REVERSIBLE TRANSFORMATION

From pavilion schools to housing and back again

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Thank you to

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Max Lifmark | 2026 | Reversible Transformation | From pavilion schools to housing and back again | Architecture and Urban Design (MPARC) | Chalmers School of Architecture + Department of Architecture & Civil Engineering | Examiner: Kaj Granath | Supervisor: Anna Braide

Figure 1

Original roof detail in Trollängskolan.
(Authors own picture).

”Age plus adaptivity is what makes a building come to be loved. The building learns from its occupants and they learn from it.”

Steward Brand in How Buildings Learn, 1994 (p. 31)

Figure 2

Picture of the preserved, orignal window details in Trollängskolan. (Authors own picture).

Abstract

Among decision makers in Gothenburg, there is a lack of nurture of the city's built environment. The demolition wave of buildings during the 1960s are today being widely condemned, while buildings from the 1960s are simultaneously being demolished much in the same way. Although all of these buildings might not be widely loved, there are almost always qualities to be found and reasons for them to be preserved. One such building type being the pavilion school.

The municipality of Gothenburg faces a problem where a decrease in children being born forces schools to close. The first schools to close are often the smallest ones, making the pavilion schools the most likely candidate. Due to their history of not being maintained, cared for or preserved, they also risk demolition.

To prevent the demolition of these school buildings, they are in need of new functions. The decreased need for schools is however temporary, meaning that the schools buildings will be needed again. To make this possible, a reversible transformation is instead proposed, with shared housing as its temporary replacement.

This thesis explores how the reversible transformation of pavilion schools can be used to both preserve and improve them. The qualities found in shared housing can be used to steer the transformation of the school buildings to better match the modern requirements for schools, thus leaving a better building than before behind. Similarly, qualities found in the pavilion schools can be used to improve the conditions for the shared housing, creating qualities that might not otherwise be found.

In addition to this, qualities can be found in reversible design strategies that improve both the pavilion schools and the shared housing. It is then the relation between these three that creates the foundation for the principle *reversible transformation*.

The design proposal in this thesis investigates an alternative to the suggested demolition of Trollängsskolan, set to close in 2026 due to the decreased need of schools. It illustrates the qualities that can be gained through such a transformation, and how it can be used to both preserve and improve the school.

Intention

The purpose of this thesis is to explore how reversible transformation can be used to preserve and improve pavilion schools threatened by demolition.

The aim is to find how the reversible transformation can develop and create qualities for both schools and housing, as well as being a sustainable solution for the municipality and the built environment.

Delimitations

The focus of the thesis is the architectural qualities that can be gained from the reversible transformation, rather than factors such as financial calculation logistics or detailed maintenance strategies.

Although the idea of reversible transformation can be applied in a broader sense, the thesis focuses specifically on the pavilion schools in Gothenburg, as well as the shared housing typology.

The thesis does not aim to change schools and housing from their cores, but instead investigate how the reversible transformation between the two can be used to improve them.

Research questions

How can reversible transformation through shared housing be used to preserve and improve pavilion schools?

What architectural qualities can be gained from a reversible transformation between pavilion schools and shared housing?

Terminology

Reversible transformation: The term proposed to explain the act of transforming a building with the intent of improving and returning it to its original function.

Pavilion school: A typology of schools from the 1960s in one story, often with spread out volumes. They are defined by their simplistic, often standardized plan structures, arranged in different ways depending on the specific school.

Shared housing: Apartments where residents share functions and spaces such as kitchens and bathrooms, with their own, smaller private spaces.

Preservation: The act of keeping something in its original state, protecting it from both demolition and decay.

Adaptability: The principle of adjusting buildings according to changing needs or functions.

Design for disassembly: Designing artefacts in such a way that they can be dismantled and reused without damaging or reducing the quality of their parts.

Figure 3

Picture of Trollängsskolan, where the vinyl flooring meets the pillar. (Authors own picture).

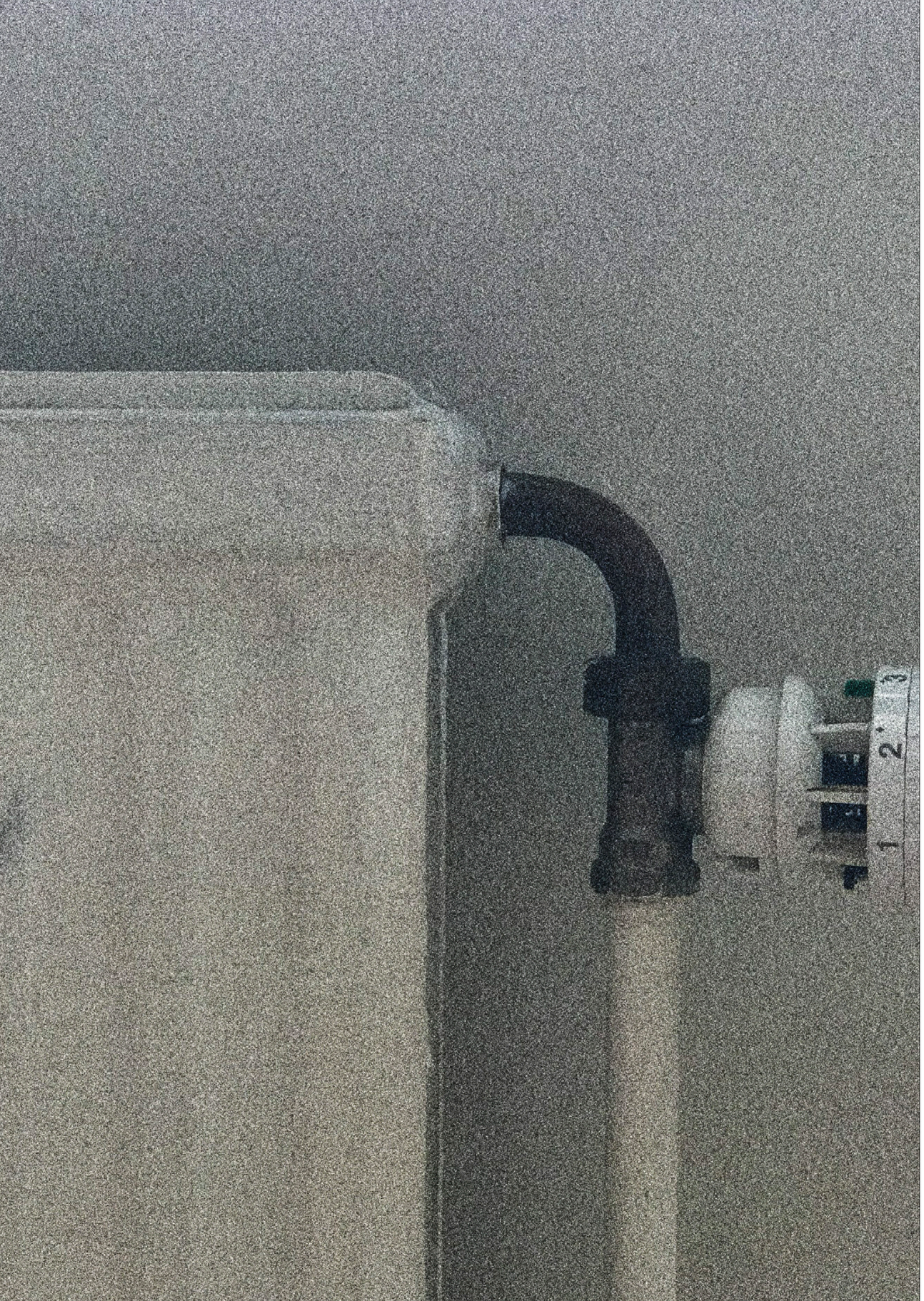

Figure 4

Picture of preserved, orginal radiators in Trollängsskolan. (Authors own picture).

Methods

To form a cohesive picture of the principle of reversible transformation of schools to housing, the research has been conducted in several ways.

For the background, literature studies have been conducted of several reports, such as Ekonomiska drivkrafter bakom rivningar av skolor (Johansson, 2025), exploring reasons behind demolitions of schools, and Kulturmiljörapport - Kunskapsbyggen (Jonsson & Lindman, 2021), which investigates the schools of Gothenburg. These, together with population statistics form the base for the thesis.

The thesis has then been divided into three parts, representing the reversible strategies, pavilion schools and shared housing. The research for the reversible strategies was conducted through literature, as well investigating built reference projects using relevant strategies. The references were chosen to span both from more theoretical to more practical, with How Buildings Learn: What Happens After They’re Built (Brand, 1994) and Building a circular future (GXN Innovation, 2019) being the main ones.

The part of pavilion schools is instead focused more on analysis of the buildings and reports from their time, while also including research on the future of schools and pedagogy, as well as relevant reference projects. For the existing schools, most of the research comes from Kulturmiljörapport - Kunskapsbyggen (Jonsson & Lindman, 2021) and for the future of schools it comes from Skolans nya rum: En antologi om samspelet mellan pedagogik och arkitektur (de Laval, 2017).

The part of shared housing was conducted through a literature study of Framtidens delade boende (Teng, 2024), in combination with analysis of references from both shared housing and villas from the 1960s.

These three were then combined to find strategies for the reversible transformation of schools to housing, which were applied in a pavilion school threatened by demolition. All parts have been researched simultaneously and iterated throughout the process, to form the research by design.

Interviews have been conducted with persons within relevant fields, to guide the process of the thesis. These include architects and project managers within the municipality, the school sector and the field of circular architecture.

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Picture of the afternoon light striking the original windows of Trollängsskolan. (Authors own picture).

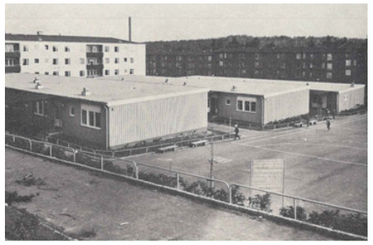
1. BACKGROUND

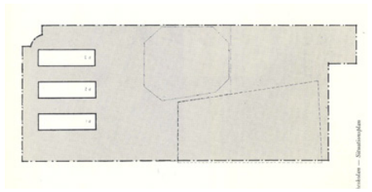
An already lost heritage

The following schools are a selection of the pavilion schools that have already been demolished, most of them replaced by new schools.

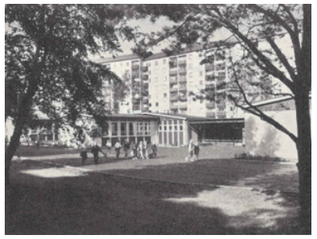
Figure 6a - 6k

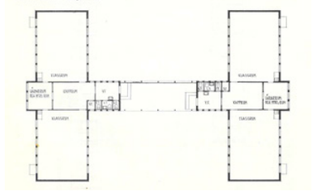
Pictures and drawings of now demolished schools. (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.



