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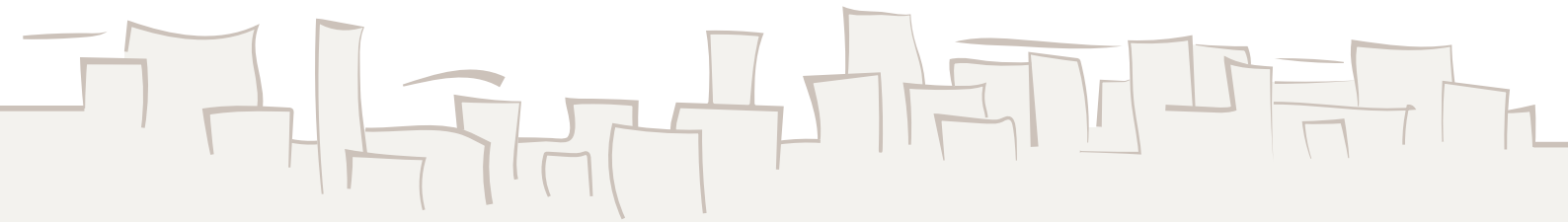
Ongoing trends in multifamily residential construction in Gothenburg municipality



Tomas Johansson Ågren

Master's Thesis | Spring 2023
Chalmers School of Architecture

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Ongoing trends in multifamily residential construction in Gothenburg municipality

Tomas Johansson Ågren

Master's Programme of Architecture and Urban Design
Department of Architecture and Civil Engineering

Chalmers School of Architecture

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Direction: Housing
Examiner: Anna Braide | Supervisor: Kaj Granath

Cover: Illustration by the author

ABSTRACT

This thesis is a contribution to- Building permits Gothenburg 2021, an ongoing series by CBA that explores what is being built right now. It aims to provide food for thought and discussion of our contemporary multifamily residential architecture and its trends. It does so by peering into the collection of granted building permits, often seen one by one, but not as a whole.

The approved multifamily residential projects of 2021 in Gothenburg could be summed up with the metrics of 56 permits with a total of 6073 pages, and 4945 apartments divide onto approximately 450 000 square meters of Gross area. This tells us that the city is growing, but it doesn't nourish our curiosity of how, where and with what it grows. Fortunately, scrutinizing those 6073 pages does. Together they form a crystal ball, or a road map into our near future, detailing how and where we will live.

And something is happening. The question of where the city is developing is examined by introducing a novel way to visualize in which direction Gothenburg grows. Backed up by exploring the municipality's strategy for expansion and the political ambition to add housing to the north-east part of the city. The investigation reveals that the set goals likely are met. However, on average two thirds of the apartments end up in the southern parts of the city, with Sydväst literally shattering their target.

The thesis also asks the question of what trends can be seen in the permits, and there are several. On a positive note, 2021 sees more projects with a larger diversity of apartments-types and a larger share of three- or more-bedroom apartments. On the other hand, there is a continued increase in the share of the smallest apartment-type, the studio apartment. There is also a rise in what can only be described as monocultures, entire projects only containing one apartment-type.

Lastly it asks how our buildings and apartments are developing. And there are reasons to worry. One of them is that 45 percent of the apartments found in the permits are single sided. This is a result of an increasing number of apartments per level. This, coupled with shrinking apartment-sizes and a market that strives for the minimum regulatory requirements, tells a story of an ongoing loss of quality in our smallest dwellings.

Keywords: building permits, Gothenburg, residential architecture, dwelling space qualities, statistics

ABOUT THE AUTHOR

Tomas Johansson Ågren

MASTER OF ARCHITECTURE

Architecture and Urban Design
Chalmers University of Technology, Gothenburg
2021-2023

STUDIOS

Matter Space Structure 3

Future visions for healthcare, housing and work 2:
Housing inventions

Future visions for healthcare, housing and work 1:
Residential healthcare- housing for seniors

BACHELOR OF ARCHITECTURE & ENGINEERING

Chalmers University of Technology, Gothenburg
2018-2021

BACHELOR OF MARINE ENGINEERING

Chalmers University of Technology, Gothenburg
2010-2014

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I would also like to thank my examiner, Anna Braide, the student critics, and others that have taken the time to look at my work. You have provided valuable perspective and insights that I needed to develop this thesis. It wouldn’t be what it is without you.

And lastly my family, Puck, and August. Life is wonderfully complicated, ours isn’t any different.

I love you both.

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INTRODUCTION

Background

This thesis is a part of an ongoing series that analyses building permits for multifamily residential buildings in Gothenburg. The project was inspired by the art project *Bygglovsboken: Flerbostadshus 2014*, from 2015 by the architectural collective Svensk Standard, and brought to Gothenburg and CBA by Professor Ola Nylander.

In the original, Svensk Standard created a catalog with un-doctored floorplans and sections from 51 projects in Stockholm municipality. The aim was to provide a "neutral" evidence base, for a discussion of contemporary architecture and its associated democratic processes. This concept was expanded on by both parties by adding a through and in-depth analysis of the floorplans. Secretary (a trio from Svensk Standard) did so by releasing a digital report the fifth of November 2019, containing an initial analysis of Stockholm region during the record year of 2017. This work was finished with the publication of the book 14,495 Flats in 2021. CBA did so with its first report in the series, Bygglov Göteborg 2016, delivered from the printing house the 22:nd of November 2019.

