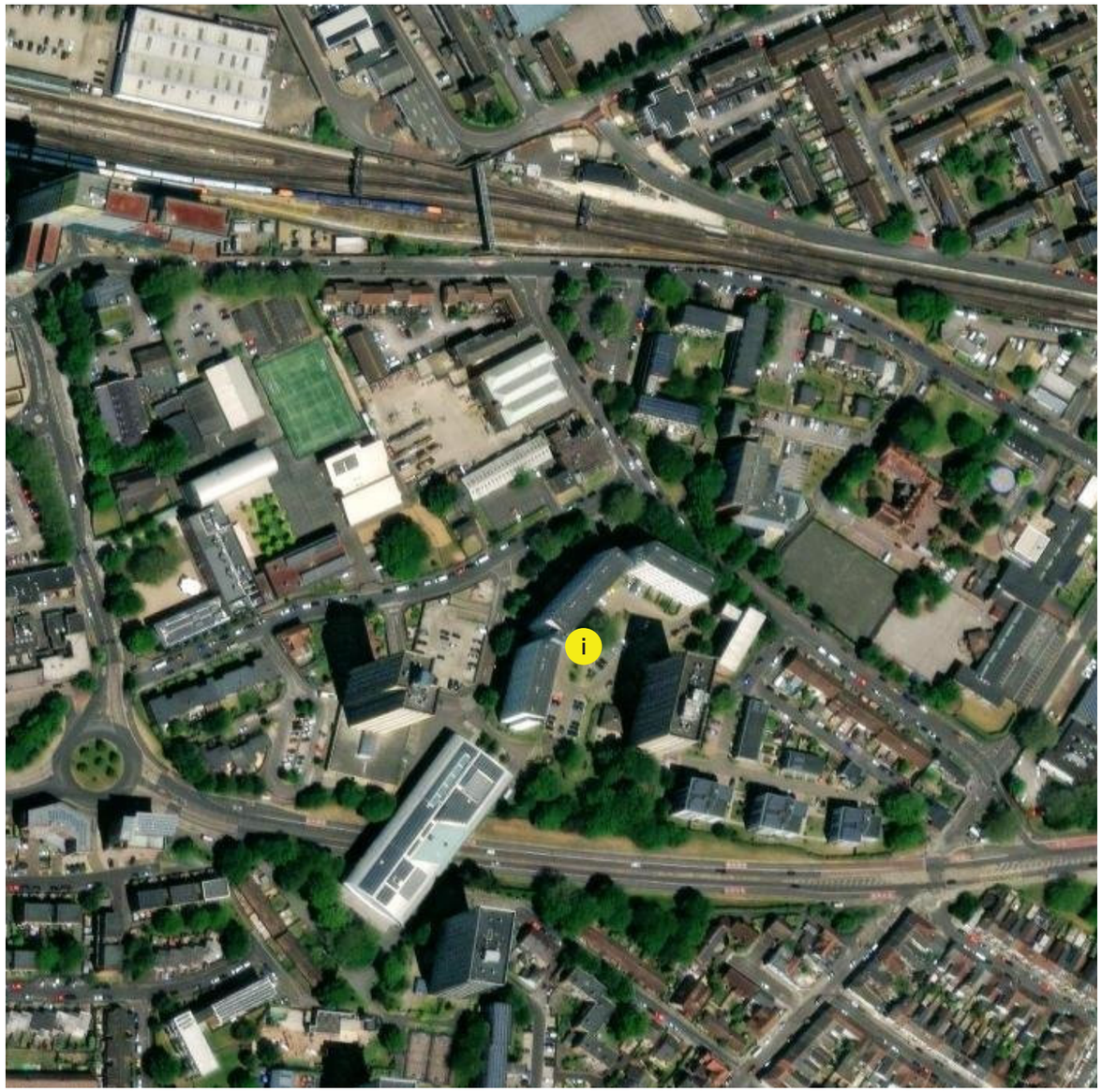
Sectional detail of the new facade. Collective Architects.

Enclosed balconies above the new entrance to the building.

New landscape works integrate the towers into the neighboring four-storey walk-up flats.

19
Wilmcote House
Portsmouth, England
ECD Architects

i. Wilmcote House. Refurbished block



1. North West Europe. 2020. Wilmcote House.
2. Portsmouth City Council. 2012, November 6. Housing decision meeting agenda.
3. ibid

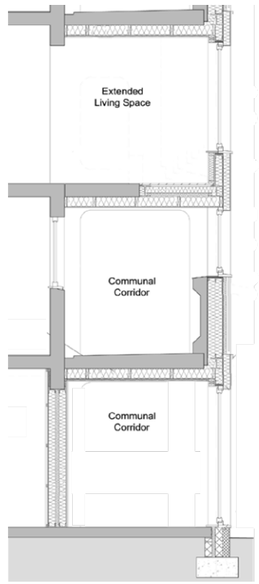
The decision to retrofit the towers was driven by several critical factors. Many residents were unable to afford heating their homes and had little control over indoor temperatures. The windows and roof had reached the end of their serviceable life, and concrete repairs were needed to ensure the structural integrity of the buildings. A third of residents reported issues with condensation, and several properties experienced problems with mold. Additionally, 80% of residents had reported window repairs over a two-year period, while communal and external linings were deteriorating. Security in communal areas was also found to be ineffective, further emphasising the need for renovation.[1]

