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ARCHITECTURAL POTENTIAL OF DECONSTRUCTION AND REUSE IN DECLINING MASS HOUSING ESTATES

SATU HUUHKA, NANDA NABER, CLAUS ASAM AND CLAES CALDENBY

Abstract

In Western Europe, many large housing estates have experienced spirals of intertwined physical and social decline. Such estates have wound up at the bottom of the housing hierarchy, which is manifested as high turnovers and vacancies. This qualitative multi-case study contributes to the research on the sustainable management of declining neighbourhoods' housing stocks. The study learns from four individual cases in which vacancies were tackled with an extreme architectural transformation. In the investigated cases, large-panel buildings were partially deconstructed and renovated, and the reclaimed concrete panels were reused for new construction nearby. The approach integrates demolition, renovation and new construction – the three characteristic building stock management strategies in disadvantaged neighbourhoods. The cases are located in Sweden (Gothenburg, 1984), the Netherlands (Middelburg, 1986), Germany (Berlin, 2004) and Finland (Raahe, 2010). Deconstruction was the landlords' way to manage their assets in the face of vacancies and social problems in relatively young, unamortized buildings. The projects proved technically feasible, yet they have been criticised for their economic and social implications. Nonetheless, the approach seems to have contributed to extending the life cycles of the buildings in question, and it has the potential to improve the quality of life in large housing estates.

Keywords:
Adaptation measures, disadvantaged housing estates, deconstruction, mass housing, partial demolition, prefabricated concrete, renovation, reuse

Introduction

In Western Europe, large housing estates often represent the least popular segment of the housing market. Today, such estates house many precarious demographic groups. These estates were originally built when there were housing shortages, and were initially classed as average on a socio-economic scale. As the housing markets loosened, i.e. other options emerged – in some places because there were more options from new construction, in other places due to demographic decline – these neighbourhoods experienced out-migration of their better-off residents and low in-migration. This led to low occupancy rates and a high turnover of residents, which in turn increased the rate of material deterioration of the properties, and eventually led to them being occupied by a concentration of socio-economic groups with little choice as to where they lived. This kind of succession of intertwined social and physical problems has often been described as a self-reinforcing downward spiral. Fundamentally, the neighbourhoods' decline is often associated with their low physical attractiveness, caused by low-quality design and a remote location (Turkington, van Kempen and Wassenberg, 2004, pp.11–12; Bråmå, 2006, pp.25–26).

In the housing market, the status of older housing estates is not solely dependent on the properties themselves, but also on the public's expectations for housing, which is informed by the standards set for new construction (Thomsen and van der Flier, 2011; see Figure 1). When buildings age, they inevitably become worn and torn. Although maintenance can restore the quality of the original building fabric, the standard of new construction tends to rise, so the quality gap between old and new buildings is constantly widening (Kaivonen, 1994, p.21; see Figure 2). Renovation and refurbishment are ways to raise the standard of existing housing closer to that of new housing, but the lower the original quality, the wider the gap that has to be bridged.

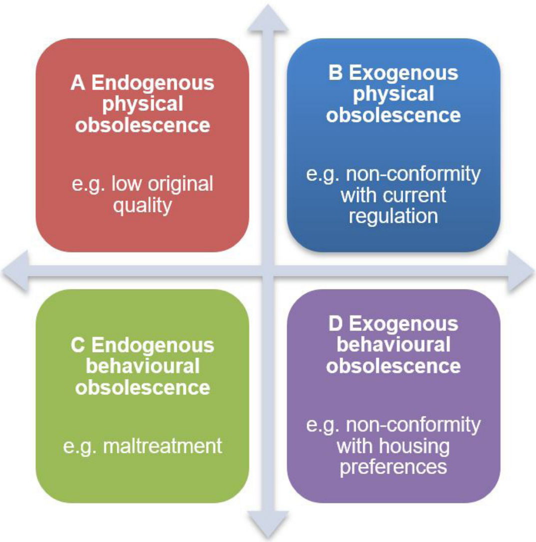

Figure 1
Thomsen and van der Flier's conceptual model for buildings' obsolescence, distinguishing between physical/behavioural aspects and their endogenous/exogenous origins. Adapted from Thomsen and van der Flier (2011) and Thomsen, van der Flier and Nieboer (2015).

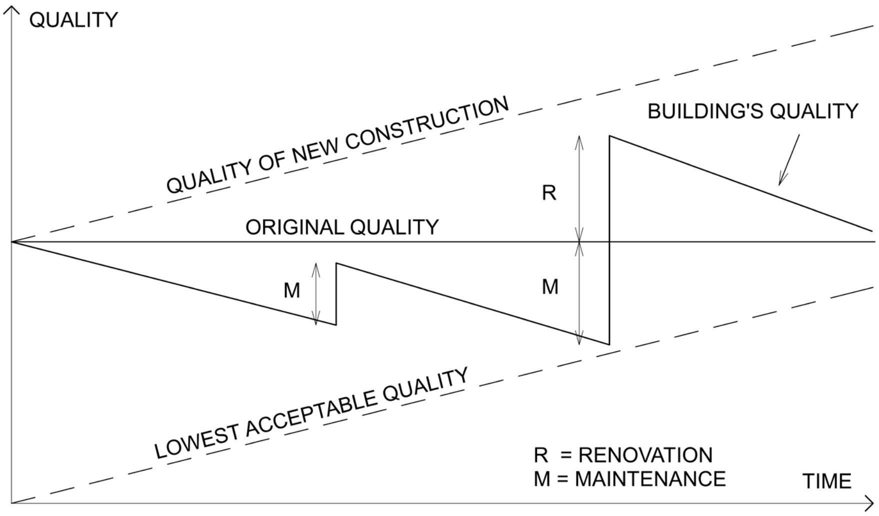

Figure 2
The development of obsolescence in existing buildings over time in relation to new buildings. Adapted from Kaivonen (1994, p.21). Similar models have been presented by other authors, see e.g. Thomsen (2014, p.9).

Policy responses

Since the original quality of housing in large estates is low, catching up with the maintenance backlog will hardly improve their position. Therefore, many housing estates have undergone cycles of minor improvements over the decades. It is increasingly common for this chain of renovation measures to end up with the building's demolition and replacement with more upscale buildings. The growing preference for demolition has been coupled with the re-emergence of market liberalism in society (Glynn, 2009). Demolition attracts the landlords, since the aged buildings are in need of renovation but their market value is low. At the government policy level, the replacement of old housing aims at dissolving agglomerations of the socially disadvantaged, as it is believed that a sufficiently "mixed" demographic composition will dilute the social problems that can occur (Bolt, van Kempen and van Weesep, 2009).

According to critics of these policies, demolition and new building does not necessarily improve the lives of the original residents, even though it may improve a neighbourhood's statistical indicators. As the newly built housing is rarely affordable, the original residents are usually compelled to move to another low-status area (Bolt, van Kempen and van Weesep, 2009). This may lead to further concentration of social problems. The reason is that social networks that enhance the well-being of poor-but-decent people are broken (Gilbert, 2009), whereas antisocial behaviour tends to follow the actors (Frazier, Bagchi-Sen and Knight, 2013). Therefore, social scientists have criticized the outcomes of such policies (e.g. Gilbert, 2009; Glynn, 2009).

On the other hand, when the resourcefulness of the residents of these deprived areas has been improved (through people-based programmes such as language-training, education, etc.), the better-resourced residents tend to switch to "better" neighbourhoods in accordance with their better socio-economic position (Bråmå, 2006, pp.42–44). Sweden, for instance, is a country that has always prioritized social measures, but these have not always been effective in the vulnerable areas (Legeby, 2010, pp.17–18). Therefore, it has been argued that housing policies should not focus on physical measures or social programmes alone, but should do both at the same time, i.e. improve the residents' resourcefulness and capacities and – in order to make them stay – provide them with attractive housing within their own neighbourhood (Ouwehand, 2006). In Finland, for instance, a quarter of out-movers mention the low quality of the architecture as one reason for their outmigration (Vilkama, Vaattovaara and Dhalmann, 2013). However, even if the liveability of a neighbourhood is improved by demolishing and replacing older buildings, it is hardly sustainable from an ecological viewpoint. This is because the demolition takes place way before the end of a building's physical service life (Thomsen and van der Flier, 2009). So, what to do when normal renovation will not suffice but demolition is a waste of natural resources?

The purpose and design of the paper

In different parts of Europe, a small number of projects have emerged in large housing estates where the buildings have been "downsized". Often the volumes of the prefabricated buildings have not only been adapted to meet the decreased demand but the deconstructed concrete panels have also been reused in new buildings. These "downsizing projects" have all occurred independently of each other in different countries, and although they have been studied on the national level, they have not so far been investigated together, on a supra-national level. Therefore, this paper reviews four deconstructions of mass housing blocks in four countries over three decades employing an explorative, holistic case study approach (Routio, n.d.) with a historical-interpretative methodology (Wang, 2002).