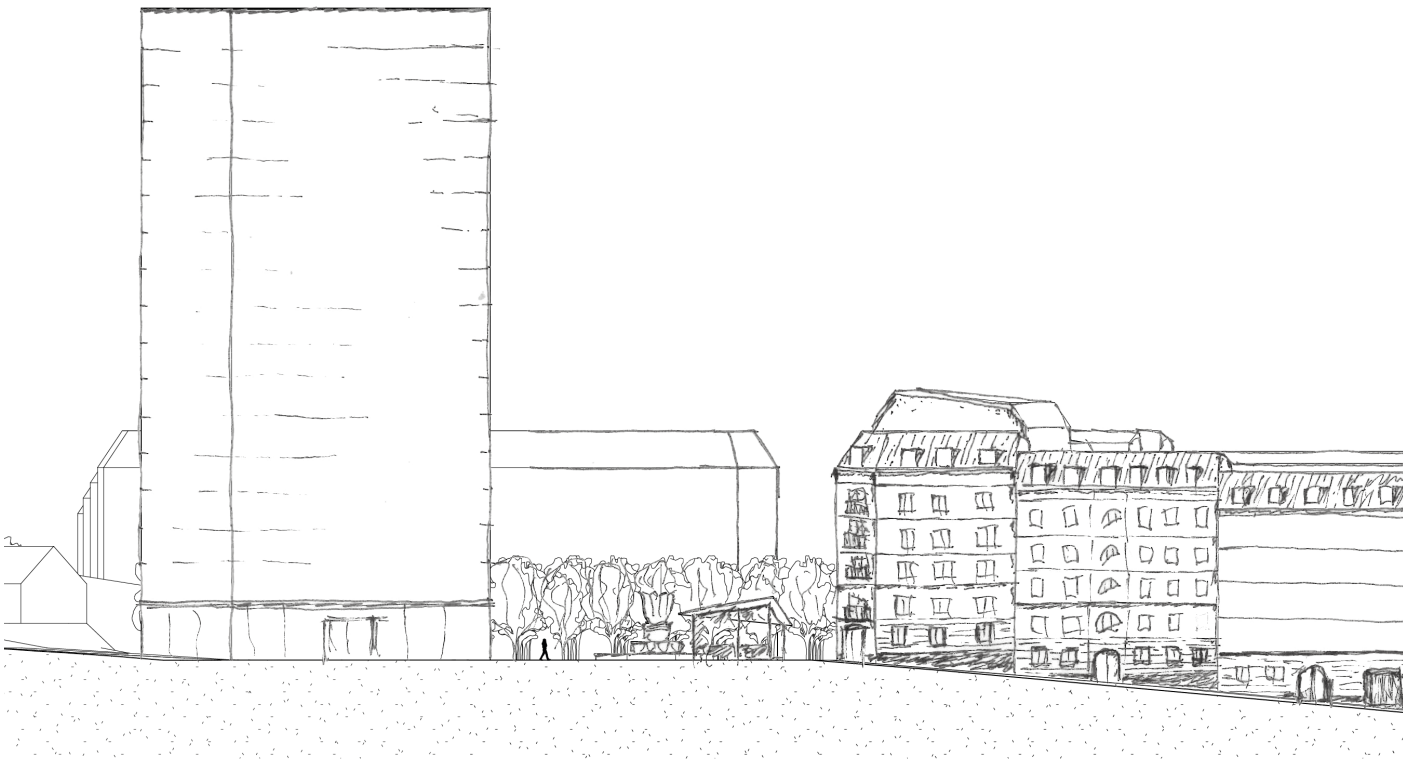
This paper focuses on the year 2021, the sixth consecutive year in the series. However, as of now, not all previous years are finished. This shows as a gap in the data presented.

Reserch questions

- *Where is Gothenburg developing? Is there a pattern to it, is it evenly distributed across the municipality and is there a focus on certain aspects?*

- *What trends can be seen in the approved building permits from 2021 for multifamily residential buildings in Gothenburg, are there projects that stand out for any particular reason, and what can we learn from those?*

- *How are our buildings and apartments developing? Can the trend of shrinking apartments, that is the reduction in the number of square meters per apartment, be seen in Gothenburg? And if so, what are the effects of it?*



Delimitations

The series Bygglov Göteborg has an established format. It contains an analysis of the year, including new findings. A catalogue of all the projects, and a final chapter delving deeper into one interesting aspect of housing. All packaged into a book, written in Swedish.

This thesis does not aim to produce a finished year in the series. The aim is to collect the data, analyse chosen parts of it, and to develop the project by adding new ideas of what knowledge can be extracted from the material.

Focus

The series has always had a strong focus of what is being built. But where, have not been examined in any greater detail previously. Gothenburg is a city with social inequalities that affects where construction of new housing is most lucrative. Efforts are made to explore the political and financial mechanisms that contributes to the story of where in the city construction takes place.