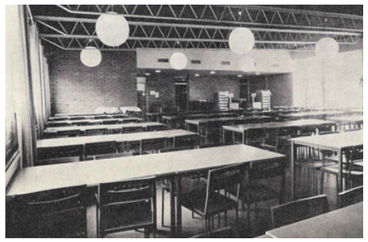


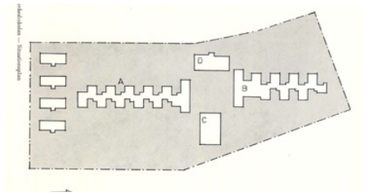
Solbackeskolan, 1968



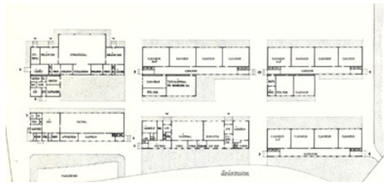


Kaverösskolan, 1960

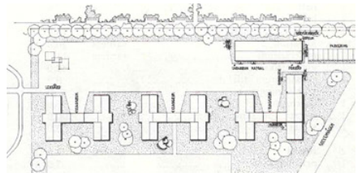




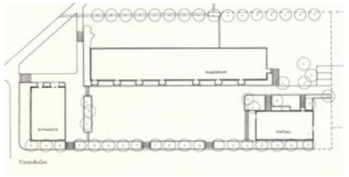
Västerhedsskolan, 1966



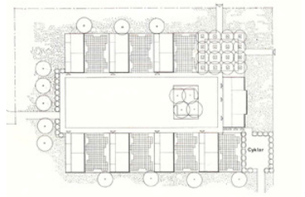
Fågleroskolan, 1960



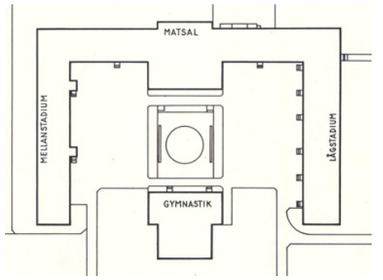
Fogdegårdsskolan, 1961



Vetteskolan, 1966

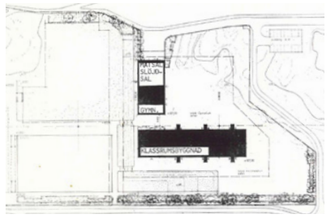


Tomtebergsskolan, 1964



Nya åkeredsskolan, 1966

Spinettskolan, 1964



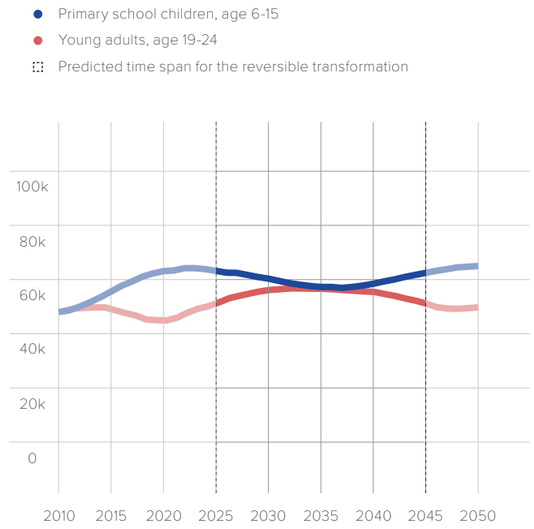
Långmosseskolan, 1966

Figure 7

Picture of the now demolished pavilion school, Svartedalsskolan. (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.

Figure 8

Graph showing the predicted population changes in Sweden. (SCB, 2024). Adapted with permisson.



The effect of population changes

For the past years, there has been a decrease in the amount of children being born (SCB, 2025). This decrease will, according to the predictions from SCB, continue for several years before returning to present levels in around 2045.

Municipalities therefore now face a problem, where fewer children means that fewer schools are required, resulting in some of them being forced to close. In Gothenburg, five to ten schools are already set to close (Rosén, 2025) and more are expected to follow in the future.

The emptied schools are therefore in need of new functions, for them not to be demolished or stand empty, costing money. If the schools are permanently transformed for a new function, however, a new site and building would have to be found and constructed, which is not ideal for the municipality.

The municipalities are therefore in need of a solution for these schools, which can be housed for the required time frame and then returned to schools again.

Ideas of transforming them to offices are on the table, but since office buildings are already being left unused and empty, there is a risk of them not solving the problem. The need of housing, instead, is still an important issue in Gothenburg. The graph in figure 8 also shows that the amount of young adults mirrors the amount of children in school age, thus being a relevant replacement for the schools.

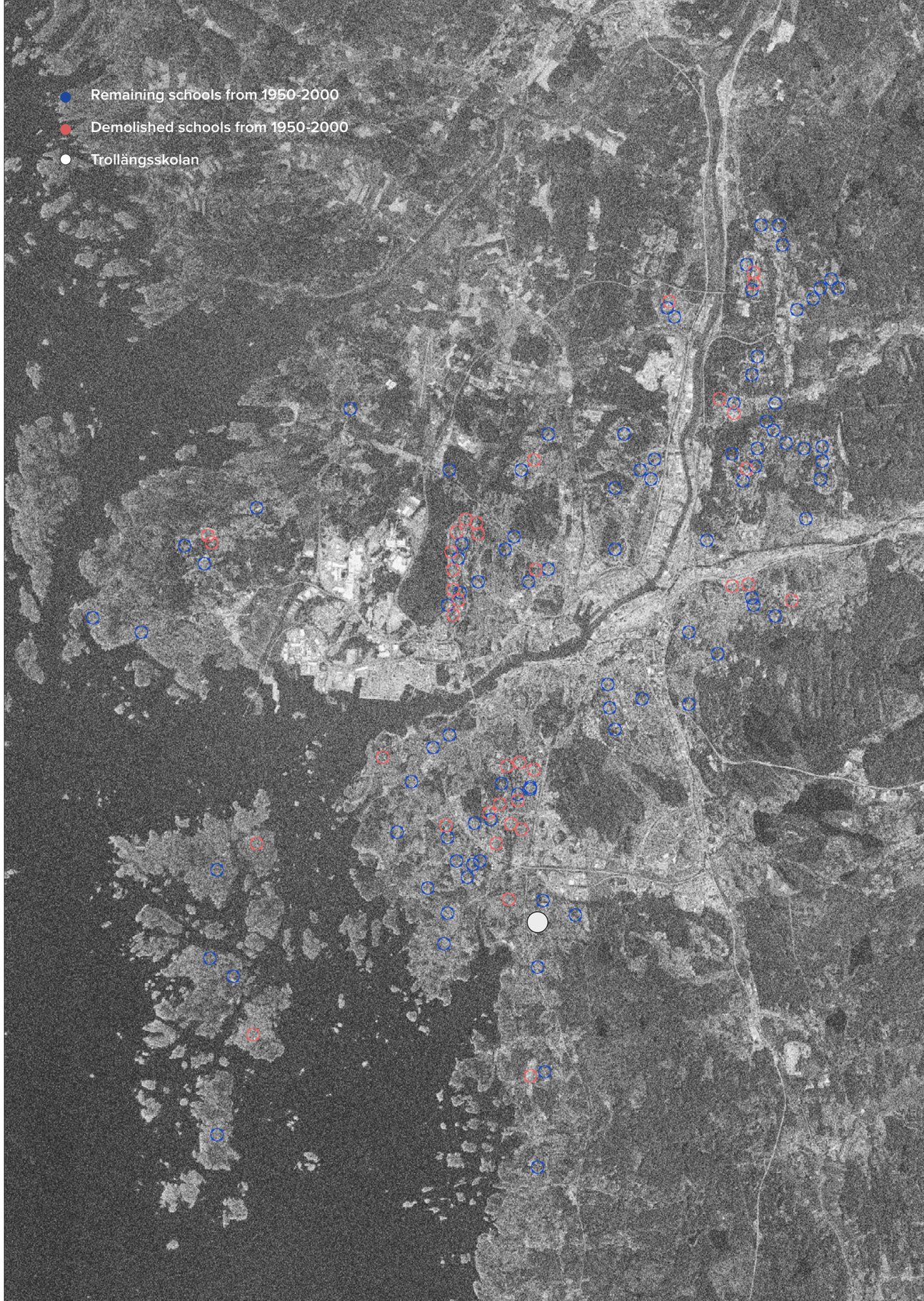


Figure 9

Map of preserved schools (blue) and demolished schools (red) from 1950-2000 in Gothenburg. Image composed by the author (2026), based on data from Lantmäteriet.

Schools and demolitions in Gothenburg

Gothenburg has an extensive history of demolishing school buildings. Of the schools that have been built between 1950 and 2000, a third had been demolished in 2021 (Jonsson & Lindman, 2021), with more since then and even more planned.

As Björn Johansson shows in his report on school demolitions (2025), there are several reasons for the demolishment of school buildings in Sweden. In the report, it is also suggested how to work past these reasons and continue to use older schools for a modern pedagogy.

One of the reasons is connected to the fact that the programs which steer what the buildings should contain, do not match the older buildings (Johansson, 2025). This creates a conflict, where the older buildings are considered not fit for modern pedagogy. This often leads to the buildings being forced to close and be demolished, even though they could probably continue to be used. In the report, Frida Brismar Pålsson, school planner and educator, argues that it would be possible to pursue modern pedagogy within these schools.

Both economy and emissions are often miscalculated when it comes to the decision of demolishment of schools (Johansson, 2025). The way that the municipalities are structured creates difficulties when calculating the economical difference between renovation and demolition.

According to Johansson, the municipalities often do not correctly value the effects of emissions connected to demolitions (2025). When calculating the effect of a new building, the demolition of the previous building is not accounted for. Since preservation can save 50 to 70 percent of emissions compared to demolition (Dyson et al., 2023), this way of calculating creates a misrepresentation of the actual effects.

In addition, the decision of demolition is often made before any formal investigations are made (Johansson, 2025), resulting in demolitions that might not otherwise have been decided.

Similarly to the way that older buildings in Gothenburg faced a wave of demolitions during the 1960s, buildings from around 1960s now also face another demolition wave (ACAN Sverige, n.d.). There is therefore a risk of large parts of the built heritage from this time being lost, including both the pavilion schools and other buildings.

The 1960s represented a time of expansions, where newly developed areas from the million homes program were in need of new schools (Jonsson & Lindman, 2021). Already built parts of Gothenburg were also expanding with more housing and therefore too being provided with new schools, such as the pavilion school Trollängsskolan.

The school buildings from the 1960s were often representative of their time, being designed by architects that were not only working with schools, but also other building types (Jonsson & Lindman, 2021). The buildings would vary in appearance and size, but one type of school building, the pavilion school, had its peak during this decade.

They are characterized by their spread out volumes in one story, often with one or two classrooms per entrance. This resulted in smaller schools, often in need of outdoor movement between parts of the school. Although this brings a set of qualities, the most spread out schools received criticism due to this (see figures 2-5), and many of them are now demolished (Jonsson & Lindman, 2021).

Since larger schools are generally preferred by the municipality (Göteborgs Stad, 2018) smaller schools are often the first to close. This, together with the fact that many pavilion schools have already been demolished, puts these schools at the most risk.

Figure 10

Picture of the modern, temporary pavilions of Nya Åkeredsskolan. (Anton Engblom, n.d.). Reprinted with permission.

Figure 11

Picture of the 1960s, now demolished pavilions of Nya Åkeredsskolan. (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.

The state of reversiblity

Although demolitions are a substantial issue, transformations and adaptations are still common to an extent. Planning for adaptability from the beginning, however, is still not as common (Ostapska et al., 2024).