The cases are located in Sweden (Gothenburg, 1984), the Netherlands (Middelburg, 1986), Germany (Berlin, 2004) and Finland (Raahe, 2010). They were selected on the basis of their pioneering nature, their representativeness, and the availability of good research material and contacts. The Swedish case is apparently the first of its kind in the world. The Dutch and the Finnish cases are the only ones of their kind in those countries, and although the German case is by no means unique in Germany, it was the first of its kind in Berlin, and for the parties involved. The research material consists primarily of previously published research reports, as with a qualitative metasynthesis approach (Salminen, 2011, pp.12–13), but it also includes the researchers' own observations. For the Swedish and Finnish cases, the somewhat sparse documentation was further supplemented with popular and professional articles, interviews with key players (see Acknowledgements) and further documentation provided by them.

The objective of this study is to compare the circumstances, aims, design choices and outcomes of the four projects in order to find generalizable features which can help us learn from these experiences. The focus is on the architectural potential of deconstruction and reuse. The research questions include: What were the circumstances that led to the initiation of the projects? How were the projects developed? What was done, and how? What was expected and were the expectations met? What were the implications for the neighbourhoods?

Below, the results of the four cases are presented in chronological order. They take the form of narratives that first describe the background to the project, then what was actually done, and lastly, how well the final outcome of the project was received.

Results and discussion of the cases

Developments leading to the project

Background for the project in Gothenburg, Sweden

Swedish industrial towns started to grow after WWII, since Swedish export industries benefitted from the international economic boom. The quick urbanization added to the problems of one of the already most overcrowded housing stocks in Europe. The state gave advantageous loans for the industrialization of the construction industry, which responded with the so-called “Million Programme”, i.e. the construction of one million flats in ten years (1965–1974). Gothenburg was one of those rapidly growing industrialised cities with large shipyards and factories, and Bergsjön was one of the satellite towns erected near Gothenburg at that time.

The municipal housing company Göteborgshem was at the forefront of industrial construction at that time thanks to the enthusiasm of its manager Inge Hjertén. The responsibility for developing the company’s own construction system, “Ingebäck”, was given to Helmut Junkers, a young German-born engineer. Junkers came up with a system whose panels were not bolted or welded, but were “hooked” together (Figure 3). Stjärnbildsgatan street in Bergsjön was one of the many areas built using this system. Built in 1967–69, the neighbourhood comprised ten quarters consisting of 4–5 storey buildings (Figure 4, left).

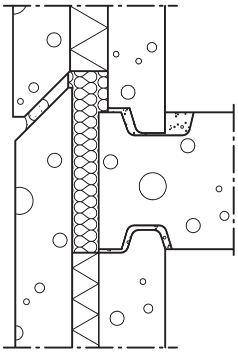

Figure 3
A structural detail (slab-wall connection) of the Swedish Ingebäck panel system. The purpose of the design of the connections was to avoid dilatation joints. Adapted from a document courtesy of Helmut Junkers.

Figure 4
Buildings in Stjärnbildsgatan street before the deconstruction (the block of flats on the left) and after it (the row-house on the right).
PHOTO: © CLAES CALDENBY.

Questions about the quality of the housing built for the Million Programme started early on. By the end of the 1960s, newspapers had labelled some areas as newly built slums, which was hardly fair by international standards. The apartments themselves were of high quality (Figure 5) but journalists and experts criticized the poor outdoor spaces, the dependency on cars, and the lack of services. Some of this criticism was justified. In Bergsjön, flat-ground building types were used, even though the terrain had a significant relief. In addition, the elevators and escalators that connected the residential quarters to the tram stations of the city centre line were soon closed down due to maintenance problems.

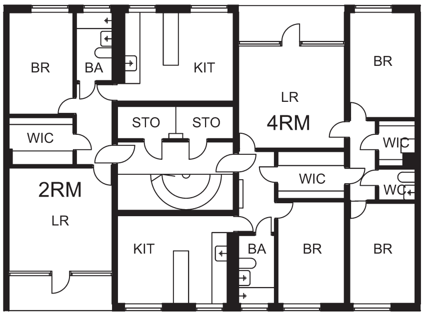

Figure 5
Original plan of Stjärnbildsgatan 60–64. Adapted from a document courtesy of Helmut Junkers.

In the 1970s, a series of global economic crises hit Gothenburg. The oil crisis was the final blow, and three of the city's shipyards were closed down. The resulting outmigration and housing vacancies occurred first in the recently built residential areas like Bergsjön, as these areas were not regarded as attractive. By the early 1980s, Gothenburg had over 5,000 empty homes, and 90% of Göteborgshem's 648 flats in Stjärnbildsgatan were vacant. This not only meant a serious loss of rental income, but also increased maintenance problems and gave the area a reputation which discouraged new tenants from moving in. At the same time, Sweden accepted many refugees from overseas, and these mainly underprivileged new citizens started to concentrate in the recently deserted flats.

Background for the project in Middleburg, the Netherlands

WWII destroyed a significant part of the Dutch building stock. The concrete prefabrication industry in the Netherlands developed rapidly right after the war in order to make up for the housing shortage (Bennenk, 2002). Middelburg, the capital of the rural province of Zeeland, was one of the communities heavily damaged in enemy bombardments (Stichting Kennispunt Mei 1940, 2014). The 1960s also gave a boost to Zeeland's seaport industries, which meant that people relocated there (Provicie Zeeland, 2002). To solve the housing deficit, Middelburg and two other municipalities commissioned the building company De Delta to introduce an industrial building system (Figure 6) (Coenen, Lentz and Prak, 1990). In 1971–72, this building system was used to build three 12-storey blocks of flats for the municipal housing association in Magistraatwijk, outside the city centre (Figure 7).

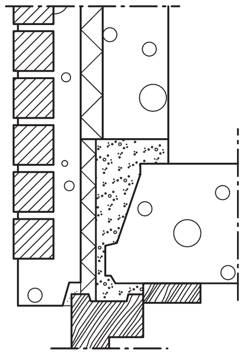

Figure 6
A structural detail (slab-wall connection) of the BMB panel system with strip panels. Adapted from Coenen, Lentz and Prak (1990, p.18). The system was originally based on English building technology, but it had been used in the Netherlands since the 1950s (Coenen, Lentz and Prak, 1990, p.14).

Figure 7
The original apartment blocks. The building on the right is called Schotteflat, presumably after the street named Schottestraat, (now named Johan Adriaen van de Perrestraat). These were the last buildings to be built with the BMB system in Zeeland (Coenen, Lentz and Prak, 1990, p.14). Reprinted from De Kop is Eraf: Evaluatie van de aftopping van een flat in Middelburg, Michel Coenen, Gea Lentz and Niels Prak, 1990, p.9, with permission from IOS Press.

Unfortunately, the design of the buildings was troubled. At a late stage in the design phase, their type of access was changed from balcony access to corridor access. The intention was to make the residents feel safer in the high buildings, but this had adverse consequences. Adding the corridor and adjacent storage rooms took so much depth from the flats that no space was left for balconies next to the living rooms. Therefore, the locations of the living rooms and the bedrooms were interchanged (Figure 8). However, the windowsills of the now-to-be living rooms were not lowered from the 1,200 mm which had been deemed suitable for the bedrooms because the prefabrication had already proceeded too far. Thus, the living rooms not only lacked balconies, but they also had obstructed views. The design of the access routes was also problematic. The elevators only stopped on every third floor; the floors above and below were accessed via staircases (Figure 9). A third elevator was removed from the middle of the block to compensate for the increased design costs. Consequently, the corridors carried heavy traffic causing disturbances to the adjacent flats' residents. The corridors also lacked social control because they were not visible from the flats; and as the entrances and storage rooms could not be locked securely, vandalism occurred (Coenen, Lentz and Prak, 1990).

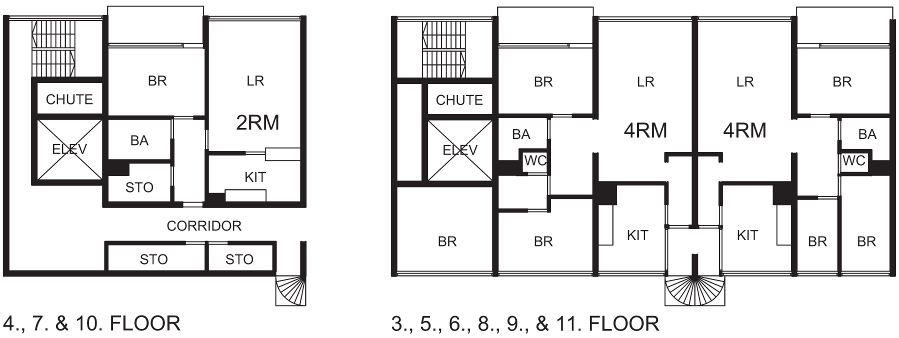

Figure 8
Original plans of the Schotteflat with full-length corridors only on every third floor, where the elevators stopped. Adapted from Coenen, Lentz and Prak (1990, pp.12–13).