There is also a focus on comparing the results against previous years. This way trends start to emerge that can be analysed. The data extracted from the permits is compiled into diagrams and tables that tells an indisputable story. It goes further than previous years, not settling on knowing that something exist but striving to precisely describe the prevalence of it.

What happens on the inside of the apartments are well explored in previous years. This year focuses on the boundary of the apartment. Size, views, and staircases. Adding to the overall knowledge and understanding of the current housing production in Gothenburg.

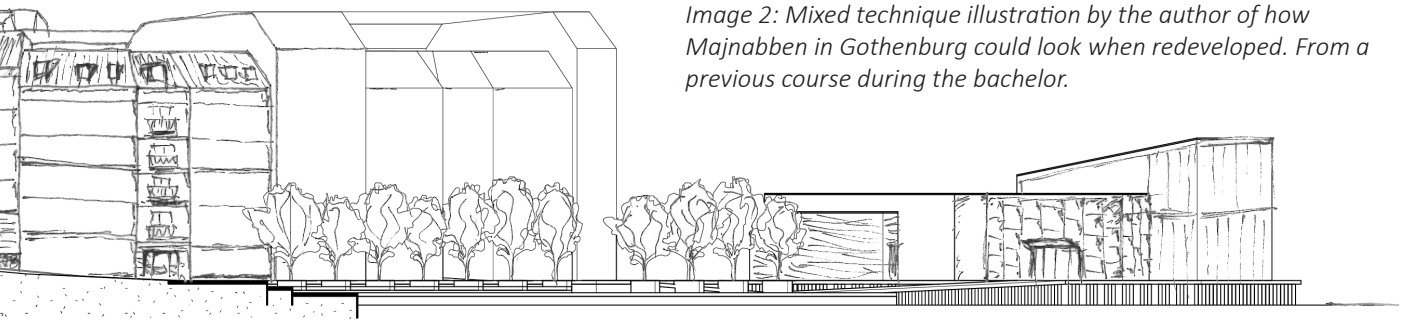


Image 2: Mixed technique illustration by the author of how Majnabben in Gothenburg could look when redeveloped. From a previous course during the bachelor.

METHOD

Collection of data sources

At the start of the semester, the previously used framework was provided by Kaj Granath and Johan Gren for how, and what data to collect. This was necessary since this thesis is in part a contribution to the ongoing series "Bygglov Göteborg". However, encouragement was made to expand the dataset and gather other data, based on relevant findings.

The first step was to contact Stadsbyggnadsförvaltningen and ask them to gather the applicable permits. The sought building permits were to abide the following requirements:

- Only building permits granted in 2021.
- Containing new multi residential housing projects.
- Student housing shall be included.
- Care facilities, rowhouses and villas shall not be included.
- If an individual project contains a mixture of housing, it shall be included.

A request for a wider net to be cast was made, to avoid mistakes leading to applicable projects being sorted out. Likewise, for the same reason a request was made for all the appended documents in the applications to be passed along.

A templet of what data to collect was created with the aid from previous years. It contained entries for data necessary for the series, and other parameters deemed interesting. Based on the findings, the templet was reworked multiple times, and the changes were applied to all projects. The gathered data from the permits and their associated documents were structured with the help of this template into individual Excel worksheets gathered in one workbook.
In addition, Lantmäteriets online service "minkarta" was utilized to obtain the coordinates of every project. Together with GIS-data from Gothenburg's municipality, the projects could be orientated in the city. This allows for an analysis on a city level to be conducted, showing what and where new housing is built.

Drawings of floor plans etc. were also gathered as .PNG-files. The rasterization of pdf-files was made to avoid scaling of line weights that might otherwise occur. This material was utilized in the thesis.

Furthermore, publicly available statistics from SCB, Lantmäteriet and Gothenburg municipality were also used. Specialized data from the apartment register (Lägenhetsregistret) were also ordered from SCB.

Gathered project data

The following data was gathered from every projects. It is structured in four levels. The first level has generalized data for project, the second level has data about the buildings, the third about apartment types and the last about individual apartments.

Project

- Permit registration number
- Real property unit according to permit
- New real property unit (if applicable)
- Real property unit title holder
- Number of pages in permit application
- Coordinates of project in WSG84/SWEREF 99
- Administrative areas (Stadsområde & Mellanområde)
- Street
- Architect
- Developer
- Area- BTA
- Areas (if present) – BYA, BOA, LOA
- Total number of apartments
- Mixed use development (yes/no)
- Does a podium exist (yes/no)
- Temporary building permit (yes/no)
- Specialty housing (yes/no)
- Form of tenure (if present)
- Name of housing cooperative (if applicable/ present)

Buildings

- Number of buildings
- Building typology

- Are they part of a block / free standing etc.
- Number of floors
- Number of apartments
- Number of staircases
- Number of apartments in each staircase
- Are corridors present with a proportion of at least 1:6 (yes/no)
- Number of apartments in corridors
- Average number of apartments per corridor
- Average proportion of corridors

Apartment type (for each type)

- Number of apartments
- Smallest apartment size
- Largest apartment size
- Average apartment size
- Number of apartments in each BBR size interval

Apartment (for every apartment)

- Staircase/entrance solution
- Size
- Number of views
- Rooms smaller than 7 square meters
- Wardrobes intended for sleep or other usages

Processing of data

When preparing and processing the data, in certain cases choices are made that are worth mentioning. The following section outlines and explains the reasoning behind noteworthy decisions.