Some reversible buildings are already in use, such as the provisional school buildings with the purpose of accommodating temporary needs (figure 10). These are, however, only made for short time use and not to be used as regular buildings that can be disassembled at the end of their lifetime. These therefore often lack the care and design that should be expected from good architecture.

Architecture designed for disassembly is beginning to be used in practice, however often in pilot projects (Ostapska et al., 2024). When researching the subject Ostapska et al. found that there were several factors limiting the use of reversible design implementations, with uncertainties at the core of them. It is for example, according to people asked in the survey, difficult to value how much the building's parts would be worth far into the future when disassembled.

Because the decreased number of children is predicted to be limited to a shorter time span (SCB, 2024), however, the uncertainty risk can be limited with a reversible transformation of school buildings. It therefore creates opportunities to continue to test and develop the reversible design possibilities.

Why Gothenburg should approach it

The municipality of Gothenburg states on their website that the city is in need of a strategy for the schools affected by the decreasing amount of children (Göteborgs Stad, n.d.). They also write that they plan to renovate the schools with great maintenance needs in the coming years, as well as making investments to replace the provisional school buildings such as in figure 10.

In addition to this, the municipality has ambitions to become more circular (Göteborgs Stad, 2021). They have a large strategy for this and claim for example that the waste in the city should be reduced by 40 percent from 2021 to 2030, as well as Gothenburg's climate impact coming close to zero.

The Urban Property Department in Gothenburg, responsible for the school buildings, also have their own circular strategies (Fahlén, 2024). In addition, they also do research projects on the subject, with ambitions to be innovative within the field.

The municipality is therefore in need of strategies that solve the decreased need for school buildings, that replace the use of provisional schools and steer the city in a circular, sustainable direction. A reversible transformation has the possibility to accommodate all of these issues, and can therefore be suitable for the city of Gothenburg.

Instead of relying on the use of provisional pavilions, the well designed pavilion schools from the 1960s can be used to accommodate changes in needs, by using reversible transformation as a strategy.

2. REVERSIBLE TRANSFORMATION

Figure 12

Picture of Hökegårdsskolan (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.

Introducing reversible transformation

In addition to solving problems for the municipality and further developing the use of reversible methods, the reversible transformation has the possibility to improve both of the functions involved. Not only can the housing bring revenue to the municipality, but also be used to renovate and improve the school buildings for the future. It builds upon the principle that when the function of a building is switched, it forces changes to the buildings that can also come with improvements.

In the same way can the qualities found in the pavilion schools also affect the housing positively. This can result in qualities that might not otherwise exist in housing.

It is this symbiosis between the two functions and the reversible transformation in between that forms the base of the research of this thesis. By researching both reversible design, pavilion schools and shared housing, it can be discovered how they can improve each other.

Figure 13

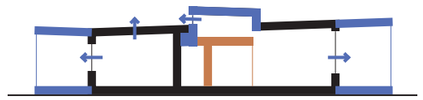
Picture of Kavåsskolan, now only preschool (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.

Figure 14

Illustrations of reversible transformation. (Authors own picture).

Before reversible transformatiion

A building, in this case a pavilion school, is in need of both improvements and a new, temporary function.



During reversible transformatiion

A new function is added, in this case shared housing, transforming and improving the building.

After reversible transformatiion

The orignal function, in this case the school, is returned to a renovated and better functioning building.

Figure 15

Picture of Rosenhoj before transformation. (EFFEKT Architects, n.d.)

Figure 16

Picture of Rosenhoj after transformation. By viewing the buildings and the site together, new qualites were created with smaller measures. (EFFEKT Architects, n.d.)

Architecture, process and time

In How buildings learn, Stewart Brand (1994) argues that there are issues among architects and stakeholders in how buildings are viewed and addressed. He states instead that buildings should be addressed and approached not only as a whole in space, but as a whole in space and time.

One such view is of historians compared to preservationists. Brand means that historians mainly focus on the intention and influence of buildings, rather than the long term effects and use. In the same way, he views architectural photography as a misrepresentation of architecture, since it only captures the appearance of one moment in time, rather than the process, use and function. If they're allowed, buildings have the opportunity to create stories of both time and use.

Brand argues that architecture is never finished, but instead constantly shifting with both changes in use and time (1994). Architecture has limited itself as the art of the building specifically, rather than the life of the building. They mean that the obsession of style and star architects have steered the focus architecture wrong, making it afraid of its own users.

Architecture needs to move from the idea of a hotel room, where all traces of previous users are removed, and instead embrace the idea of a mountain hut, where every hiker leaves their trace in a different way (Brand, 1994). Instead of viewing users and time as a problem, architects can use it to their advantage. Brand states that the use adaptation of an already existing building can create better qualities than starting from a blank slate. The original building can free design by restraining it, by making it easier to continue than to begin. "Age plus adaptivity is what makes a building come to be loved. The building learns from its occupants and they learn from it." (p. 31).

By addressing architecture in this way, new qualities can be found and gained which would otherwise be lost. Many buildings are often discarded as boring or unattractive, while still having the possibility to adapt and evolve. What is valued less by some people, is often valued more by someone else. In Rosenhoj, for example, (figure 15 and 16) the disliked 1970s housing was transformed and improved by smaller measures such as making the area greener and adding smaller buildings, to bring scale down (EFFEKT, n.d.).

While Brand argues the importance of adaptability, Hedström & Westin (2023) also show the risks in connection to preservation. When adapted or renovated, buildings often risk their original details being replaced, thus damaging the traces of time. This often includes original windows, doors and radiators, such as in figure 2-4 in the introduction. This tendency is also discussed by Brand (1994), where he identifies technology, money and fashion as three substantial forces affecting the change of buildings.

Figure 17

Picture of the temporary meeting space RAUM (Overtreders W, n.d.).

Figure 18

Plywood details in St Kilda East House, by Claire Scorpo (Tom Ross, n.d.)

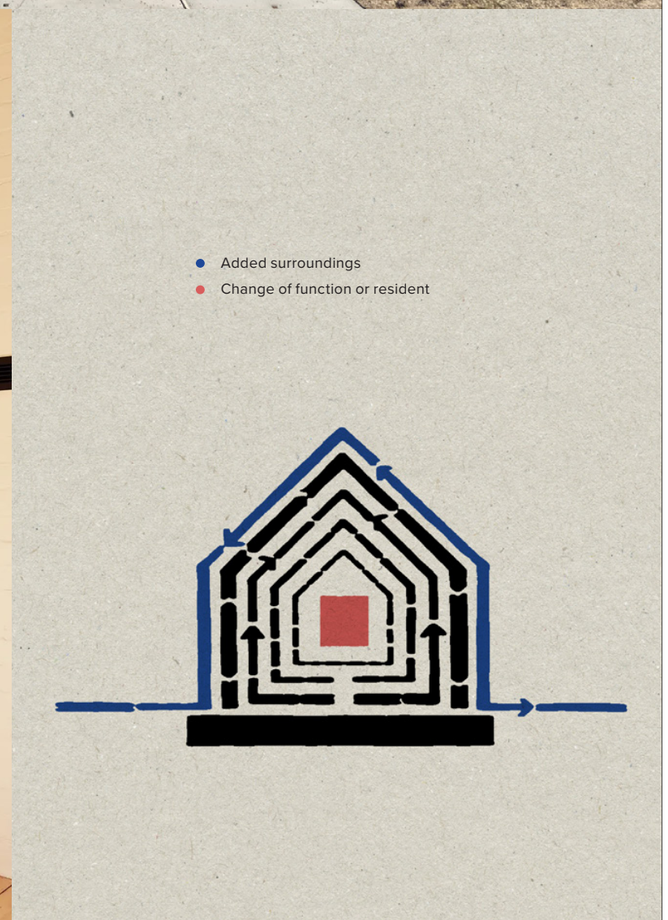


Figure 19

Figure illutrating shearing layers. (Schmidt III & Austin, 2016), originally by Steward Brand (1994).

Designing for adaptablity

If the built heritage is to be preserved and adapted, it is important to see the building as more than just a whole, finished structure. When constructing new buildings, they need to be designed in such a way that they can be adapted or disassembled if needed. For the reversible transformation it would be a combination of the two, with an adaptation of the already existing building and planned disassembly of the added building parts.

Brand (2024) shows that if this is to be possible, the buildings need to be viewed as a set of layers, all with different functions and life spans (figure 19). Throughout a building's lifetime, parts are altered, replaced or decayed, and these changes need to be able to occur without damaging the other layers.

Schmidt III & Austin (2016) builds further upon this in Adaptable Architecture, adding two more layers to the figure, the social and the surroundings. The social is strongly connected to the reversible transformation, where it is the change in function that can be taken advantage of to build upon and improve the building. The surroundings are also important for the pavilion schools, which since they are in one story are strongly affected by it. When intertwined like this, a change in the surroundings would also change the appearance of the architecture as a whole.

This principle of separated layers can also be applied on an even smaller scale. If the building, or part of it as in the reversible transformation, is to be disassembled, it has to be able to do so without damaging its individual parts. For this, there are several strategies which GXN Innovation (2019) proposes in Building a circular future.

The connections in between the parts need to be reversible, meaning that for example screws and bolts are preferable over nails and glue (GXN Innovation, 2019). It is also important for the connections to be easily accessible, resulting in them often being more visible. There is therefore a possibility to work with these connections as ornaments and design them, as the RAUM pavilion by Overtreders W does in figure 17.

It is also important to design in such a way that the building parts can remain whole, without having to be cut or altered (GXN Innovation, 2019). One such method is to use modular measurements, making sure that for example doors fit between the pieces, rather than having to cut them and waste material. As St Kilda East House by Claire Scorpo Architects illustrated in figure 18, this can also be of aesthetic value.

A third strategy is to use robust materials. If cheaper, more brittle materials such as gypsum walls are used, they are less likely to be able to be reused. This forces the buildings into more qualitative materials such as the plywood in figure 18, benefiting the architecture.

3.

THE SCHOOLS

Figure 20

Picture of Assaredsskolan. (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.

Figure 21

Picture of Treröseskolan. (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.

Figure 22a - 22k

Illustrations of remaing pavilion schools. Author's own pictures,

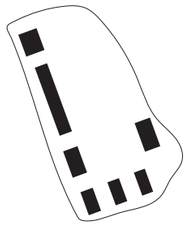
Remaining pavillion schools

A majority of the pavilion schools have been demolished, but there are still a few left. These vary in both shapes and sizes and are all designed by different architects, with the exception of Treröseskolan and Assaredskolan.

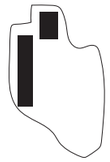
In the inventory of school buildings from 1950-2000 in Gothenburg, all schools have been given a grading of either A, B or C depending on their importance (Jonsson & Lindman, 2021). Vättnedalsskolan, Trollängsskolan and Assaredsskolan score the highest, with Hökegårdsskolan, Ängåsskolan, Kavåsskolan and Treröseskolan being given the middle score. The pavilion schools therefore score an average rating between A and B, compared to an average between B and C for the rest of the schools from this period.