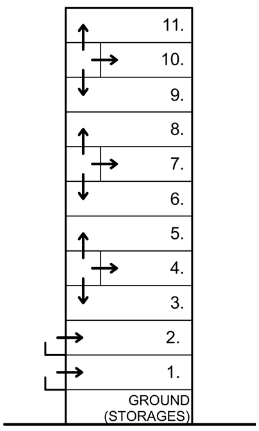

Figure 9
Original access arrangement with the skip-stop elevators, similar to the one in the infamous Pruitt-Igoe. Adapted from Coenen, Lentz and Prak (1990, p.11).

Soon after the buildings' completion, the global economic decline hit Zeeland. The unemployment rate was high, and as the region had the loosest housing market in the Netherlands (CBS, 1986) there were soon plenty of unoccupied flats in the least popular estates. In 1974, the Schotteflat's and its sister buildings' vacancy rate was 21%. The flats were renovated to make them more attractive, but this didn't last long. In 1977, the vacancy rate had again climbed to 19%. Social problems proliferated, and the flats, which were largely occupied by recent immigrants, became in effect segregated areas. (Bureau Criminaliteitspreventie, 1988).

Background for the project in Berlin, Germany

The village of Marzahn was absorbed into Berlin in 1920 as a result of the city's industrialization (Bezirksamt Marzahn-Hellersdorf, 2010). WWII destroyed one-third of Berlin's homes (Wedler and Hummel, 1947), and when the city was divided, Marzahn was stranded on the east side of the iron curtain. From early on, the GDR based its reconstruction policies on prefabrication. In the 1970s, the focus shifted from rebuilding city centres to building large housing estates on a city's outskirts. For East Berlin, Marzahn was regarded as a suitable area for residential construction thanks to its existing infrastructure and the fact that there were 50,000 jobs in the industrial area. This housing was erected using the large panel system "WBS 70" (Figures 10–12). From the inauguration of the first high-rise building in 1977 to the time of German reunification in 1990, Marzahn's population grew from 64,400 to 152,000 (Ifland and Peters, 1997).

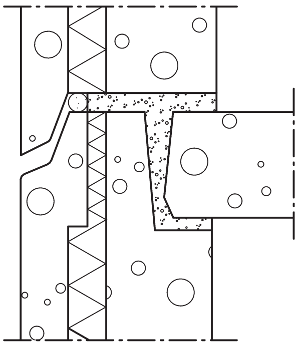

Figure 10
A structural detail (slab-wall connection) of the German WBS 70 large panel system. It was the culmination of the GDR's prefabrication technology and the most widespread of its panel systems. Adapted from BMBau (1993, p.32).

Figure 11
WBS 70 buildings along Havemannsstraße and Rosenbecker Straße streets, Marzahn.
PHOTO: © CLAUS ASAM.

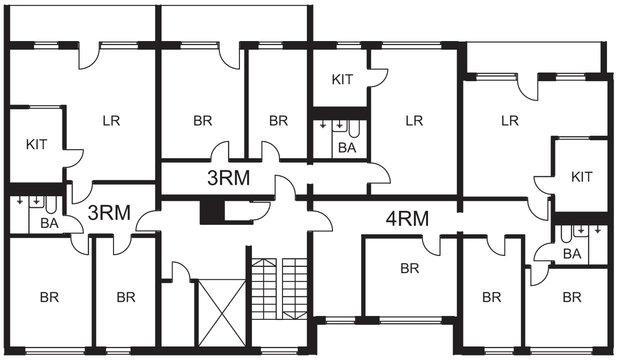

Figure 12
Original plan of a normal floor in the middle segment of a WBS 70 building. Adapted from “Plattenbau” (n.d.).

After the fall of the wall, the former GDR flats were handed over to local government, which decided to privatize them (BMRBS, 1993). The federal government speeded up the process with financial incentives (Mezler and Harff, 1993). In Marzahn, the city of Berlin retained its ownership of some blocks, such as the buildings on Havemannsstraße street from 1985 (Figure 11) but sold the majority of the other buildings to property developers, who soon modernized the buildings to optimize rentals. Despite the modernization, a lot of prefabricated homes were vacated in East Germany after reunification. Tenants left in pursuit of jobs, home-ownership and more attractive living environments. Marzahn faced competition from the neighbouring municipality of Brandenburg, where new single-family houses and shopping complexes had been built. The number of empty homes in Marzahn had risen to 12% by 2001 and ranged from 21–27% in northern Marzahn, where Havemannsstraße street is located (Röding and Veith, 2003).

Background for the project in Raahe, Finland

Finland was one of the last European countries to industrialize. WWII speeded up the process, as Finland has to pay war reparations to the USSR in the form of industrial products, which resulted in a strong metal-working industry. In 1960, the state established a steel factory in Raahe, a small peripheral town with a high unemployment rate (Korkiakoski, 2005). This turned Raahe into one of Finland’s fastest growing communities at the time (Rajaniemi, 2006, p.11). At the same time, the house-building sector was industrialized, in order to cope with the housing deficit resulting from increasing urbanization (Hankonen, 1994).

As part of the preparation for founding new residential areas in Raahe, the factory workers were surveyed about their housing preferences. The preference was low for flats, but high for houses. Nevertheless, experts believed that the preference would change in favour of flats in the future (Rajaniemi, 2006, p.116). Therefore, two large housing estates, Kummatti and Ollinsaari, were founded outside the town centre. The state subsidized the loans and the municipality commissioned the buildings. Kummatti was built gradually between 1967 and 1988 (Kiinteistö Oy Kummatti, 2005; 2015a; 2015b) with low slab blocks (Figures 13 and 14) and high point blocks (Figures 15 and 16). Typically of the era, the construction focused on speed and profit, which resulted in a monotonous living environment (Rajaniemi, 2006, p.190). The structural systems followed the development of prefabrication technologies, from factory-specific partial prefabrication methods to one nationwide open-source panel system, "BES" (Figure 17).

Figure 13
A 3-floor slab block in Jousikatu street.
PHOTO COURTESY OF HARRI HAGAN.

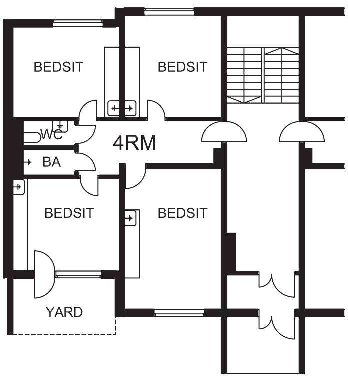

Figure 14
Excerpt from the original plan of the ground floor of a 3-floor slab block with bedsits for students. Adapted from documents courtesy of Harri Hagan.

Figure 15
7-floor point blocks in Jousikatu street.
PHOTO COURTESY OF HARRI HAGAN.

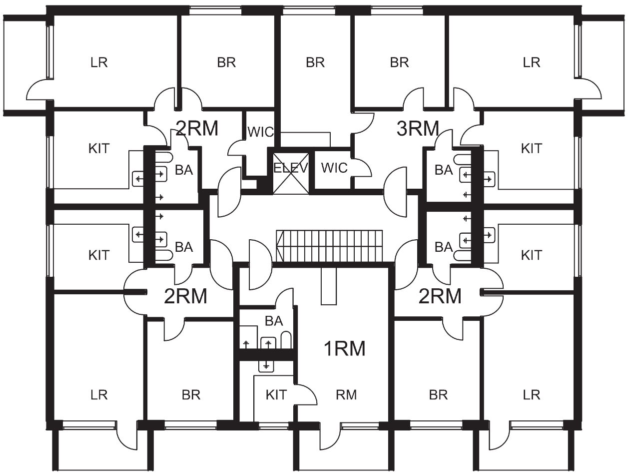

Figure 16
An original plan of a 7-floor point block. Adapted from documents courtesy of Harri Hagan.

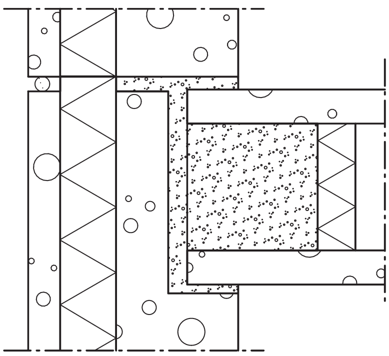

Figure 17
A structural detail (slab-wall connection) of the Finnish “BES” panel system. Adapted from BES (1969).