Diagram 3-4 & 7-8

The dotted and solid yellow lines in the diagrams indicates the distribution of existing apartments in Gothenburg, as of 2020-12-31. It is based upon publicly available data from Statistics Sweden (2023), where the categories: multifamily residential buildings, other buildings and specialty dwellings are grouped as one. The specialty dwellings category includes care facilities, a category outside the scope of this thesis. They are included since excluding them would also exclude student housing and BmSS-apartments, categories that should be included. Equally, apartments that lacks a kitchen, or has a kitchenette are grouped together with the regular apartments.

Diagram 5, Table 4-5 & 11-15

The diagram and tables all use a threshold value of five percent. Meaning that if there is less than five percent of a particular apartment type, then it is not considered to contribute to the overall diversity of a project. The reason behind this threshold, is that the entrance- and top-floorplan usually differs slightly from the standard-floorplan, resulting in a few apartments of another type. An example of this is Kallebäck 18:13, a project with a total of 182 apartments. It has three, three-bedroom apartments (4 Rok) and one four-bedroom apartment (5 Rok). These large apartments are important for the overall diversity of the area, but they are not the result of a conscious effort to create a mixture and diversity in the project.

Heading, Table 6-7 & Image 3-4

Linear algebra was utilized for the calculation of the population centers. To do the calculation two things are needed, a direction and a length. Together they form a vector.

In the case of the projects, the direction to a project was obtained by feeding The Land Survey's (Lantmäteriet) online service, minkarta, the real property unit. A spot was chosen approximately in the middle of the development and the coordinates for that spot was noted as the direction for that particular project. The length is the estimated number of inhabitants in a project. It is based upon the number of apartments, their type, and the data available in table 6. To obtain the result for the year, the vectors are summed up and divided by the sum of the estimated population.

Table 6 holds the average number of inhabitants per apartment type in Gothenburg. It is based on data from the last census, conducted in 1990.

This is an old source, but it is the last publicly available data that contains the necessary information to calculate table 6. The values have most likely changed since then. Likewise, these values most likely differ depending on the social economic status of an area. This is not seen as a large problem since the entire calculation is an approximation. What is important is how large effect these errors have on the result. To gauge that, the result is compared to that calculated using rooms (a variable unlikely to change) instead of inhabitants as length, see table 7.

The calculation of Gothenburg's population center is based on publicly available geodata from The Land Survey and Statistics Sweden. It is provided in the shape of a database where the entirety of Sweden is subdivided into squares, with coordinates and the number of people that lives in every square. The calculation is done in the same way as the projects, with the center of the squares as the coordinates and the number of people as the length.

The squares do not follow the border of the municipality. This is not a big problem in the north, since there is good separation between Gothenburg, Ale and Kungälv, but more so in the east and south towards Partille and Mölndal. If a square covered more than one municipality, then it was attributed to the one with the most visible housing. The calculations are based on 592 414 individuals, the actual population in the municipality at the time were 587 549 (Statistics Sweden, 2023). An error of 0,83%, skewing the result slightly towards Mölndal and Partille. Nor does the population necessarily live in the center of a square. The maximum possible individual error of √2*500 meters is effectively cancelled out by the large sample of squares, 425, and large number of individuals contained in those squares, 592 414. This is possible since there is no correlation between the superimposed grid pattern and the underlying urban fabric. As with table 6, both these error sources are not seen as a major problem, based on the approximative nature of the calculation.

Cost indicators & Table 9

The available data from Statistics Sweden and Svensk Mäklarstatistik both use the old boroughs (Stadsdelar) instead of the new administrative areas (Stadsområden), this means that a portion of industrial land between Säveån and E20 counts to Centrum instead of Nordost in their statistics. However, this portion does not contain housing to any larger extent and should not affect the statistics notable. They are therefore used interchangeably.

Typology & table 16-18

The definition of building typologies used in this thesis are mostly inherited from the Bygglov Göteborg project. The project however lacked a robust definition of the Mittkorridor/Central corridor typology. Their definition is based on one of the problems with the typology, that is the large amount of single sided apartments. This is a good definition, but without a specific amount specified, it becomes arbitrary. To rectify this, a limit of at least 75 percent single sided apartments is used in this thesis. This means that the least number of apartments a double-sided central corridor can have is 8 apartments per story, if all cardinal directions is utilized. That is also the reason no comparison against previous years is made.