This means that although the schools are built to be cost efficient and are modest in their appearance, they can still be qualitative architecture and of great cultural historical importance. By the fall of 2026, however, three of them will be closed and therefore also risk demolition. The plot of Kavåsskolan does since 2010 only house a preschool (Jonsson & Lindman, 2021), Ängåsskolan and Vättnedalsskolan are proposed to combine into one school and Trollängskolan is closing in the fall of 2026 (Rosén, 2025) and suggested to be demolished (Göteborgs Stad, 2025).

Vättnedalsskolan 1969
John Snis



Kavåsskolan 1967
Boustedt och Heineman
Arkitekter.

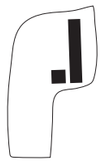


Hökegårdsskolan 1965
Arkitekt Nils Einar Eriksson

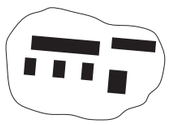
Treröseskolan 1964
Arkitekt Johan Tuvert

Trollängsskolan 1969
AB Wallit, Gunnar Cederwall arkitektkontor

Backegårdsskolan 1969
Lund och Valentin Arkitektkontor



Assaredsskolan 1965
Johan Tuvert



Ängåsskolan 1969
WAAB Whites arkitekt
Lars- Gunnar Jönsson

Figure 23

Picture of a 1960s pavilion school, Spinettskolan. (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.

Figure 24

Picture of a modern school, Brogårdaskolan. (Matilda Kjell, n.d.).

Pavilion schools and modern pedagogy

The view of pedagogy and the way that schools should be formed has always been changing in Sweden, leading to older buildings not matching the modern requirements (Johansson, 2025). As Johansson identified, the municipalities often view these differences as a problem and therefore prefer constructing new schools.

As Brand (1994) states, however, there is often an advantage with working with already existing buildings. It is therefore important to identify both the qualities wanted in modern schools, the qualities already in the 1960s pavilion schools and investigate how they can intertwine.

The pavilion schools from the 1960s come with many qualities. Although the buildings were made to be affordable, they consist of materials that can be considered more exclusive, such as windows made from heartwood and pressed glass (figure 2). The one story volumes also creates a better connection to the outside, making it easier for it to complement the indoors. In addition to this, the spread out volumes creates more defined outdoor spaces between the buildings.

In relation to the modern requirements, some differences are more substantial than others. Many of the pavilion schools lack proper wheelchair accessibility, both regarding bathrooms and ramps. The modern programs in Gothenburg require one group room per classroom (Göteborg Stad, n.d.-b), which only some of the pavilion schools have. The programs define more requirements, such as the amount of classrooms, accessible toilets and much more.

Other conflicts include a desire for more cooperation between teachers, leading to larger schools being preferred over smaller ones. Smaller schools, however, often create better conditions especially for the children having a more difficult time in schools (Tufvesson, 2017).

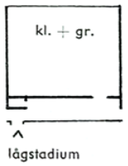
There are also today ambitions of trying to reduce the clearly defined classrooms, either by creating more complimentary spaces shared between the classes, or removing the classrooms entirely (Thörnqivst, 2017). More collaboration and practical education is desired, so that it is possible to learn in more ways than only from a school bench. Brogårdaskolan is one such school, where figure 24 shows a room between the classrooms that is flexible for different kinds of uses.

Research also shows the importance of good connections to the outside (Laike, 2017), which is not always easy with multiple story school buildings. The pavilion schools instead make this possible much easier, and the connection can become even stronger with a transformation.

Ängåsskolan

The school is divided into two volumes, with one straight and one comb shaped. This creates enclosed spaces within the comb shape, with three classrooms per yard. Administrative and other functions are placed in the volume connecting arms of the comb, as well as the larger arm in two floors.

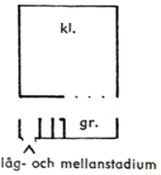
The classrooms and group rooms follow the principle of group rooms within the classrooms, thus limiting the possibility for the classes to split up.



Trollängsskolan

The school is divided into three volumes, with one U-shaped and two straight ones. The classrooms are placed along the arms of the U-shape, while administrative and other functions are placed in the base of the U-shape as well as the straight volumes.

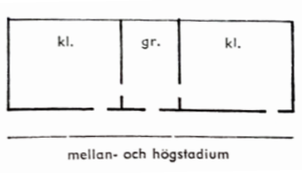
The group rooms are placed between the cloak rooms and classrooms, with one group room per classroom.

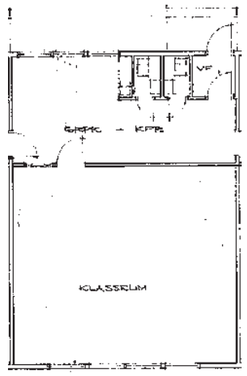


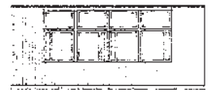
Assaredsskolan

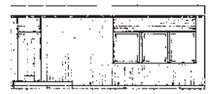
The school is divided into six volumes. Administrative and other functions are placed into the two volumes to the right, as well as in the larger building.

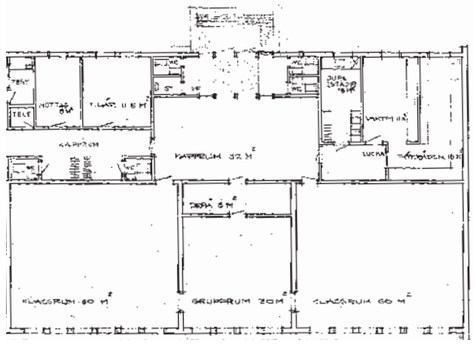
The classrooms in the larger building share one group room per two classrooms, as well as entrance and cloak rooms. The smaller volumes are instead somewhere between the solution of Trollängsskolan and Ängåsskolan.

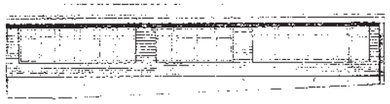


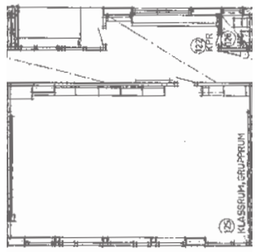












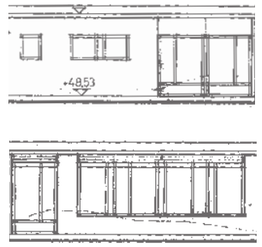


Figure 30

De Zevensprong before transformation (Max Hart Nibrrig, n.d.)

Figure 31

One of the enclosed classroom yards of Munkegaard School (August Fischer, n.d.)

The possibility to adapt

The fact that pavilion schools are only one story tall, makes them possible to expand and adapt in all directions. This can for example include adding new volumes to provide space for missing functions, such as group rooms, accessible toilets or ramps.

Since there are no floors above, it is also possible to make changes vertically. According to Laike (2017), daylight has substantial effects for schools and learning. By opening up the roof, it is possible to provide more daylight to the center of the buildings, thus providing even more daylight than a modern, multistory school would. Although this has yet to be done in Gothenburg, De Zevensprong (figure 30) was transformed in this way.

Although the pavilion schools have good connections to the outside, there is room for much improvement. The connections from the classrooms are often quite complicated, making it difficult to use the outdoor spaces for more than only recess. If the classrooms would instead have direct access, like in Munkegaard School (figure 31), it would be possible to also use the school yard for outdoor classrooms.

The outdoor spaces themselves are also quite limited. While modern research points toward a need for engaging schoolyards with impressions of nature (Laike, 2017), pavilion school yards are often flat and covered with asphalt. They are however almost always surrounded by nature, trees and slopes, making it possible for them to change.

For a reversible transformation, it is primarily the window placement and measurements that will affect possible division of spaces. The center to center distance differs between the buildings, but are always large in the classrooms and letting much light in.

3. SHARED HOUSING

Figure 35

Private room in HSB Living Lab
(Ola Kjelbye, n.d.).

Figure 36

Shared space in HSB Living Lab
(Lisa Thanner, n.d.).

Advantages of shared housing

The reversible transformation relies on the possibility to easily disassemble and return the buildings to schools. Housing, especially an array of small apartments, differs a lot from schools. They create a lot of spread out services such as bathrooms and kitchens, which are costly and more difficult to reverse.

Shared housing, instead, creates the possibility to concentrate these installations to specific places. In this way they can either be more easily reversed and disassembled, or placed strategically to be of use for the schools. Shared housing is also more flexible in placement of rooms, making it easier to fit into the already existing buildings.

The purpose of reversible transformation is in the end also to reduce resource use, which also coincides with shared housing. There, it is possible to share more functions and assets than in regular housing.

In Framtidens delade boende, Teng (2024) investigates how shared housing can be part of a sustainable transition. She emphasizes the importance of utilizing the common spaces, for example by each room not having their own kitchenette and toilet, instead relying on more generous common ones. The report also shows that spontaneous interactions often occur around the kitchen, a lot of times resulting in the residents dining together. In HSB Living Lab (figure 36), for example, a central kitchen island makes these spontanious meetings possible.

For their shared housing HSB living lab has 6 residents per cluster, which coincides with regulations in BBR, limiting the maximum number of residents per fire cell to six people (Teng, 2024). To make the private rooms more spacious in a limited area, HSB Living Lab uses the generous room height to create a loft (figure 35). This way, the rooms can feel less like a simple bedroom and more like something closer to an own apartment.

Figure 37

Atrium in Augustigatan. (Svensk Fastighetsförmedling, n.d.).

Figure 38

Äppleviken by Carl Nyrén. (Åke E:son Lindman, n.d.).

1960s housing

The pavilion schools are often representative of the general architecture of their time, with the architects often also working with for example housing (Jonsson & Lindman, 2021). For the reversible transformation of pavilion schools, it is therefore natural to look for inspiration in the housing from the same time frame.

Villas from around the 1960's were often one story, sometimes souterrain, with strong connections to the surrounding garden (Bülow, 2022). This was often achieved with roofs and walls protruding outside and creating rooms there as well, as seen in figure 38. Another common way of integrating the outside was to have atriums or courtyards, creating a more private outdoor space within the building (figure 37).

The villas often also take advantage of their one story volumes in more ways, such as opening up the roof to let more light into the center of the buildings. This, as well, can be seen in figure 38.

4. SOLUTION & PROJECT

Figure 39

Trollängsskolans many entrances. Authors own picture.

From pavilion schools to housing and back again

The core idea of the reversible transformation of pavilion schools and shared housing is for the schools to become better from the housing and vice versa. All decisions made should therefore also reflect this, making sure that both of them are improved from the process.

This is ensured by properly analysing both the pavilion schools, housing and contemporary schools, in combination with ensuring its feasibility from a reversible perspective. The specific qualities, requirements and possibilities vary from school to school, but some common factors can be recognized.

The pavilion schools are often in need of an improved connection to their outsides, which is both desirable from a modern pedagogy perspective and easy to achieve in their one story, spread out volumes. As shown from the housing from around the 1960s, the villas are often better at taking advantage of this relation. The reversible transformation through housing would therefore make sure that these qualities are added.

There are also many general requirements that the pavilion schools do not fulfill. Their repetitive classroom entities are one part of this. Since each entity often has its own entrance, toilets etc, every entity also has to be adapted for accessibility, which therefore often has not been done.