In Raahe, housing surveys showed that residents of flats were the ones most dissatisfied with their living conditions (Rajaniemi, 2006, p.53). When jobs in heavy manufacturing industry started to decline in Finland in the 1980s (Statistics Finland, 2005; Rajaniemi, 2006, p.78), vacancies began to appear in Kummatti. Over the years, the number of steel workers decreased to one-fifth of its peak (Heikkinen, 2006), turning the town into one of the most rapidly shrinking communities in Finland (Rajaniemi, 2006, p.11). In 1987, Raahe incorporated all its municipally owned homes, and by 2004, when Leo Sassi was appointed as the municipal housing corporation's new general manager, Kummatti's vacancy rate had risen to 30%. Kummatti had a bad reputation, and the crime rate was high. As the buildings in Kummatti comprised more than half of the municipal housing corporation's flats, the high vacancy rate was extremely detrimental for the corporation's bank balance. The general decline in the town's population aggravated the situation, because there were plenty of other housing options available (Rajaniemi, 2006, pp.145–146).

Synthesis of the backgrounds

The erection of all the housing estates in this study was associated with the development of prefabricated concrete construction which occurred after WWII, regardless of whether this was in response to the destruction of housing stock in the war or the rapid increase in urban populations linked with industrialization. The decline of all the communities was related with the global economic crises of the 1970s/80s and the shift to a post-industrial economy. This interpretation can be made even though the development was delayed in Raahe, and also in Berlin – where the housing demand was also influenced by the opportunities that opened up when communism fell – and the population decline was most often not final (Figure 18).

Large housing estates represented the least popular housing option in these communities. In addition to the non-attractive scale and appearance of mass-produced housing, they were further bedevilled with design and maintenance flaws. Thus, as the housing markets loosened, they were the first type of accommodation to increase their vacancy rate, typically resulting in a concentration of poorly-resourced groups, and the concomitant emergence of crime and other indicators of deprivation.

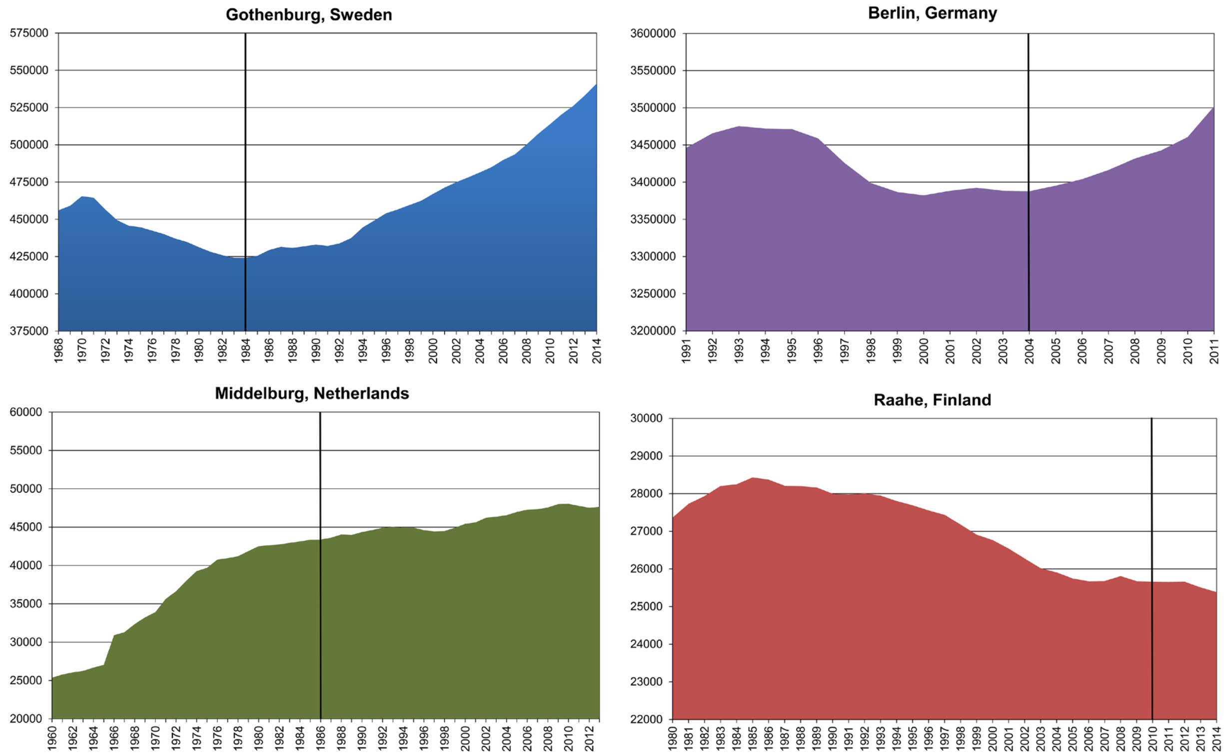

Figure 18
Demographic developments in the case communities. The years the deconstruction projects were finished are marked with vertical lines. Note: Start and end years of statistics (x-axes) and ranges of population values (y-axes) vary due to the availability of data and the difference in the size of the communities. Sources: Statistics Sweden, 2015 (Gothenburg); CBS, 2015 (Middelburg); Amt für Statistik Berlin-Brandenburg, 2015 (Berlin); Statistics Finland, 2015 (Raahe).

Chosen measures and outcomes

Project in Gothenburg

Göteborgshem's first reaction to the fall in occupancy was to step up their advertising, but this had little impact. Then, new inhabitants were offered reduced rents for the first year, which upset older residents. The discontinuation of a public subsidy for vacant flats in 1982 exacerbated the situation (Tibblin, 1986), but Göteborgshem was still reluctant to demolish the 15-year-old buildings. Architect Peter Broberg and Lars Jonsson from the building company ABV came up with the idea of deconstruction. Helmut Junkers saw the opportunity, not only to turn the high-rises into more attractive row-houses, which Göteborgshem aimed to privatize, but also to reuse the excess panels. He was appointed the project manager. The architects responsible for the original design, Celander–Forser–Lindgren, also joined the project. One block was designated a test case, and ABV started the work in 1984. First, the walls were braced and the roof panels were lifted down with a specially made fork. Then, anchors were screwed into the wall panels so that they could be lowered down to the ground. The deconstruction proved to be relatively easy thanks to the "hooked" joints. The panels were then transported to a disused panel factory for cleaning with high-pressure water-hoses, after which they were placed in storage.

In the first quarter, 107 flats from four-storey buildings were transformed into 34 homes in row-houses. The houses were given gable roofs and bay windows, and the new accommodation was larger and more modern than the old flats (Figure 4, right, and Figure 19). They also had attractive gardens and public spaces. As befitted the 1980s post-modernist zeitgeist, the architecture became softer and more varied. Both the state and the municipality contributed subsidies of 2 million Swedish crowns (SEK) to the project, making the cost of the transformation 4.700 SEK/m². Although Göteborgshem had originally intended to retain four blocks as social housing, the deconstruction was eventually extended to all buildings. Owing to the discontinuation of the state subsidy, the cost had risen to 10,000 SEK/m², the same as for new construction, by the time the project ended in 1988.

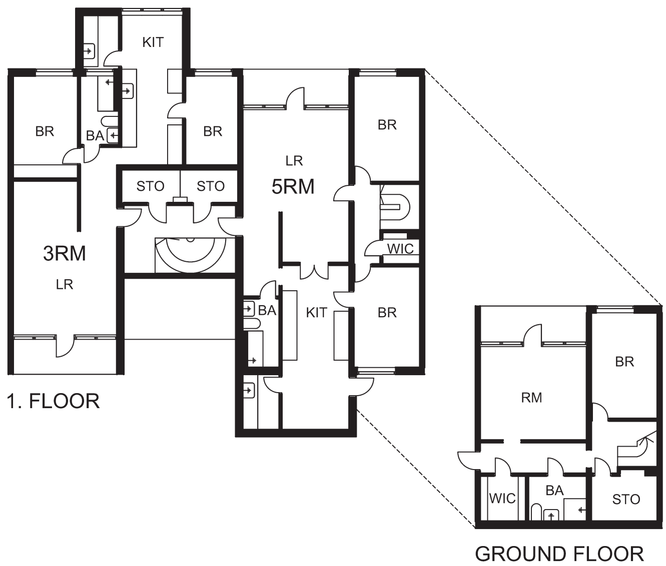

Figure 19
Modified plans of buildings on Stjärnbildsgatan street, cf. Figure 5. Adapted from a document courtesy of Helmut Junkers.

80–85% of the deconstructed panels were found to be reusable. The remainder were damaged in some way during the deconstruction. The successfully deconstructed panels were as good as new ones, but only one-third of their price. They contributed to 320 new homes in four separate projects in the Gothenburg region (Junkers, 1994). The most remarkable of them was a seven-storey infill building in the city (Figure 20). They were also used for building houses in suburban locations, similar to the buildings on Stjärnbildsgatan street after deconstruction (Figure 21).