The following text defines the typologies used:

- Punkthus/Tower block – a building with one central staircase/core. Generally standing alone in solitude, but can in some cases be connected to another lower building. The link should be visually very weak, giving the impression that the building stands alone. An example of this is Karlatornet, Lindholmen 2:19 & 2:20, where the tower is connected via a podium to the other buildings in the city block.
- Lamellhus/Linear block – a minimum of two staircases distributed along a mostly straight line. Can form part of an open block or stand alone in solitude.
- Vinkelhus/Angled block – a minimum of two staircases with at least one closed corner.

Can form a closed block, be a part of an open block or stand alone in solitude.
- Loftgångshus/Gallery building – a building that utilizes exterior egress balconies. Can be a part of a closed/open block or stand alone in solitude.
- Gathus/Urban infill – an infill project with one or more staircases added in between two (in rare cases one) firewalls to form part of an open or closed block.
- Stadsvilla/Villa – a small building with 3-8 apartments and a maximum of 3 stories. The character is such that the building could fit into an urban fabric containing mostly single-family detached housing.
- Mittkorridor/Central corridor – a building with a single- or double-sided central corridor that has at least 75 percent single sided apartments.
- Podium – a building that covers an entire city block and has a purpose other than housing. The roof of the podium building is often used as an elevated courtyard with one or several housing projects built on top of it.

One exception to this is if a project contains one large building complex where several typologies are found. Usually there is a clear vertical separation between them, where for instance 3 staircases might belong to the typology angled block, and the other 2 staircases to the typology gallery building. In those cases, the building complex is treated as two or more buildings depending on the number of typologies that are attached to each other. No consideration is taken to different façade expressions and number of stories that the individual staircases might have.

Mixed-use developments

The definition of mixed use in this thesis is that the project contains a public accessible commercial space somewhere at street level. Examples of this could be a space suitable for an office, a small shop or a restaurant. A community room/area in a housing cooperation is not considered publicly accessible, nor commercial. It is therefor not included in the definition.

There are exceptions to this, specifically Backa 264:6 and 264:10. These two buildings consists of a podium in the shape of a parking garage with housing on top. The garage is accessible from street level, and the public can most likely rent a parking spot/permit in it. It therefor somewhat fulfills the definition, but not the intention. These are not counted as mixed-use developments in this paper.

Staircases & diagram 10-12

A separate entrance is defined as an entrance that is not connected to a stairway or a gallery. It is fairly common that gallery entrance projects have utilized the possibility to create separate entrances on ground level with a small private patio and a communal pathway outside of it. For these to be counted as separate entrances there must be some sort of detailing in the drawings that indicates that this is the case.

Diagram 10 shows how many apartments per entrance situation there is. The staircase category is divided in 11 different options ranging from 1 apartment (1-spännare) per level to 11 or more (11+-spännare). The idea that a staircase has a certain number of apartments per level throughout is a hypothetical construct, very few staircases have the same number of apartments per level. The entrance and top floor usually have fewer apartments than the floors in between. To get around this problem, every level is counted by itself. That means that a staircase may contain 2 apartments in the 2-spännare group, 20 in the 5-spännare and 3 in the 3-spännare.

Previous years had the central corridor as its own category. However, a central corridor is a staircase with apartments along an elongated entrance hall. This, coupled with the previously mentioned unprecise definition of the central corridor is the reason why it is not presented separately, and why no comparisons are made with previous years.

Corridors

The definition of a corridor used in this thesis,

is a room with the visual proportions of at least 1/6 (width/length). It is based on a quick experiment made by the author, of when the perception of a room changes. This will of course differ depending on the individual, and should therefore be considered an arbitrary lower limit.

When measuring, a straight line of sight has been used. This means that an L-shaped corridor is measured as two separate corridors with their own length and width. Likewise, the width used is the projected one, that is the narrowest section of the corridor. The allows differently shaped hallways to be measured in a consistent way.

Diagram 13-22

The data used in these diagrams are truncated, that is rounded of to the nearest full square meter. This is done for practical reasons. Compiling them with an arbitrary number of sizes would be possible, but impractical. It would render both diagrams unreadable, obscuring the data with clutter. It would also add false precision to the graphs, since the area for a large number of apartments is presented rounded off, to the nearest full square meter in the drawings.

The data in the even-number diagrams is compared against the existing housing stock in Gothenburg. These curves are based on data from 225 232 apartments found in The Land Survey's apartment register the last December of 2020. It is treated the same way as the data for the yellow lines in diagram 3-4 & 7-8, with the slight difference that the specialty apartments, 17 in total, are remove for the largest catagory (5 Rok). The reason behind it is, that they are likely incorrectly categorized and more importantly, they are in the realm of micro-data. There are also 727 apartments that lack vital information, such as size, number of rooms, etcetera, that are removed from the set. The truncation of the data also serves to avoid micro-data in the set.

Cardinal directions & table 21

In most cases, the number of cardinal directions an apartment have views in, is self-explanatory.