For the reversible transformation to shared housing, there are some common, overarching strategies that can apply. By pairing the classrooms and reducing the number of ”classroom entities”, better pedagogy qualities can be achieved as well as making them easier to turn accessible. This can also be motivated from the perspective of shared housing, where the larger entities make for better group sizes of five or six persons.

When fitting the shared housing into the pavilion schools, some functions are generally better suited in some places. The classrooms are the most simple in their size and formation, not requiring much adaptation. Their windows are also evenly distributed, making them easy to divide evenly. They are therefore suitable for the private rooms in the shared housing, since these are repetative and temporary.

The shared housing spaces are instead more flexible. They have the ability to adapt to the different configurations of the supporting functions in the schools, as well as also improving them in different ways. In contrast to the classrooms and private rooms, functions such as accessible toilets, ramps and kitchens have the possibility to be left behind.

If the shared spaces are not large enough for the housing, they are most likely not large enough for the modern pedagogy either. Additions should then be made in connection to these, which can also be used to help strengthen the connection to the outside.

In addition to all of these points, the reversible transformation would also simply be used to renovate the schools to a better standard. As the municipality of Gothenburg has recognized, the pavilion schools are in urgent need of maintenance. A transformation to housing would mean that maintenance issues would need to be solved, which can then be financed and ensured through this transformation.

Figure 40

Trollängsskolan's position in Askim, in the southern part of Gothenburg. Image composed by the author (2026), based on data from Lantmäteriet.

Trollängsskolan

Trollängsskolan was designed by Gunnar Cederwall architecture office and constructed in 1969, thus being one of the last pavilion schools of the time (Jonsson & Lindman, 2021). It was built together with the surrounding residential area, as part of the expansion of the city.

The report from Jonsson & Lindman (2021) rates Trollängsskolan with the highest possible grade. It is one of the most well preserved schools from this time, still containing original details such as windows, doors and radiators (figure 2-4). The school acts as a clear representative of the architecture from this time.

Although building details and appearance is well preserved, it is not as well maintained (Göteborg Stad, 2025). Parts of some windows are starting to rot, there are signs of moisture issues and other problems, and it is therefore in critical need of maintenance.

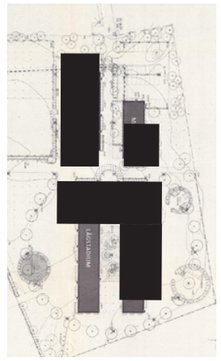
Despite its cultural historical importance, the decision has been made to close to the school due a decrease in children being born. In addition to this, a new detailed development plan has been proposed for the area, suggesting demolition and replacement for the school (Göteborg Stad, 2025).

Figure 41

Trollängsskolan with a proposed building in addition to the reversible transformation. Image composed by the author (2026), based on data from Google Earth.

Figure 42

The already proposed replacement of the existing Trollängsskolan (black).



A decision already made

The main reason for the demolition and replacement of Trollängsskolan stated in the planning description is to create space for a larger school of 380 students, compared to the 200 students it housed then (Göteborg Stad, 2025).

The problem is that those numbers are misrepresented, because they are based on the present number of students in Trollängsskolan, rather than what is possible to fit in the school. With a total of 14 classrooms and an average of 28 students per classroom (Göteborg Stad, n.d.-b), the total instead becomes 392 students, more than the desired amount. 14 classrooms is also the exact number required in the school programs of Gothenburg (Göteborg Stad, n.d.-b).

In connection to the new detailed development plan, a heritage impact assessment was conducted (Bengtsson, 2023). Much like the report of Jonsson & Lindman (2021), the heritage impact assessment also concludes that Trollängsskolan is an important building from a cultural historical perspective. This includes for example its similar appearance to the surrounding villas, its many entrances, its original details and its clear representation of a pavilion school from the 1960s.

Although the planning description also recognizes and admits that the demolition of Trollängsskolan would have substantial effects on the cultural heritage of the whole area, it does not affect the decision (Göteborg Stad, 2025). This also follows the trend illustrated by Björn Johansson (2025), where the decisions are often already made before any formal investigations are conducted.

This thesis therefore instead proposes a reversible transformation of the schools, which solves the issues required within the school programs. If needed, an added building in two stories is suggested in connection to the cantina, where it can mirror the larger volume of the sports hall. This way the purpose of the new detailed development plan, including pre-school, can be solved without demolition.

(previous page) Figure 43

Picture of the central courtyard (Mattias Joklint, n.d.).

Figure 44

Original drawings of Trollängsskolan.

Analysis

The entire school is divided into three volumes, with the main one consisting of classrooms and administration. Two arms consisting of seven classrooms each stretch around either side of an enclosed yard, each connected by doors leading all the way to the administration.

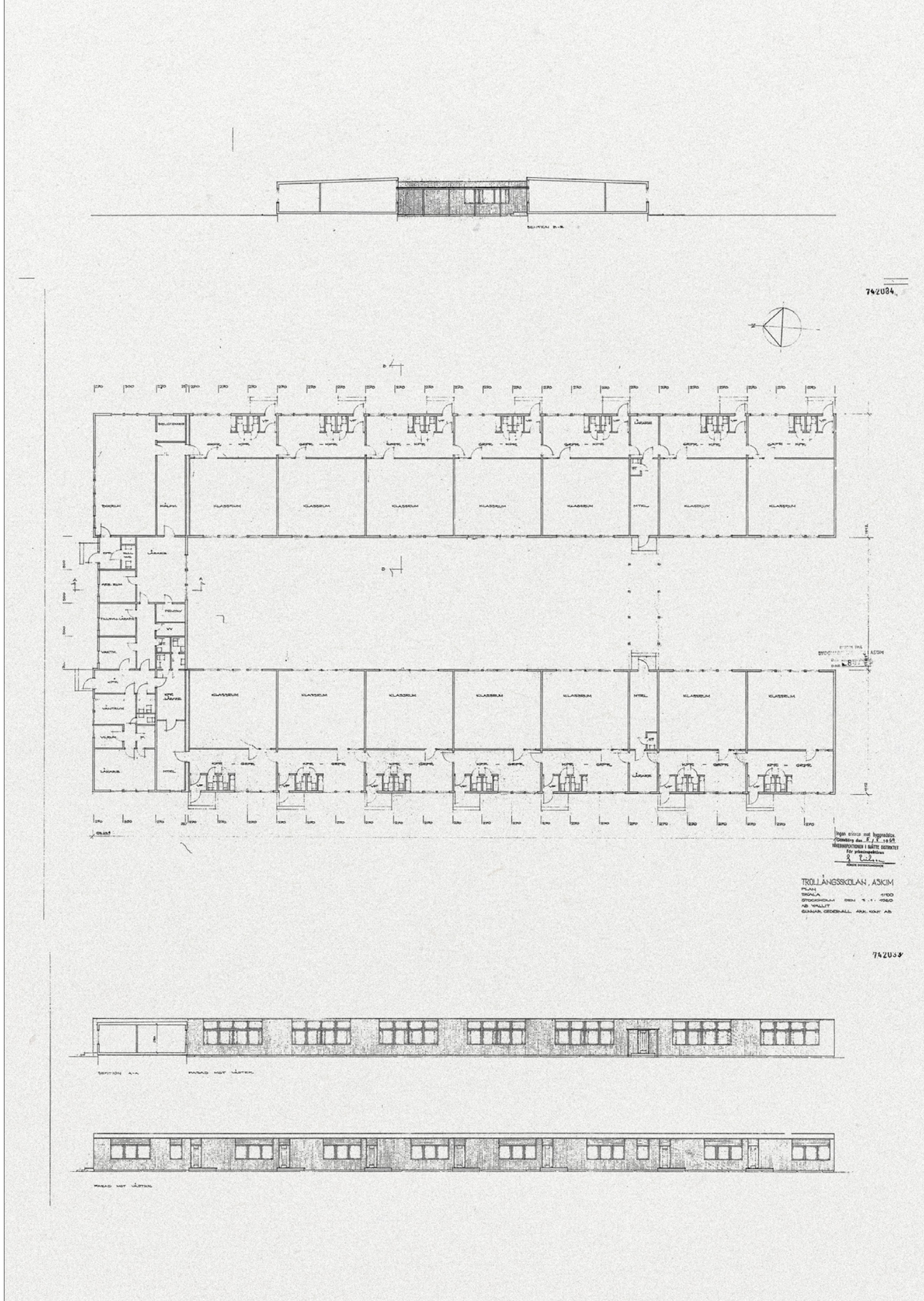
Each ”classroom entity” consists of a 60 square meter classroom, 15 square meter group room, dual bathrooms and a cloak room area. While the entry is located on one side of the ”entity”, the door into the classrooms is located on the other, making the connection to outside weaker.

Since the only way to access the courtyard from the inside is from two points, now transformed to ventilation rooms, it is difficult to use. The classrooms are almost always used on either side, making it difficult to use also during breaks.

The building follows a division of 2700 millimeters, making it possible to divide the private rooms equally. In the group room, cloak room and bathroom area it is instead more difficult to fit the shared areas of the housing. But since this area also requires the most changes to fit the modern school programs, the reversible transformation can be used to increase the size of this area.

The classrooms have larger room height, spanning between 2.6 and 2.9 meters. The group room area instead is lower, with only 2.2 meters. This full height is however between 2.5 and 2.6 meters, and can be achieved by removing the lowered ceiling height.

Functions such as cantina, sports and crafts are already separated into the detached volumes, making it possible for them to be externally used both during the duration of the housing as well as after.