Figure 20
An apartment block on Prinsgatan/Plantagegatan streets, central Gothenburg, with reused panels in the courtyard facade. The street side has a brick facade to conform with the surroundings, and the slab was made anew.
PHOTO: © CLAES CALDENBY.

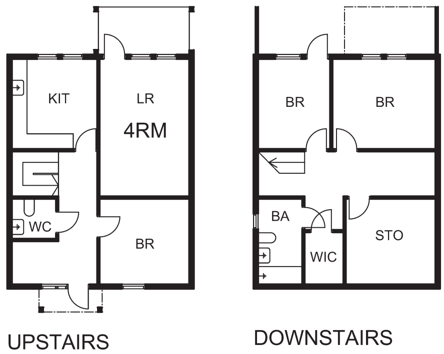

Figure 21
The plan of a row-house in Torp-Södergården, Lerum, made of reused panels from Stjärnbildsgatan street. Similar houses were built in Kungälv and Backatorp. Adapted from a document courtesy of Helmut Junkers.

Project in Middelburg

As social and occupancy problems persisted prior to the 1978 election, politicians proposed the idea of demolition for the failing housing estate, even though the buildings were only 6–7 years old. The housing association suggested fundamental renovation instead, but this was not deemed feasible because there was no guarantee it would pay for itself. The manager of the housing association, J. Tevel, came up with the idea of deconstruction and reuse in 1982. From that point on, the decision-making took four years. The aim was to increase the quality of the housing complex. The association believed the costs could be managed if the panels could be reused and the unemployed workforce could be utilised, although the latter idea was turned down by the Ministry of Social Affairs. The government had become involved since the project was the first of its kind. The government's wish was that the experiment should begin with only one building, known as "Schotteflat". A financial feasibility study with several alternatives was performed; the chosen solution involved deconstructing seven floors and building new flats with those panels in the neighbouring district of Dauwendaele.

The work, which began in 1986 and took six months in all, was conducted by the original contractor, de Delta. To guarantee success, some of the methods and machinery were specially developed for the project and tested beforehand. One of these tests concerned the actual deconstruction phase, and it showed that the cast concrete infills only had very limited adhesion to the prefabricated parts, which eased deconstruction. The slab-wall connections were diamond sawn, the panels – 900 of them – were demounted, marked with individual codes and transported away into storage. The remaining part of the building was renovated (Figure 22). The corridors of the two topmost floors were replaced with galleries (Figures 23 and 24). The flats could be enlarged slightly because the storage rooms were relocated to the ground floor. The living room windowsills were lowered, and the security locks and the entrances were improved (Coenen, Lentz and Prak, 1990). The load-bearing concrete panels were reused in erecting three low-rise blocks of flats (Figure 25). As the Schotteflat's original layout was deemed flawed, the plan was redrawn (Figure 26). Once the project was finished, the housing association chose to pursue a careful policy in assigning the flats. Convinced that homogeneous demographics would lead to a more harmonious community, the housing association rented the new flats to middle-aged people (Bureau Criminaliteitspreventie, 1988).

Figure 22
The deconstructed 5-floor Schotteflat, cf. Figure 7.
PHOTO: © NANDA NABER.

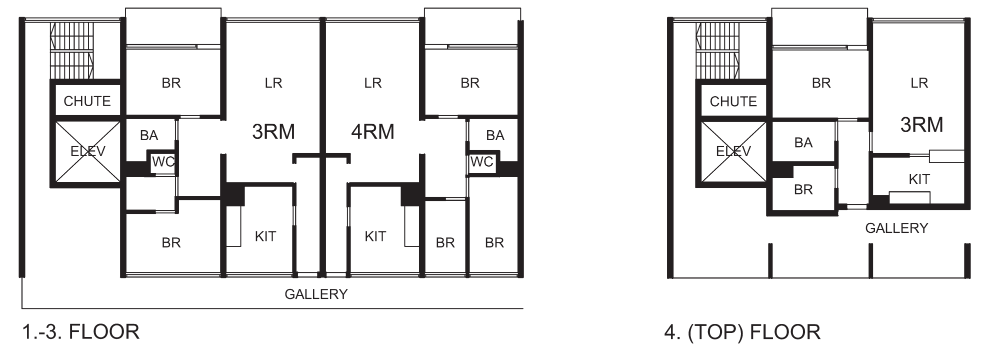

Figure 23
Modified plans of the Schotteflat, cf. Figure 8. The modification made the third floor identical to the original first and second floor, which remained unchanged. Adapted from Coenen, Lentz and Prak (1990, pp.168–169).

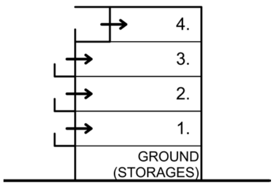

Figure 24
The access arrangement after the modification, cf. Figure 9. It relies on galleries instead of corridors. Adapted from Coenen, Lentz and Prak (1990, p.167).

Figure 25
One of the three buildings made out of deconstructed panels, designed by architects van Pepper Jongepier, cf. Figures 7 and 22. The buildings are located in a quarter delimited by Vrijlandstraat, de Roozenburglaan and Buitenhovelaan streets.
PHOTO: © NANDA NABER.

Figure 26
Plans of the new blocks of flats made out of deconstructed panels, cf. Figure 8. The access arrangement and the distribution of the flats on the upper floors have been completely redesigned. Adapted from Coenen, Lentz and Prak (1990, pp.195–196).

Project in Berlin

To reduce the general devaluation of properties in the former East Germany, the federal government initiated an urban regeneration programme "Stadtumbau Ost" in 2001. It was aimed at removing surplus flats from the market. The remaining housing stock was to be modernized to decrease energy consumption and to respond better to housing needs. The Berlin municipal authority participated in a federal competition for urban regeneration, part of Stadtumbau Ost, to benefit from demolition and refurbishment subsidies which were offered as prizes. The quarters on Havemannstraße in Marzahn were one of the areas selected for the competition. The massive 11-storey scale of the estate had posed problems for urban planning right from the start. Therefore the plan, developed together with the residents, focused on a floor-by-floor lowering plan, intended to remove 1,800 flats. (Gruppe Planwerk, 2007).

In 2002, researchers at the Technical University of Berlin came forward with an alternative plan because they believed that merely reducing the number of flats would not increase the value of property in the neighbourhood. In addition to issues concerned with urban planning and architecture, they argued that the technical infrastructure networks would become underutilized. Thus, they proposed deconstruction of the existing blocks and construction of a low-rise infill development out of the dismantled panels. Inspired by the Gothenburg project (Wbm Mediathek, 2014), such ideas had been proposed in Germany soon after reunification (e.g. Senatsverwaltung für Bau und Wohnungswesen, 1994, p.94). Research had been conducted and several projects had already been implemented from 1999 on (Asam and Dallmann, 2005; Kil, 2008; Mettke, et al., 2008; Mettke, Heyn and Thomas, 2008). In Marzahn, the idea of infilling did not receive a sympathetic hearing. Nevertheless, many families were attracted by the idea of building their homes out of deconstructed panels, as evidenced by the fact that Conclus, an architectural office involved in creating the alternative plan, received 90 queries for private projects.

As a result, the buildings on Havemannstraße were deconstructed and extensively renovated (Figures 27 and 28). The windows and facades were renewed to reduce energy consumption, and the surroundings were landscaped. The flats were enlarged, and penthouses were given large roof terraces, which lent their name to the whole development, "Ahrensfelder Terrassen". During the deconstruction, the researchers performed tests and calculations on the new roof terraces and the dismantled panels. It was concluded that the roofs did not need any additional reinforcements, despite the increased loads induced by the roof gardens. The only problem was that the removal of the slabs above them left gaps between the neighbouring walls and slabs, which had to be secured with flat bars and a concrete infill. The quality of the dismantled panels was found to depend primarily on the quality of the deconstruction (Asam and Dallmann, 2005).

Figure 27
The finished project, now known as "Ahrensfelder Terrassen", designed by architects Stephan Schüttauf and Michael Persike, cf. Figure 11. The final number of floors varies from 3 to 6. The transformation has been described as the largest urban regeneration project in Berlin, the volume of which is best described by the numbers of flats before (1,689) and after (447); the number of different types of flat was increased from 10 to 39 (Friedrich, 2015).
PHOTO: © CLAUS ASAM.