A small number of apartments have features that blur the lines. An example of this is 4 two-bedroom apartments found in Heden 22:21. These are primarily single sided, but have a large bay window in the living room with views in three directions. When seated in this part of the apartment, those views will be experienced. However, the apartments lack much of the benefits gained by views in several directions, and are therefore more similar to a single sided apartment then a three-sided one. These are still classified as three-sided. The reasoning behind it is two-fold. The first is that a small part of it actually have views in three directions. More importantly, views in more cardinal directions are generally positive feature. A small number of apartments classified as having more views than they subjectively should have, is less of a problem then the opposite when the goal is to show the large number of apartments with few views. The risk of exaggerated numbers is therefore reduced.

Another example is Amhult 108:6, a building with the corners truncated to a 45-degree angle. The apartments located in these corners are classified as having two adjacent views. While strictly not true, they offer more than a single sided apartment does. A similar situation can be found in Backa 261:1 (Dufins gata 6). This project contains 3 studio apartments classified as having three views. While true, the third view is thru the glazed balcony door onto a small inset balcony. This configuration gives the inhabitant an angled sight line out, much like the truncated corners found in Amhult 108:6.

The room that is not a room & diagram 23

Finding all "rooms" smaller than 7 square meter is an extensive task. For those projects that have the area of rooms printed out in the drawings, the task is simplified, and those numbers are used. For the projects that doesn't have that, measurements have been taken in the pdf drawings. Since all but one project use vector-based drawings, the measurement tool in Acrobat can snap onto lines, making those measurements very accurate.

A small amount of error has been allowed. Several projects have rooms that over multiple measurements (same room different floors) have measured to 6,9… If the area equals 6,93 or smaller, they have been counted, areas above that have been excluded. There are therefor most likely several rooms that belongs to this category that have been excluded, but the opposite can also be true. No good ways to find out the accuracy in the generated vector drawings is known.

Most of them are likely generated in a BIM software, such as ArchiCAD or Revit. A small test was conducted by drawing a room with the internal measurements of 2100x3300 mm in Revit. It was exported as an A1 in scale 1:100 and 1:200. With the measurements tool in Acrobat the room measured 21,00x33,00 and 10,50x16,50 mm. These are the exact dimensions of the room as drawn, but at scale.

Diagram 24-26

As with diagram 13-22, the data is truncated to nearest full square meter.

The wardrobe that is not a wardrobe

There is an inherent subjectivity to if a storage space can be used for something else. In some cases, as with one type of studio apartment in Masthugget 43:9, it is obvious that the space is intended to be used as a bedroom. In others it is not as simple. Generally, two things have been gauged. That is furnishability and access to daylight. Specifically, what is judged is if a bed or a desk and chair combo be fitted. If a space has good furnishability but no daylight, its location in the floorplan have been used to judge the architect's intention for the space.

PROLOGUE

The year of 2021

After a year of social distancing, cancelled events and an uprooted everyday life, 2021 brought hope. Pfizer/BioNTech's vaccine against Covid-19 was approved (EMA, 2023 B) just days before Christmas 2020 and Moderna's vaccine received its approval a few days into 2021 (EMA, 2023 A). The following mass vaccination, critique against who receives it first, the unfair division of vaccine amongst countries and of course the discussion of EU's vaccine passports ensued. Even though Sweden remained relatively open during the whole pandemic, some effects, like material shortages and price increases could still be felt in the construction industry (Statistics Sweden, 2023 B).

On the 6th of July the Land and Environment Court of Appeal rejected Cementa's application to continue its mining operations at Slite. The decision sent shockwaves throughout the Swedish construction industry, since the site, at the time produced circa 75 percent of all cement used in Sweden. An analysis made by the trade association Svensk Betong (2023), claimed that the ensuing risk for a construction halt could lead to a 20 billion SEK lapse in investments, per month, and the loss of 400 000 jobs in the sector. Still, an economic upturn could be felt throughout 2021 in the construction industry. The 3rd quarterly report from Business Region Gothenburg (2023) states that there had been a large increase in the number of employees in the sector during the year, and that every forth company had plans for, or were in the process recruiting further employees.

It was also a year when the effects of climate change were felt. Heavy rainfalls in July led to floodings that greatly affected parts of Germany and Belgium. The water caused landslides, ruptured dams and large-scale power loss (Nummenmaa, Sjöblom, Bülow, & Fredriksson, 2021), killing over two hundred people (SMHI, 2023). Likewise, the summer also brought heatwaves in many parts of the world, leading to, among others, extensive wildfires around the Mediterranean Sea (Majlard, 2021). Fittingly half of the Nobel prize in physics was awarded Syukuro Manabe and Klaus Hasselmann "for the physical modeling of Earth's climate, quantifying variability and reliably predicting global warming" (The Royal Swedish Academy of Science, 2021).

The year also saw the Prime Minister Stefan Löfven ousted by Riksdagen after a no-confidence vote (Sveriges Riksdag, 2023), brought on by the loss of support from the Left Party. The schism was over the stipulated introduction of market rents in the January agreement for newly produced housing (Vänsterpartiet, 2023). Out of the 12 144 apartments finished in 2021 in Stockholm, Malmö and Gothenburg, roughly two thirds, or 8 147 were rentals (Statistics Sweden, 2022 B).