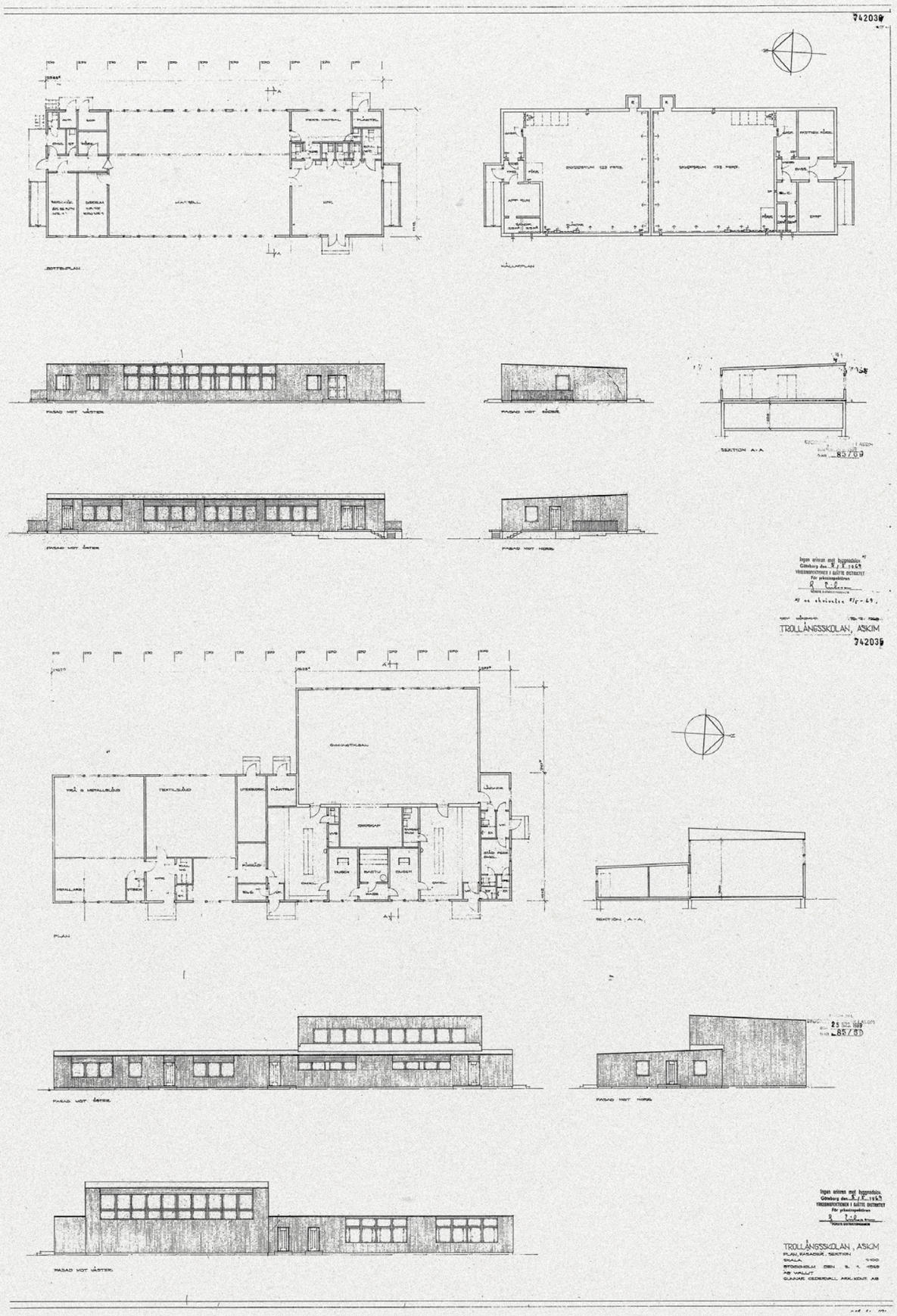


Figure 45

Original drawings of Trollängsskolan.

Figure 46

Illustrations of strategies, Authors own pictures.

Strategies

As established, the main strategy in the reversible transformation of schools is to use the shared housing to create better qualities for the future school, as well as using the already existing building to create good qualities for the shared housing.

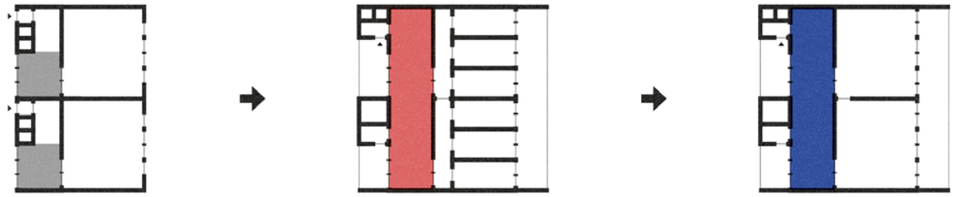
The specific strategies for this are many, but all connect to both the present school, the shared housing and the future school. This includes for example more ways of utilizing the outside, as well as solving problems such as wheelchair accessibility. Many of the issues connect so simply pairing two classrooms together, solving both the requirements of shared housing and modern schools.

By making additions to the outside of the building, more space can also be freed within the existing volume to create better conditions both for the schools and the housing. These additions can at the same time help bridging the connection between inside and outside, which the school is lacking in today.

Existing school

Shared housing

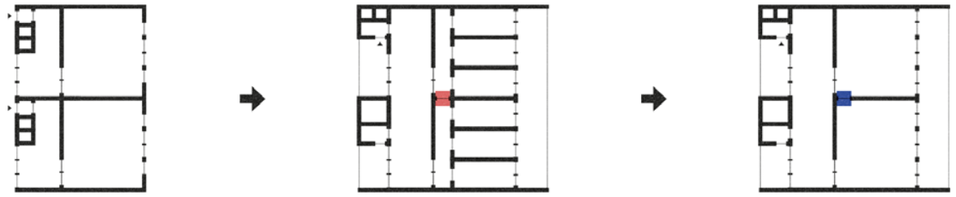
Future school



Small group rooms

Large common rooms

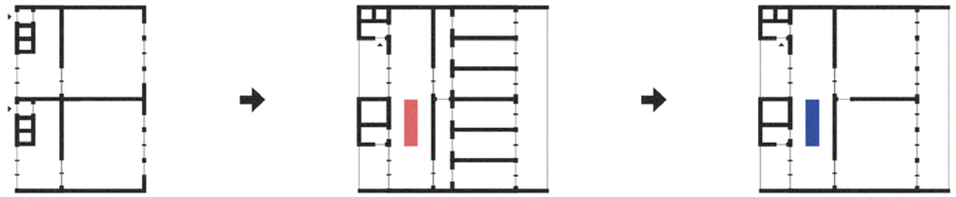
Larger group rooms



Divided classrooms

Corridor connection

Classroom connection



Undifined spaces

Focus aroud the social

Focuses on cooperation

Deep, dark building

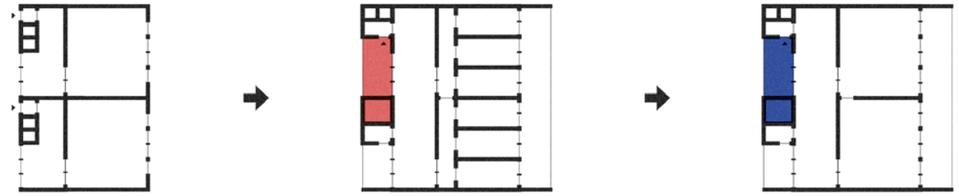
Loft with daylight

Daylight to the classroom

Existing school

Shared housing

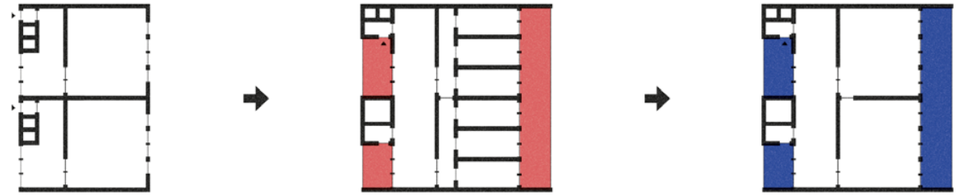
Future school



Not wheelchair accessible

Ramp and WC added

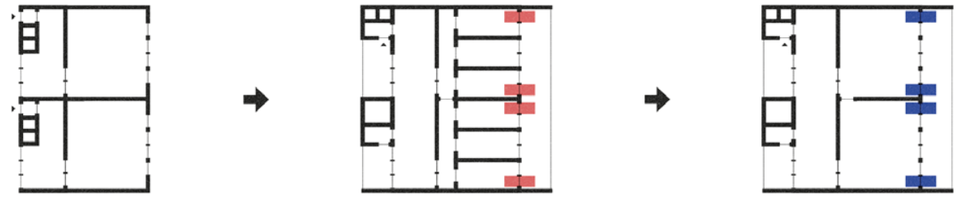
Wheelchair accessible



No outdoor connection

Added terraces

Outdoor connection



Limited use of yard

Doors from apartments

Outdoor classrooms

Old, bulky ventilation

Improved ventilation

Improved ventilation

Application

To create a school that builds upon cooperation and shared learning, the classrooms are paired together for each year group. They then share their common rooms together, including entries, ramps and toilets.

For the housing, this pairing can instead be used to make the classroom house three classrooms each, resulting in the recommended six residents per entity. The shared space occupies and expands the group room area, leaving behind a better and more generous one than before.

New back doors are added for the private rooms to be able to use the central courtyard, strengthening the connection to the outside. After the reversible transformation, the courtyard can instead be used for outdoor classrooms, thus giving the previously unused area a better purpose.

To enhance the connection between inside and outside, emphasize the pairing of the classrooms and divide the long facades, the dividing walls are extended out outside of the buildings. This creates divisions similar in appearance to that of Villa Äppleviken (figure 38). For the courtyard, this also reduces the disturbance between the outdoor classrooms.

While the classroom entities house both the private rooms and the common spaces within each housing entity, the staff rooms can house shared functions for all the residents. This includes for example laundry, couch groups, table tennis, bike storage, etc.

Relating the outside

Although the schoolyard of Trollängsskolan is mostly asphalt, it still has qualities coming from the original design. The asphalted area is formed as a large circle, being broken off by other, smaller circles containing different functions. Outside of this large circle, more natural elements take over on the eastern side and lawn on the western side.

To improve the yard while still making it useful for children in need of hard surfaces, the asphalted circle is still preserved. It is, however, broken up with more circles introducing more natural elements, such as trees, vegetation and sandboxes. For the housing, these circles can instead of for example the sandboxes house the possibility to cultivate food.

The area around the circle introduces more natural elements and vegetation, to both create a clearer barrier for the residents in the housing, as well as providing more possibilities for children to engage with the environment.

Around the circles, simple pergolas are also placed. These can act as places for the residents to sit closer to the added vegetation, but also for the schools to be able to house more forms of outdoor education.

Figure 47a

Reversible transformation of Trollängsskolan. Authors own drawings.