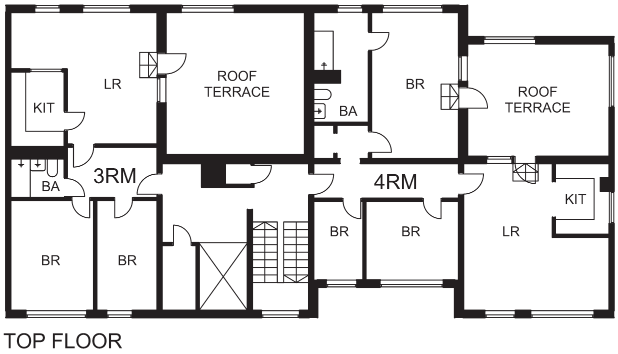

Figure 28
One modified plan of the buildings, cf. Figure 12. Adapted from SPP Property-Project-Consult (n.d.).

Figure 29
A new single-family house in Mehrow, designed by Conclus, that was built using reclaimed panels and slabs from Marzahn. The two other projects are located in Schildow and Karow. The distance to the donor buildings is 6–25 kilometres.
PHOTO: © CLAUS ASAM.

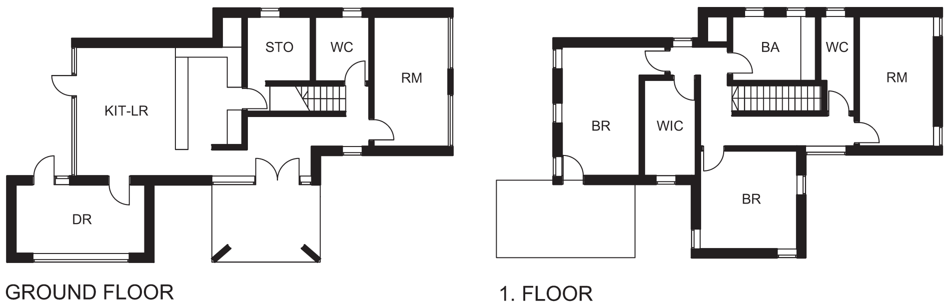

Figure 30
Plans of the Mehrow house. Adapted from Conclus (n.d.).

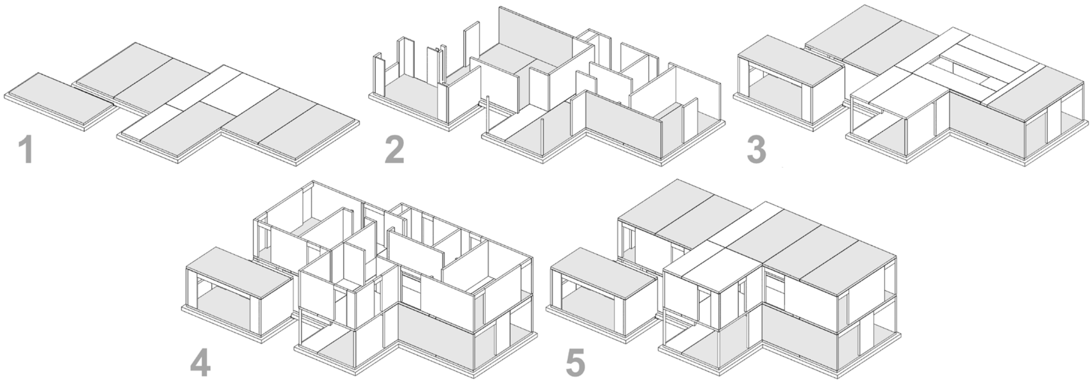

Figure 31
The composition of the frame in the Mehrow house, layer by layer. Grey colour indicates whole panels, while all the others have been cut. Almost all the wall panels were narrowed, but only a minority of the floor panels needed to be shortened and/or narrowed. Adapted from documents courtesy of Conclus.

In parallel, three private reuse projects were initiated for single-family houses in suburban locations (Figures 29–31). The deconstructed panels were cleaned with high-pressure water and diamond sawn on the original site to the measurements required for the new projects (Figure 31). As the wall panels did not have any reinforcement, they had to be transported to the new sites in an upright position. The floor panels were transported in a horizontal position, although this required licensing for an oversize load. Only the interior wall and floor panels were reused. The buildings out of reused panels were insulated to low-energy standards. In these projects, the research team also studied the limits to changing the original design, such as using floor panels for walls or making saddle roofs, all of which proved technically feasible.

Project in Raahe

In 2005, the state initiated a nation-wide programme for redeveloping vacant public housing in declining communities. Leo Sassi made the Kummatti housing corporation join, hoping to upgrade the buildings and the housing corporation's bank balance. An architectural competition was arranged to dispose of the overcapacity, to adjust the size of the flats to meet the current demand for small flats, and to refurbish the buildings (Kiinteistö Oy Kummatti, 2005). The task encompassed 13 buildings (Kiinteistö Oy Kummatti, 2005; 2015a). Sassi decided that no buildings should be demolished, because that would not upgrade Kummatti's quality, value or market position (Hagan and Kontukoski, 2009). He calculated that downsizing and renovation would be 20% cheaper than demolition and new construction. At the same time, the corporation exchanged the state-subsidized loans for market-based ones in order to be freed from means-testing in tenant selection.

The winning entry by the architectural office of Harri Hagan proposed to halve the volumes of the buildings (Kiinteistö Oy Kummatti, 2006). The proposal also gave some of the buildings features of row-houses, such as private gardens. The tenants, who were relocated to other flats mostly in the same neighbourhood, generally accepted the project because it was clear that their buildings needed repair. The work was put out to tender, and the project began with three low-rise slab blocks (Figure 32), which were lowered further to avoid the need to add elevators. Student bedsits were turned into individual flats (Figure 33). The contractor, Lehto, was responsible for the technical implementation of the plan. This began as conventional demolition but was soon changed to deconstruction when it was realised that this was quicker and easier. The connections between the panels were opened with chiselling robots. Lehto sold some of the deconstructed panels for agricultural construction (Hagan, 2013), which alerted Sassi to their use value. The architect, Hagan, was familiar with prior European reuse projects and favoured the idea of reusing the panels on the original site.

The deconstruction continued with four point blocks (Figure 34) whose largest flats were removed (Figure 35). Stability reconstruction measures were necessary due to changes in the stress distribution (Figure 36). Carports, garages for maintenance vehicles (Figures 37 and 38) and garden pavilions, which in the competition proposal were to be made of virgin materials, were actually built out of the deconstructed panels. As the panels' original connecting devices had been cut off and could not be reused, the panels were simply encased in a cast-in-place foundation wall. Reworking was only necessary in the gables, where the panels were diamond sawn to follow the roof shape.

Figure 32
A slab block after deconstruction and refurbishment, designed by architects Harri Hagan and Petri Kontukoski, cf. Figure 13. The tower for solar panels is a new timber-framed structure.
PHOTO: © SATU HUUHKA.

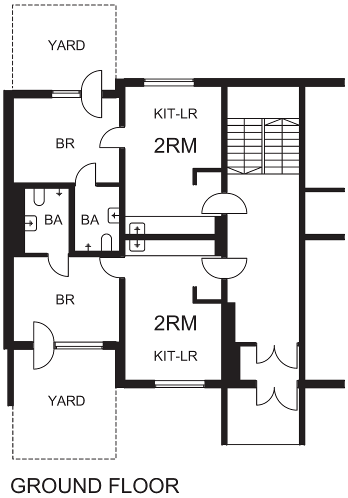

Figure 33
Modified plan of the slab block, now with individual flats, cf. Figure 14. Adapted from a document courtesy of Harri Hagan.

Figure 34
Point blocks after deconstruction and renovation, cf. Figure 15. When asked where the project failed, the housing company representative mentions the wind turbines; they have since been removed because they were constantly out of service.

PHOTO COURTESY OF HARRI HAGAN.

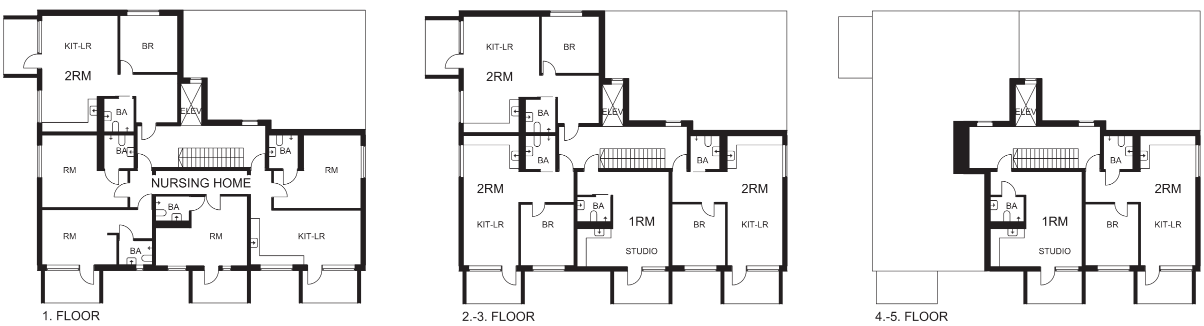

Figure 35
Modified plans of the point blocks, cf. Figure 16. Adapted from documents courtesy of Harri Hagan.