During the year Gothenburg grew with 4493 people to a total of 587 549 individuals (Statistics Sweden, 2022 A). That is a slight increase from the previous year, but far below pre Covid-19 conditions that saw a growth of approximately 7-8000 individuals per year (Statistics Sweden, 2023 C). The total net migration rate were + 679 individuals, with births accounting for the rest of the growth (Statistics Sweden, 2022 A).

On a positive note, Rannebergen was removed from the police list of vulnerable areas (Polismyndigheten, 2021).

BUILDING PERMITS - CITY

The permits

Year 2021 saw a total of 56 permits granted for multifamily residential buildings. They contain 6073 pages describing Gothenburg's future, detailing how and where the city's inhabitants will live. If built, these permits add 4945 apartments and approximately 450 000 square meters of BTA to Gothenburg's housing stock. See table 1.

The following analysis divides these projects into five groups based on the number of apartments: XS, S, M, L and XL, see table 2. The two smallest groups correspond to 23 projects for a total of 528 apartments. They therefor make up 41 percent of the projects but only 11 percent of the apartments. The 12 medium-sized projects make up 21 percent of the project and its 878 apartments corresponds to 18 percent. The majority of apartments can be found in the Large category, where 17 projects containing 2436 apartments accounts for 30 percent of the projects and 49 percent of the apartments. The 4 extra-large projects make up 7 percent of the projects and its 1103 apartments correspond to 22 percent of the apartments.

The mean-value is 88 apartments per project and the median value is 63. As with previous years, the largest projects tend to lift the mean-value above the median, see diagram 1. Equally, the two largest categories contains approximately two thirds of all apartments. In these, 2021 is a close match to 2017 and 2018. The odd one out being 2016 that contains fewer projects overall. See table 2.

Building permits of 2021 - Metrics				
	Permits	Pages	Apartments	BTA
2021	56	6073	4945	aprox. 450 000 sqm.

Table 1: An overview of the metrics of 2021.

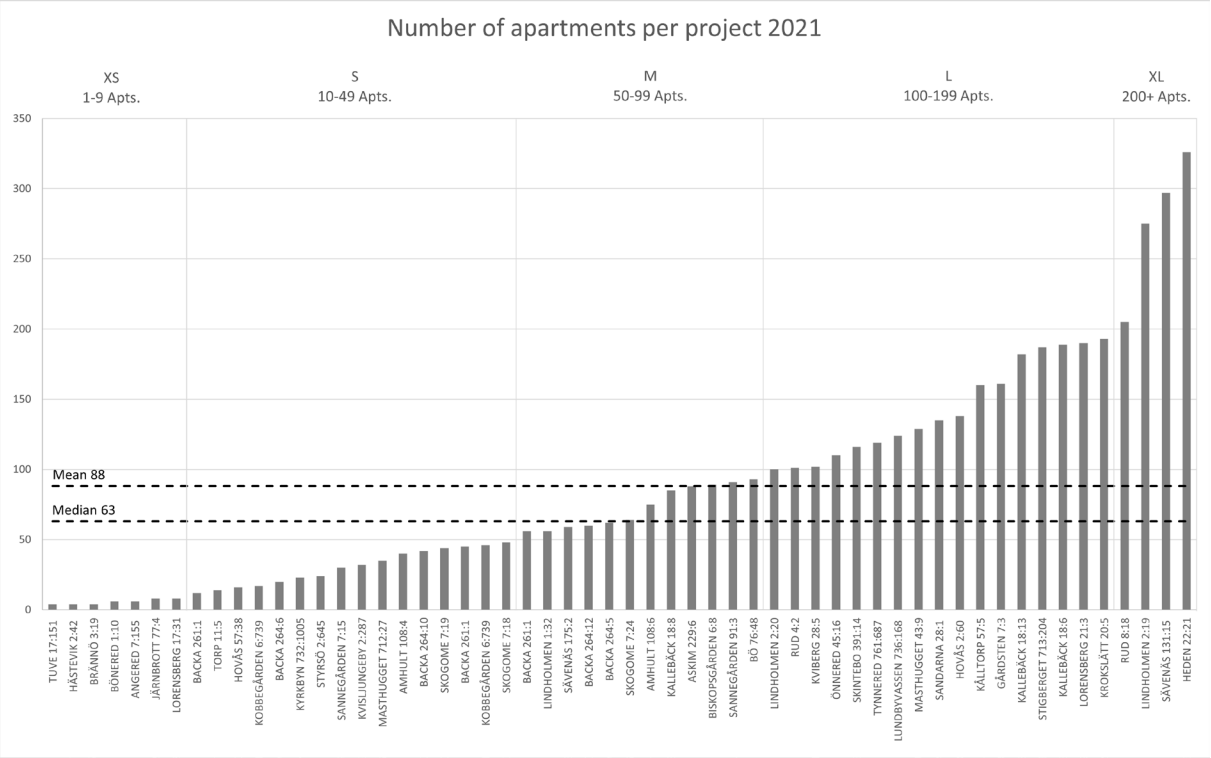


Diagram 1: Showing all projects in 2021 and the number of apartments that they contain. As seen, the largest projects lift the mean-value above the median.