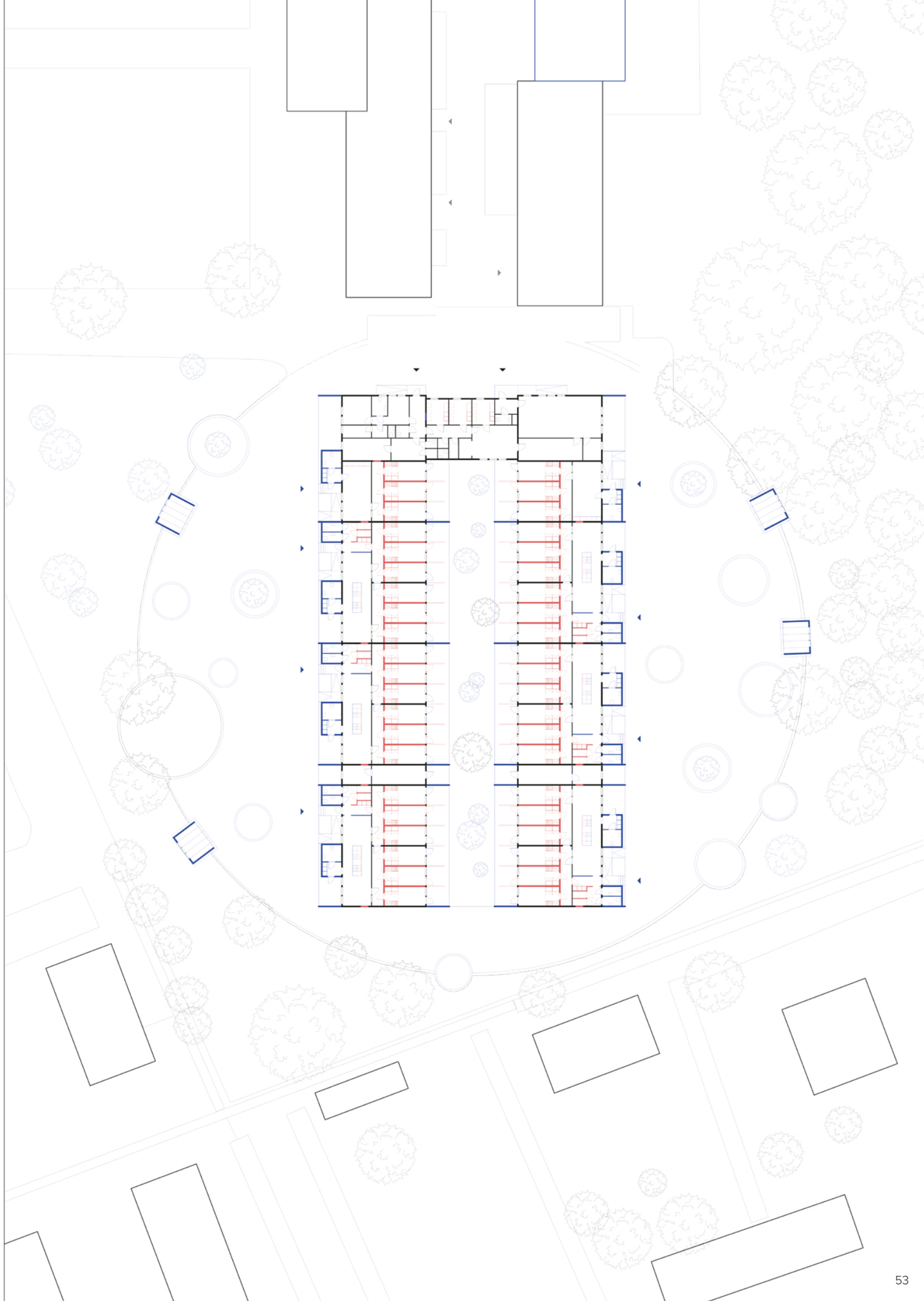


Figure 47b

Section of the reversible transformation of Trollängsskolan. Authors own drawings.

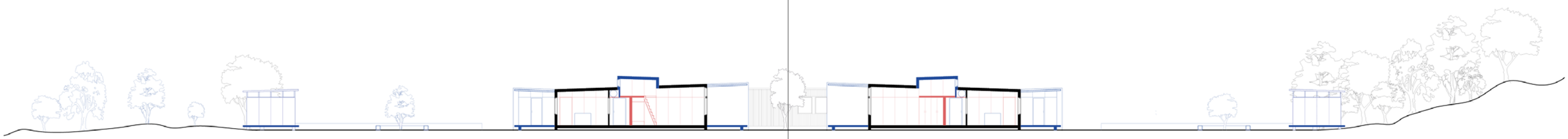
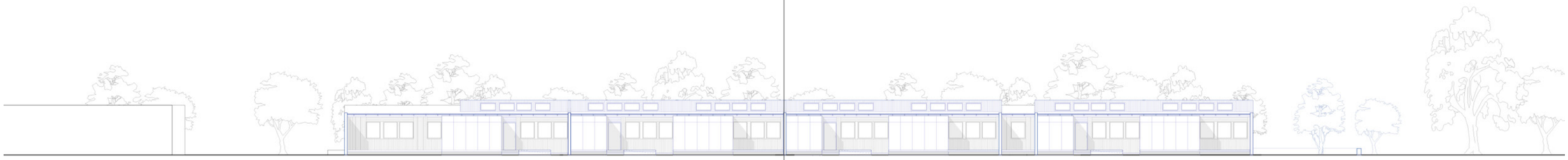


Figure 47c

Elevation of the reversible transformation of Trollängsskolan. Authors own drawings.



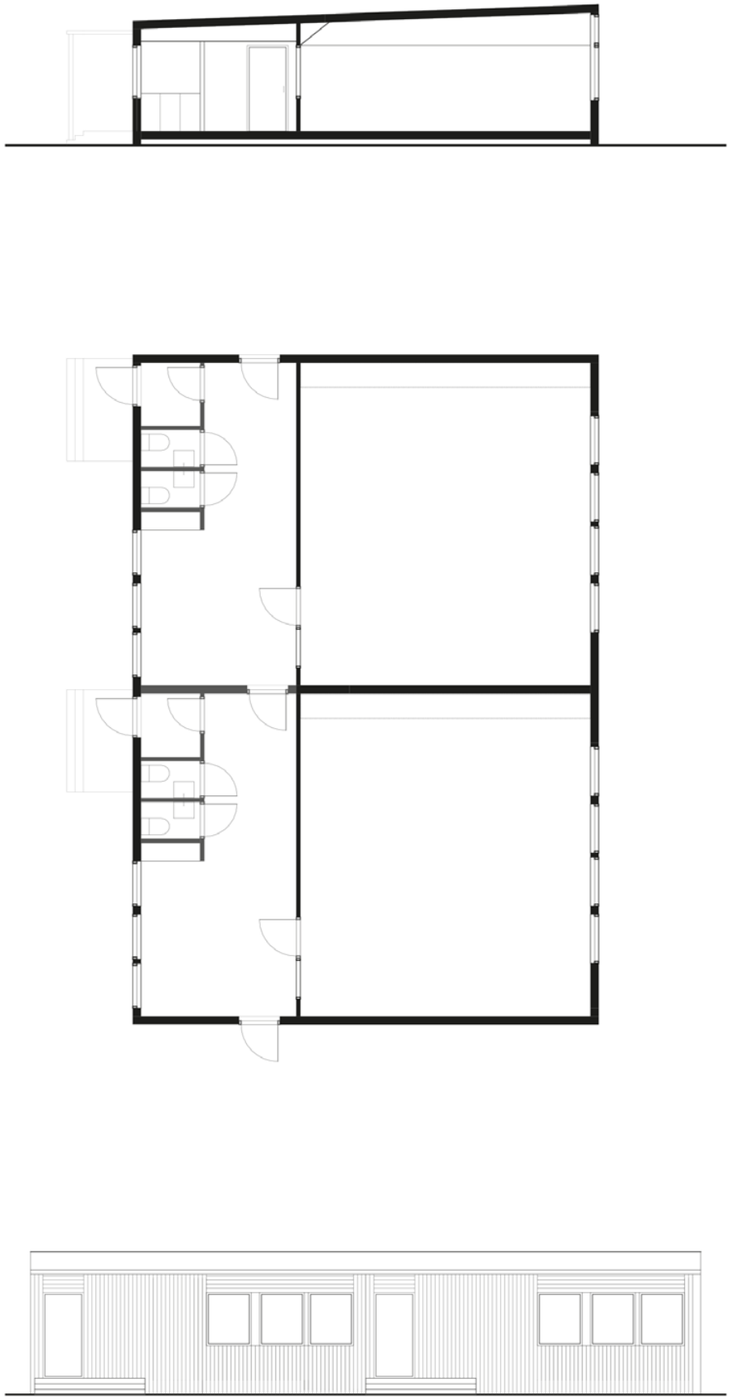


Figure 48

Reversible transformation
of Trollängsskolan.
Authors own drawings.

The existing school

Most of the changes made are additions. There are however some substractions needed to make the reversible transformation possible. To be able to make better use of the space within the common areas, the smaller bathrooms and entry area is removed. The dividing wall is also removed, making both of the classrooms connected.

In general

Grid: 2.7 m

Group rooms

Area: 15 sqm

Measurments: 3.8 × 3.8 m

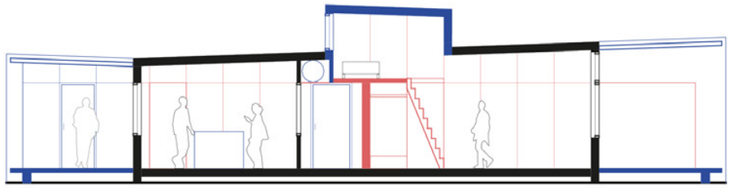
Height: 2.5/2.6 (2.2) m

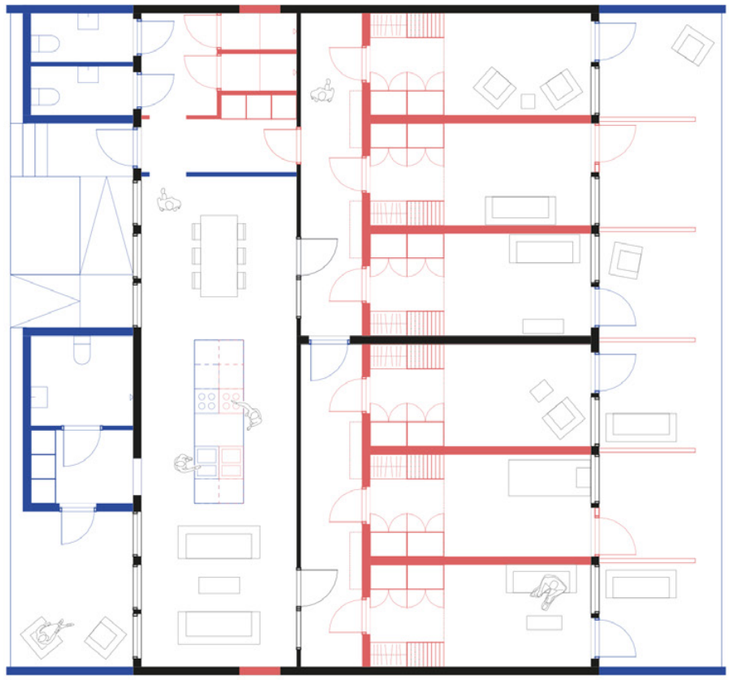
Classrooms

Area: 60 sqm

Measurements: 7.9 × 7.1 m

Height 2.6/2.9 m





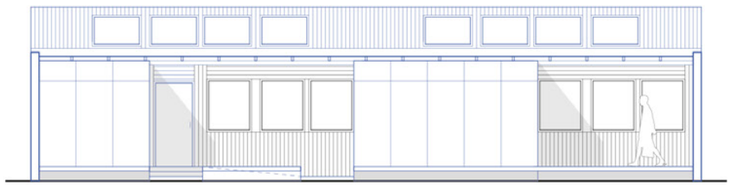


Figure 49

Reversible transformation
of Trollängsskolan.
Authors own drawings.

The shared housing

For the shared housing, both permanent additions (blue) and temporary additions (red) are made. Bathrooms and entry zones are shifted outside of the existing volume, creating space for both a terrace and a ramp in between. A clear, corrugated, plastic roof is added to the extened sections, making it possible to use these areas in all weather, while still letting light into the connecting rooms.

The enlarged common spaces have a kitchen island in the middle, centering the room toward the space which usually houses the most spontanious meetings. Two more spaces are then created on either side of the kitchen, one for a dining space and for a couch area.

The private rooms are instead temporary, but still leave qualities behind. To create as much space as possible within a limited area, lofts are added. These are in need of more room height, forced a vertical addition. The windows added with this addition, can then provide more daylight for the schools.

By both updating and shifting the positon of the ventilation, more vertical space is also created within the common areas, as well as the private rooms. The central pipe for ventilation is instead positioned in connecting to the loft, thus being able to hide it.