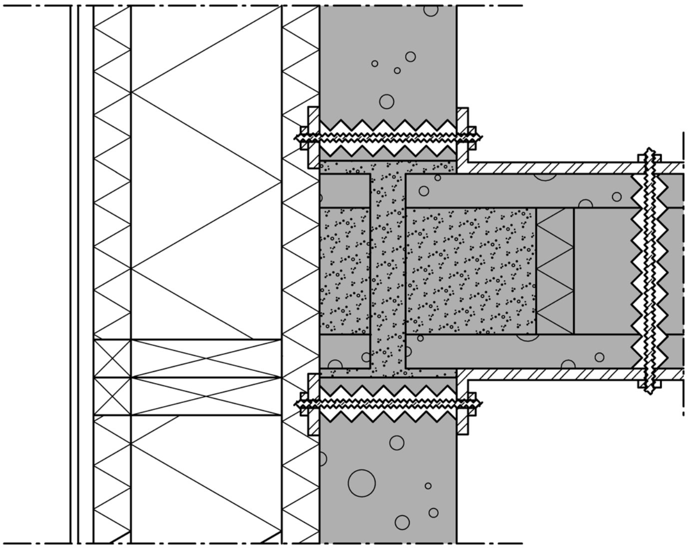

Figure 36
Structural detail of consolidation and insulation measures on former partition walls. Grey colour indicates old structures. These walls, which used to be symmetrically loaded interior walls, became asymmetrically loaded exterior walls as the result of deconstruction. New steel parts anchor the hollow-core slabs, whose bottom reinforcement has been cut, to the walls. The insulation is executed with the help of premade large timber panels. Based on Saastamoinen (2013, p.96), field observations and documents courtesy of Harri Hagan.

Figure 37
Garage for maintenance vehicles made out of the reused panels.
PHOTO: © SATU HUUHKA.

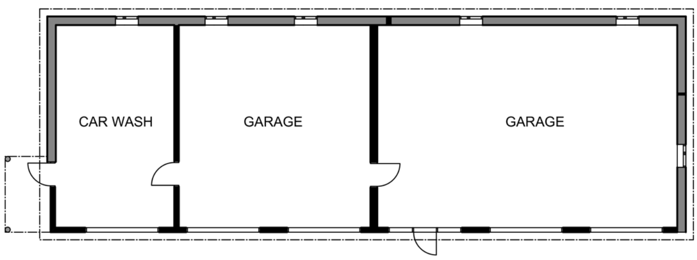

Figure 38
Plan of the garage. Grey indicates walls made out of the reused panels and the black lines are for new structures. Adapted from a document courtesy of Päivi Ilmarinen.

The aims of energy efficiency and special housing needs emerged during the project (Kiinteistö Oy Kummatti, 2006). Consequently, the buildings were insulated to low-energy standards and equipped with solar panels and wind turbines, which also gave them an avant-garde image. The flats were adapted to suit senior citizens with functional limitations; one point block was earmarked as a nursing home for senior citizens suffering from dementia, while another one was for the mentally ill. The project got modest state subsidies: 50% for downsizing the first three buildings; 50% for the cost of four elevators; and 10% for the other construction costs of the point blocks.

Synthesis of the measures and the outcomes

Despite the extensive vacancies, the landlords were reluctant to demolish the relatively new buildings. Public subsidies were necessary get these financially risky, pioneering projects off the ground. The deconstruction aimed at improving the quality and attractiveness of the neighbourhoods to an extent that neither conventional renovation nor complete demolition of surplus buildings could have achieved. The technical feasibility was verified during the process, and reuse came into the picture as a result of the panels' deconstructability. In the lowered buildings, the changes to the flat floorplans remained moderate, but in some of the new buildings, the logic of panel construction was stretched for more versatile spatial solutions. The deconstruction and reuse processes were broadly similar in all the cases, despite the differences in the construction technologies. In the deconstructed buildings, the need for stability reconstruction measures depended on whether the stress distribution had changed. In the reuse projects, some of the original panel systems proved more easily reassemblable than others.

Reception and later evaluation

Appraisal of the project in Gothenburg

The Swedish transformation project was the most radical in many senses. Of the four cases studied here, it covered the largest area and involved the most drastic changes in scale. The change in building type from blocks of flats to row-houses was accompanied by a step up in architectural quality, including the gardens, the aesthetics of the facades and the floor plans. The dwellings were upsized, making them more pronouncedly family homes. Nevertheless, if Bergsjön is looked at in its entirety, the transformation only covered about one-tenth of the total geographical area, forming an enclave which is largely isolated from the other parts of the neighbourhood. The project's wider influence is therefore quite limited. Moreover, the reuse of panels had no impact on the neighbourhood itself, as the new buildings were not located in the neighbourhood.

As a pioneer, the project was widely publicised in the press (e.g. Hårde, 1984; Burell, 1985) and the professional media (e.g. Schilling, 1987; Burkhard, 2000; Unruh and Nagora, 2002). Deconstruction and reuse had been shown to be technically feasible with the Ingebäck system. Its developer, Junkers, was a driving force in the process. Besides taking a pride in the system and a technical interest in the solution, he also had visions of ecological and social sustainability. Nevertheless, towards the end of the project the original inhabitants of the area started to question the approach because many of them could not afford to buy their homes or to pay the increased rents.

In the crisis situation of the early 1980s, deconstruction was a financially reasonable solution for Göteborgshem and for Gothenburg's fiscal health. The renovated homes were sold for as much as new dwellings. Although Göteborgshem made no profit, it avoided annual rent losses of 3 million SEK (Tibblin, 1986). For the homebuyers, the advantages were not so clear-cut. The prices they paid were not much lower than they would have paid for properties in other neighbourhoods, but Bergsjön continued to have social problems and a bad reputation. Therefore, the homes failed to reach their purchase price when they were resold (Isemo, 1988).

In 1985, following a 15-year decline, the population of Gothenburg started to increase again. In the Million Programme neighbourhoods, a series of other kinds of regeneration projects followed (Caldenby, 1986). Junkers continued to work with small-scale deconstruction and reuse in socially motivated projects in the 1990s, but by that time, he felt that the housing company had already sold out. For Göteborgshem, the situation was different from the crisis years as there were no longer empty flats or public subsidies for deconstruction. As Scandinavia's largest port, Gothenburg is today one of Sweden's most rapidly growing cities and it benefits from the globalization of economy. Bergsjön, then again, is still listed amongst the 15 most vulnerable neighbourhoods in Sweden (Nationella operativa avdelningen, 2015), and now more than half of its inhabitants are first-generation immigrants (Andersson, 2004, p.15).

Appraisal of the project in Middelburg

In all, the most significant modification of the Schotteflat was the reduction of scale, which helped to decrease the anonymity of its inhabitants. Otherwise there were only minor improvements to the architectural quality. The alterations focused on the access system to remove the opportunities for antisocial behaviour. The modifications to the flats' layouts were largely cosmetic. In the new buildings, though, previously absent flat sizes were added, which provided more residential variety, but on a very limited scale (three buildings in an entire neighbourhood). Some of the original design flaws were transferred to the new buildings (balconies attached to bedrooms), and some new glitches were created (e.g. flats without balconies).

As deconstruction and reuse were something unforeseen, discussions concerning regulation, financing and technical feasibility slowed down the decision-making. Thanks to good preparation, the deconstruction went faster than expected. The special equipment and developed processes lived up to expectations. Alas, a lot of that time benefit was lost in the less carefully planned renovation. In the end, the costs for deconstruction and renovation were 13 million Dutch guilders, only 7% lower than replacing the building with a new one (van Nunen, 1999).

Most reclaimed panels were found to be in a reusable condition, although some were damaged during the deconstruction and the connections were not perfect. The cost of reuse ended up amounting to 11 million guilders, 19% higher than a conventional new construction. The overspend was due to the pioneering nature of the project, whose first-time organization was time-consuming. In all, the entire project cost 3.4% more than a conventional one. State and local subsidies, nearly one million guilders, were crucial for the budget. The municipality bargained away the new plot and, in case the vacancies persisted, guaranteed to compensate for the shortfall. (Coenen, Lentz and Prak, 1990).

The other two high-rises were not downsized as planned. The housing association believed that with the overall improvement of the area, less costly renovations would increase the appeal enough to eliminate the vacancies. By 1990, prospective tenants were already on waiting lists for both the old and the new buildings. As a result of the tenant selection policy, social problems, such as the high crime rate, were mitigated, even if the turnover of residents was still high. (Coenen, Lentz and Prak, 1990). Therefore, it is slightly surprising that in the 2000s, the sister buildings of the Schotteflat have been replaced with new buildings on the original high-rise scale. Schottestraat has also been renamed. Although the problems seemed to lessen in the 1990s, these developments imply persistent stigmatization.