Demolition was considered as an option due to ongoing maintenance issues, but the council ultimately rejected it for several reasons.[2] The process of decanting residents, demolishing the buildings, and rebuilding would have taken a long time, requiring families to be temporarily relocated, and there was a shortage of available three-bedroom family units. Rebuilding costs were deemed prohibitive, and achieving the same housing density in a new development would have been challenging. Additionally, the environmental impact of embodied carbon from demolition was a key concern. A report from November 2012 confirmed that a deep, high-quality refurbishment would be more cost-effective over a 30-year period than demolition and rebuilding.

Before and during the design work, structural investigations, including pull-out tests, concrete analysis, carbonation depth, and airtightness testing, along with services condition surveys of risers, circuit boards, consumer units, pipework, redundant services, and asbestos surveys were conducted.

Constructed in 1968, the block was built using the large Bison REEMA concrete panel design and would have been unlikely to last another

A new external facade was retrofitted to the existing concrete panels. Image from Rockwool



Sectional facade detail showing the new insulated facade. ECD Architects

4. EuroPHit. D3.9 Case study 14: BRE overall refurbishment plan.
5. Portsmouth City Council. 2012, November 6. Housing decision meeting agenda.
6. Rockwool. ECD Wilmcote House project booklet.
7. www.ecda.co.uk/projects/wilmcote-house-passivhaus-enerphit/
8. London School of Economics and Political Science. Wilmcote House Research. See: www.sticerd.lse.ac.uk/lsehousing/research/Wilmcote-House/

30 years without intervention.[3] The windows and roof needed replacement, and the block's outdated electric heating system was costly for residents to operate, contributing to condensation issues and making the block expensive to maintain. Additionally, the lift lobbies in both stair towers experience sporadic water ingress, damaging plaster and fixtures.

Maintenance costs for the block were significant, with at least a third of residents reporting condensation problems. The double-glazed windows, installed in 1988, were at the end of their serviceable life, and approximately 80% of residents have reported window-related repairs in the past two years.[4] A structural survey in 2011 identified several necessary repairs to maintain the building's integrity. Without these structural works, large sections of concrete could potentially fall from the building within 5 to 15 years.[5]

The option to demolish the block was considered but ultimately rejected due to the immediate prohibitive costs and the long-term negative impact on residents before they could enjoy an improved living environment. Based on past experiences with decanting blocks like Horatia House and analysing the number of three-bedroom properties let in the last two years, it is expected that decanting could take 18 to 24 months, followed by at least another year for demolition before new dwellings could be constructed on the site. This lengthy process would not only adversely affect the local area but also strain the housing options waiting list, where demand for three-bedroom properties is particularly high.

A feasibility report for the cladding and refurbishment of Wilmcote House was prepared by ECD Architects. Over two years, residents of Wilmcote House had been actively engaged in consultations regarding the refurbishment proposals.[6] ECD worked closely with them to address their concerns and evaluate key issues, ultimately developing a scope of works aimed at improving their quality of life while reducing ongoing costs.[7] The architects outlined a comprehensive plan to insulate the building's entire external envelope using a combination of cladding and render finishes, along with a new roof. The proposal included replacing the existing windows with high-performance triple-glazed units, with the goal of dramatically reducing the building's energy demand and, in turn, lowering residents' energy costs. The scheme also encompassed structural repairs, external and communal area refurbishment, and the conversion of the redundant housing office into two new ground-floor three-bedroom flats. Additional improvements addressed fire safety, communal lighting, controlled access to communal areas, efficient electric heating and hot water systems.

The success of this project has been evaluated by both Southampton University and the London School of Economics (LSE).[8] Southampton University monitored the building's thermal performance before and after the project, while the LSE surveyed residents at various stages—before, during, and after the works—to understand the challenges and benefits of keeping residents in place and the overall impact on their lives.

After the project's completion, Southampton's findings indicated a significant increase in thermal comfort and reduced energy use in the flats. Meanwhile, the LSE report highlighted residents' positive satisfaction. As a crucial advancement for affordable housing, Wilmcote House has garnered attention in the press and received multiple awards for its improvements.

View of the completed Wilmcote House facade with existing tower in the background.

New facaded with high performance windows significantly reducing the energy demand.

OFFICE is a not-for-profit multidisciplinary design and research practice based in Melbourne. Their projects span the intersections of built form, research, discourse and education. As a registered charity, the studio's operations, processes and outputs are bound by a constitution to make projects for the public good.

Thank you to everyone who contributed and supported the report. This would not have been possible without your generosity.

www.office.org.au
hello@office.org.au

This research was produced with the generous assistance of the Alastair Swayn Foundation