In general

Grid: 2.7 m

Shared rooms

Main spaces: 45 sqm

Supporting spaces: 31 sqm

Corridor: 24 sqm

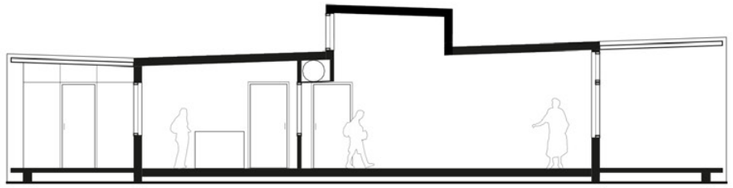
Height: 2.5/2.6 m

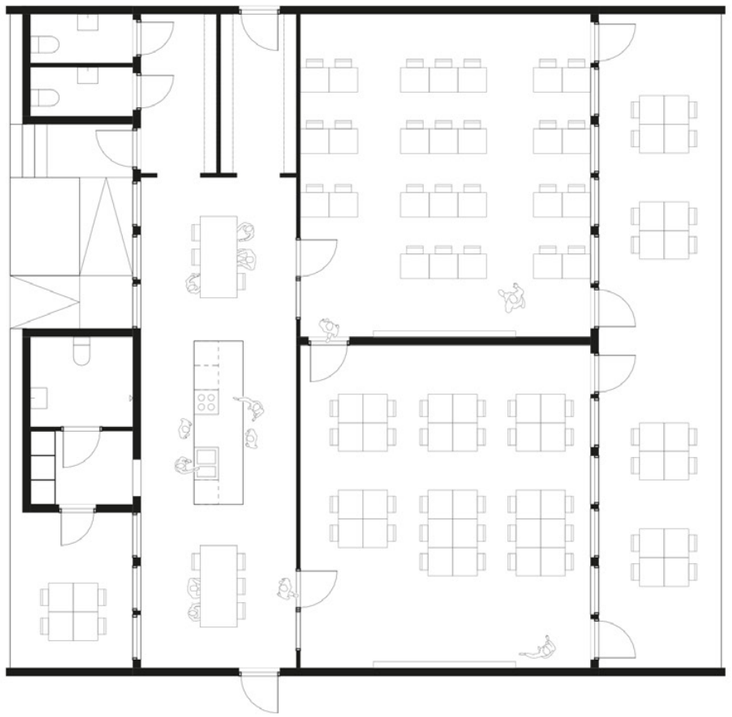
Private rooms

Area: 14 + 7 sqm

Measurments: 2.5 × 5.4

Height: 2.9/2.8 + 1.6/1.5 m





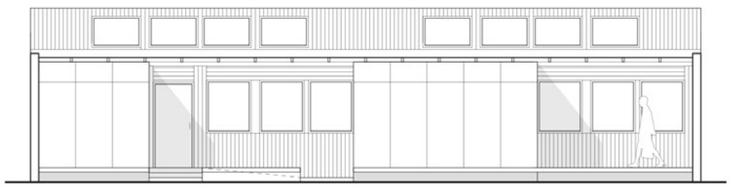


Figure 50

Reversible transformation
of Trollängsskolan.
Authors own drawings.

The future school

When the housing is reversed to school again, the only new additions needed are the furniture and more cloak room space. All the other changes that have been made have left a number of qualities for the schools.

The pairing of the classrooms, enlargement of the group rooms and access to the courtyard have made it possible to educate and learn in more ways than possible before. The lofts have left behind brighter classrooms, the kitchen island has left behind a practical working station and as a whole, the school has become better suited for a modern pedagogy.

Group rooms

Area: 45 sqm

Measurements: 11.4 × 3.8 m

Height: 2.5/2.6 m

Classrooms

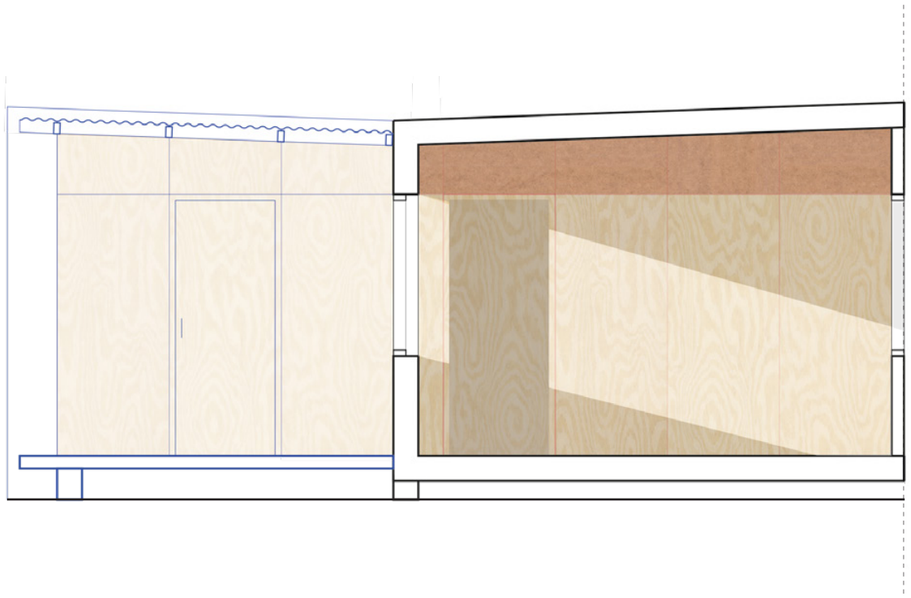
Area: 60 sqm

Measurments: 7.9 × 7.1

Height: 2.6/2.9

Figure 51

Materials of the reversible additions. Authors own drawing.



Materials and details

To make a clearer distinction between old and new, both the added exterior volumes and pergolas at the edge of the plot are constructed similarly. The visual connection between the two can also create an embracing feeling from the building to the edge of the plot. To also continue this connection into the building, the walls separating the ”housing/classroom entities” continue also outside of the buildings. The roof above the added terraces are constructed with a clear, sinus corrugated plastic, letting in light to the building while also protecting the terraces from weather.

For the reversible additions, 900 by 2100 millimeters plywood boards are used to divide the rooms. This way they fit within the already existing 2700 millimeter system of the school, as well as being able to place doors between boards. Since the boards connecting to the roof would have to be cut and altered, they are made of an already more processed material, masonite. This also creates a vertical distinction, defining the loft even more.

5.

DISCUSSION

Research questions

How can reversible transformation through shared housing be used to preserve and improve pavilion schools?

What architectural qualities can be gained from a reversible transformation between pavilion schools and shared housing?

Discussion

Through the research and application of Trollängsskolan, it becomes evident that reversible transformation has the possibility to affect both pavilion schools and shared housing positively.

The theory illustrates the importance of the function housed in the buildings, and the way that it forces the architecture to adapt and change. What the reversible transformation and this thesis does is to take advantage of that principle, and use it both to improve the architecture and solve municipal problems.

Shared housing in new production is often limited by the same factors as other new production projects. In the reversible transformation of pavilion schools, however, it is instead only limited by the school buildings. This way it can achieve such qualities as greater use and connection to the outdoor spaces, but also qualities from the reversible design strategies such as better building parts and materials.

The pavilion schools are what gains the most from the reversible transformation. Although regular renovation of schools would be able to provide some of the qualities achieved, it is the reversible transformation through housing that forces even more qualities. These include for example the added daylight provided by the lofts, as well as the increased area for the group room spaces.

It is however the impact on the societal level that makes the reversible transformation the most relevant. As Johansson illustrates in his report, and becomes evident from planned demolition of Trollängsskolan, there is a problem when it comes to the evaluation of these buildings. Not only does a demolition of these schools destroy the cultural heritage of the city and waste resources, it also removes the qualities that these schools would provide for the children.

With the reversible transformation, it is then possible to not only avoid these problems, but also solve the municipalities' imminent issues of maintenance and decreased number of children. At the same time, they can be at the forefront of circular strategies that are in need of actual projects, as they state that want to be.

If needed, the same strategies can also be applied for other schools threatened by closure, with some modification. The idea of reversible transformation is neither limited specifically to schools and housing and could probably serve to improve architecture in a broader sense. For an actual application of reversible transformation between schools and housing, the economical calculations would have to be researched further, rather than from mainly the architectural perspective presented here.

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Figures

Figure 6a - 6k
Pictures and drawings of now demolished schools. (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.

Figure 7
Picture of the now demolished pavilion school, Svartedalsskolan. [KÄLLA]

Figure 8
Picture of the now demolished pavilion school, Svartedalsskolan. (SCB, 2024). Adapted with permisson.

Figure 10
Picture of the modern, temporary pavilions of Nya Åkeredsskolan. (Anton Engblom, n.d.). Reprinted with permission.

Figure 11
Picture of the 1960s, now demolished pavilions of Nya Åkeredsskolan. (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.

Figure 15
Picture of Rosenhoj before transformation. (EFFEKT Architects, n.d.)

Figure 16
Picture of Rosenhoj after transformation. By viewing the buildings and the site together, new qualites were created with smaller measures. (EFFEKT Architects, n.d.)

Figure 17
Picture of the temporary meeting space RAUM (Overtreders W, n.d.).

Figure 18
Plywood details, St Kilda East House, Claire Scorpo (Tom Ross, n.d.)

Figure 20
Picture of Assaredsskolan. (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.

Figure 21
Picture of Treröseskolan. (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.

Figure 23
Picture of a 1960s pavilion school, Spinettskolan. (Avd. för fotografer vid Göteborgs yrkesskolor, n.d.). Public Domain.

Figure 24
Picture of a modern school, Brogårdaskolan. (Matilda Kjell, n.d.).

Figure 30
De Zevensprong after transformation (Max Hart Nibrrig, n.d.)

Figure 31
Classroom yard in Munkegaard School. (Aage Strüwing, 1957).

Figure 35
Private room in HSB Living Lab (Ola Kjelbye, n.d.).

Figure 36
Shared space in HSB Living Lab (Lisa Thanner, n.d.)

Figure 37
Atrium in Augustigatan. (Svensk Fastighetsförmedling, n.d.).

Figure 38
Äppleviken by Carl Nyrén. (Åke E:son Lindman, n.d.).

Figure 43
Picture of the central courtyard (Mattias Joklint, n.d.).

AI appendix

AI has not been used to generate any content in this thesis. It has instead been used for sorting and improvemt. This includes refining pictures, finding formulations in English and sorting and structuring data and references.

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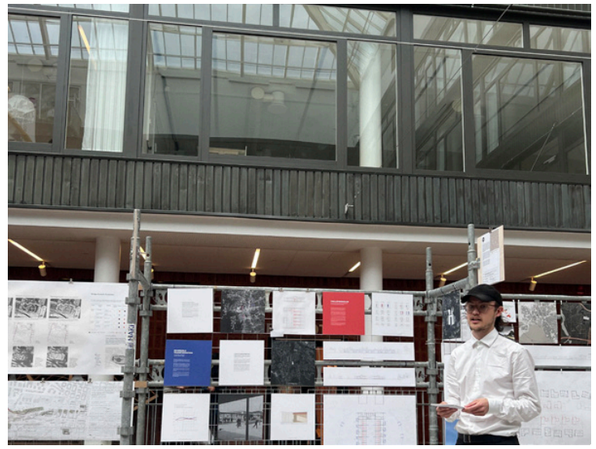

Figure 52

Me, the author, Max Lifmark, presenting the thesis.