Appraisal of the project in Berlin

Lowering and renovating the quarters brought about buildings of a dramatically more relatable scale and identifiable architecture. Even though there was no fundamental change to the building type, some qualities associated with low-rise housing, mainly private terraces and gardens, were added in favourable places. Because the infill plan was turned down, the reuse occurred elsewhere and did not influence the composition of housing in the neighbourhood. Nevertheless, the variety of housing options was increased, as the 10 standardized flat plans of the panel system were transformed into 39 modified layouts. However, even though the transformation covered four large quarters, the total geographical area of Marzahn is so big that the project is but a drop in the ocean. In the sub-area of northeast Marzahn, the project may have an effect on the neighbourhood's image beyond its scale due to its central location in the cityscape. There, the project also increases orientability.

The results were well received by the residents, having a positive resonance in Marzahn and beyond, which made the project a successful example of urban regeneration. The majority of residents have been able to stay in the renovated flats, and the district has stabilized. (Gruppe Planwerk, 2007). The demographics of Marzahn's residents have not changed much (Geoportal Berlin, 2014), but the transformation project has done much to alleviate stigmatization. However, any comprehensive use of the approach is seen as unlikely due to the costs, which are regarded as "relatively" high (Gruppe Planwerk, 2007). By today, the Stadtumbau Ost programme has decreased the housing stock by 300,000 flats in total, usually through the demolition of whole buildings. In Marzahn, too, some buildings have been torn down.

The involvement of researchers created generalizable knowledge about the reuse possibilities of the WBS 70 system. Both deconstruction and reuse were proven to be technically feasible, even with major changes to the original design. Moreover, the researchers' calculations verified the reused panels' significant ecological advantage over virgin materials (Asam, 2007). Unfortunately, the reuse pilot schemes suffered from issues that made the projects' conditions suboptimal. As the housing association had already signed an agreement to demolish the buildings, the panels were considered as waste and their ownership had been transferred to the contractor. Reclassifying them as construction products required time-consuming bureaucracy. In one pilot, conflicts also arose between the client and the demolition contractor, which resulted in the contractor not delivering the ready-cut panels. A years-long legal battle followed causing expenses to skyrocket. In the other two, more successful pilots, reusing panels saved up to one-third of the usual raw shell costs.

Appraisal of the project in Raahe

In Kummatti, the transformation did not concern so much the scale *per se* but produced a livelier, less solid and a highly identifiable massing. The high-rises were made more slender but there was no change of typology. Apart from the assisted living facilities, the changes to the remaining flat layouts were modest. The most noticeable change was the removal of the partition walls between kitchens and living rooms, which improves the experience of spaciousness and the lighting conditions. Also, enlarging the balconies and the elevator enhanced functionality moderately. The most significant updates were nevertheless to the equipment of the flats and to the interior and exterior surfaces. In the low-rises, the modifications were more pronounced. The buildings were turned into row-houses and the student housing units were turned from shared to individual units. The individual units correspond better to contemporary students' expectations of housing density and privacy. From a functional viewpoint, the affordances the neighbourhood's semi-public areas offer were improved with the help of auxiliary buildings, making the yards spatially more confined and defensible. Since the transformation covered a central and significant proportion of the entire district, it has had a major effect on the external image of the neighbourhood.

Kummatti was the most ambitious of the 40 projects that participated in the state programme. Other municipalities mostly sold whole buildings to developers or flats to private buyers (Ympäristöministeriö, 2011). Although the subsidizing government body found Kummatti's project innovative, the authorities were also concerned about the costs, given Raahe's housing market. The housing corporation itself is convinced of its having achieved steadier incomes and a more secure future. The cost estimate was adhered to, making the project 20% cheaper than demolition and new construction would have been. Reuse reduced the cost of the utility buildings by 36%. Crime and stigma have been reduced, and there are virtually no vacant flats in the downsized buildings. The special housing units (10% of the flats) are also important for the occupancy rate. The other side of the coin is that rents rose, few of the original tenants were able to return, and social problems accumulated in the other large housing estate, Ollinsaari.

Locally, the project was overshadowed by political controversy. Not everyone agreed with Sassi's strategy to upgrade Kummatti's status. Sassi himself considered it to be his legal responsibility because no social duties were recorded in the company's by-laws when the municipal housing was incorporated. Critics also questioned the sustainability of the debt burden, resulting from new loans raised on top of unamortized old ones. Some council members and officials tried to influence the outcome and circumnavigate the decision-making protocol, which contributed to disputes in court and the media. In this climate, it was Sassi's determination that pulled the project through. Plans were made ready for the deconstruction of six more buildings, but they have not been put forward because the council is no longer willing to guarantee investment loans. On the contrary, the residents were reorganized so that three of those buildings could be completely vacated and demolished. The remaining three are occupied but unrefurbished.

Synthesis of the reception

The transformations decreased scale, stepped up identifiability and architectural quality and increased the variety of housing options. Even though the cases were greeted with great curiosity, the lack of further interest in such approaches may be explained by the uncertainty of the costs. There were overspends when the decision-making and project management and were suboptimal. Even in the successful cases, the costs were relatively high in comparison to new construction and the neighbourhoods' market position. Some landlords were obviously looking to upgrade their properties' values by doing away with the old residents, who benefitted little from the projects. The desired economic and social stabilization resulted then from gentrification.

Conclusion

This paper has reviewed four case studies of partial demolition as a building-scale response to vacancies in large housing estates. Since the four cases encompassed large-panel buildings, the partial demolition was executed as deconstruction, which also led to the panels' reuse. The approach seems to have contributed to extending the life cycles of the involved buildings, as many of their non-deconstructed sister buildings have been demolished completely instead. The cases exhibited the three main characteristics of all building stock development strategies in declining neighbourhoods, i.e. demolition, renovation and new construction. The reuse, however, was most often executed in suburban locations. The opportunity to influence the neighbourhoods themselves with the reuse was missed due to the lack of integration with urban planning.

Broadly speaking, the course of events was similar in all projects. The idea of partial demolition emerged from the landlords themselves, because they were struggling with the economic implications of vacancies in unamortized buildings. Despite the seemingly positive implications of public interest, such as the neighbourhood's image or resource conservation, the driving force was the owners' asset management. The commitment of a key person was typically decisive. Public bodies encouraged the projects by arranging development programmes that contributed to the idea and/or subsidised it. It should be noted that no matter what was done, the housing companies could likely not have managed without subsidies, given the extent of the vacancies. The demand for low-rise housing made out of the reclaimed panels implies that the low value of the deconstructed buildings was related to the high-rise housing form. Prefabricated housing is often considered to represent bad aesthetic and technical quality, but the status of similar buildings and neighbourhoods actually depends on multiple factors. Prefabricated housing need not always represent a low status neighbourhood, but in these cases it did because the neighbourhoods suffered from design flaws of different kinds. This had driven the buildings to the bottom of the housing markets. The deficits were not so much related to technical issues, as to qualitative ones.

The fact that all the structural systems were different at heart is encouraging for the reuse possibilities of existing prefabricated systems, none of which have originally been designed for deconstruction. The deconstruction and reuse techniques were similar despite the differences in the building systems. During the projects, the challenges were in negotiating the process and in coordinating the integration of deconstruction, renovation and reuse. In later appraisals, controversy has surrounded the socio-economic implications. Although the transformation was generally more affordable than demolition and new construction, the cost is still a limiting factor. The additional investment may seem risky, but without it the quality of the housing will keep declining; and with only perfunctory maintenance or modest renovation, the quality gap between old and new housing will keep growing.

While it can be said that the housing quality – both aesthetic and functional – was clearly improved, it has not been possible to follow how the original residents' lives were affected. This is because some of the projects were executed decades ago. In the Swedish and Finnish cases, however, it is clear that the housing companies pursued gentrification. As understandable as that is from the financial perspective, the approach may be criticized for dislodging the old residents. Given the vacancy rates, though, the alternative to deconstruction was complete demolition, which would have dislodged them no less. Projects based on deconstruction have a chance of maintaining established social networks, but they do not always succeed. When a transformation increases property values, the residents can be expected to change, unless the former occupants are helped to improve their socio-economic position at the same time. So, while deconstruction and reuse seem to contribute to economic and ecological sustainability, simultaneous people-based programmes are vital for meeting the third aspect of sustainability, i.e. social sustainability.

Buildings are long-lasting artefacts that should easily outlast generations. The current policy preference for demolition and substitution too often results in much shorter service lives for the buildings than they have the potential for. Downsizing buildings and reusing deconstructed panels could contribute to a more resource-efficient society, as the concept shows potential for manageable costs and value creation. Thus, it would be foolish to ignore the experience to be gained from studying these pioneering projects. This paper has explored and highlighted some generalizable aspects of the cases, namely their decision-making processes, their technological issues and their socio-economic implications. Future research should deepen our understanding of them further.

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