		Comparison between years						
		XS 1-9 Apts.	S 10-49 Apts.	M 50-99 Apts.	L 100-199 Apts.	XL 200+ Apts.	Total	Projects
2016	Number of projects	6	8	10	8	3	35	Mean 79
	Percentage of projects	17%	23%	29%	23%	9%	100%	
	Number of Apts.	37	243	680	1098	722	2780	Median 61
	Percentage of new Apts.	1%	9%	24%	39%	26%	100%	
2017	Number of projects	5	10	10	17	4	46	Mean 98
	Percentage of projects	11%	22%	22%	37%	9%	100%	
	Number of Apts.	34	346	722	2314	1100	4516	Median 83
	Percentage of new Apts.	1%	8%	16%	51%	24%	100%	
2018	Number of projects	6	18	12	20	3	59	Mean 84
	Percentage of projects	10%	31%	20%	34%	5%	100%	
	Number of Apts.	36	597	834	2590	889	4946	Median 68
	Percentage of new Apts.	1%	12%	17%	52%	18%	100%	
2021	Number of projects	7	16	12	17	4	56	Mean 88
	Percentage of projects	12%	30%	21%	30%	7%	100%	
	Number of Apts.	40	488	878	2436	1103	4945	Median 63
	Percentage of new Apts.	1%	10%	18%	49%	22%	100%	

Tabel 2: Showing the data for 2021 in comparison with previous years. As seen, the Large category contains the most number of apartments in all of the examined years.

Distribution

Out of the 4945 apartments found in the building permits granted in 2021, 1330 were studio-apartments (1-1,5 Room and Kitchen), equaling 27 percent of the total. The 1895 one-bedroom apartments (2 Rok) were the largest group, making up 38 percent of the total. The two-bedroom apartments (3 Rok) with its 1164 apartments accounted for 24 percent. The three-bedroom apartments (4 Rok) with its 478 apartments accounted for 10 percent. And the largest size, with four or more bedrooms (5 Rok) accounted for circa 2 percent with its 78 apartments. See diagram 2 and 3 on the next spread.

Overall, the smallest apartments (1–2 Rok) therefore make up 65 percent of the planned new multifamily residential housing, while the larger apartments correspond to 35 percent, see diagram 3. This follows the pattern from previous years. Worth noting is the increase in the two largest sizes when comparing with 2017 and 2018, both years with a similar number of apartments. In 2017 these two sizes accounted for 321 apartments, in 2018, 467 apartments, and in 2021, 561 apartments, see table 3 on the next spread. This is a significant increase, but it is difficult to declare that this constitutes a trend without the data for 2019 and 2020.

Effects of the change in distribution

The in Sweden commonly used Trångboddhetsnorm 2 from 1967 (Inrikesdepartimentet, SOU 1965.32) states that a household is overcrowded if there are more than two individuals per room, not counting the kitchen and living room. Eurostat's definition is close to this since it allows for a pair of children up to 12 years of age to share a room. It also allows single individuals of the same sex to share room up to the age of 18 years (Eurostat, 2023).

That means that a two-bedroom apartment (3 Rok) is the smallest possible apartments a family of three can live in, if the household is not to be considered overcrowded. In the examined years there has been a trend towards a higher percentage of the smallest apartments in comparison to the existing housing stock, see diagram 3. Long-term, this may lead to an increase in household overcrowding.

Another way to analyse the data is to make a relative comparison between the existing distribution and that found in the building permit applications. By dividing the different sizes percentual value with that of the actual distribution, we transform diagram 3 into diagram 4. As previously seen, there is an increase in the smallest size (1-1,5 Rok), ranging from 115 up to 128 percent of the existing distribution. The two- and three-bedroom apartments (3-4 Rok) shows mostly values under 100 percent, indicating a shrinking share of the overall production, but not as drastically as the largest apartments (5 Rok), ranging from 14 to 63 percent. This means that the largest apartment size will be harder to come by in the future.

Estimating the need for a certain apartment size is tricky. In its report, Trångboddhet i storstadsregionerna, Boverket discusses the by Bengtsson (1992, p.70-71, referrd to in Ekstam, 2016, p.6) introduced concept of a market- and a need-based deficiency. The need-based deficiency is coupled to households living standards being lower than the political set ambition, whilst the market-based one is coupled to individuals' preferences and their ability to pay. That means that in a market equilibrium, apartments can be both under- and over-utilized according to the political set goal. Under-utilization is seldom seen as a problem, but over-utilization is.

Large apartments - Details					
	2016	2017	2018	2021	Exst. dstr. 2020-12-31
No. apt.	2780	4505	4946	4945	
4 Rok	267 / 9,6%	305 / 6,8%	430 / 8,7%	478 / 9,7%	10,3%
5 Rok	23 / 0,8 %	16 / 0,4%	37 / 0,7%	78 / 1,6%	2,5%
Total	290	321	467	556	

Table 3: An overview of the number of apartments in the two largest sizes. The years 2017, 2018 and 2021 are quite close in the overall number of apartments, but 2021 has significantly more of the larger apartments than its predecessors.

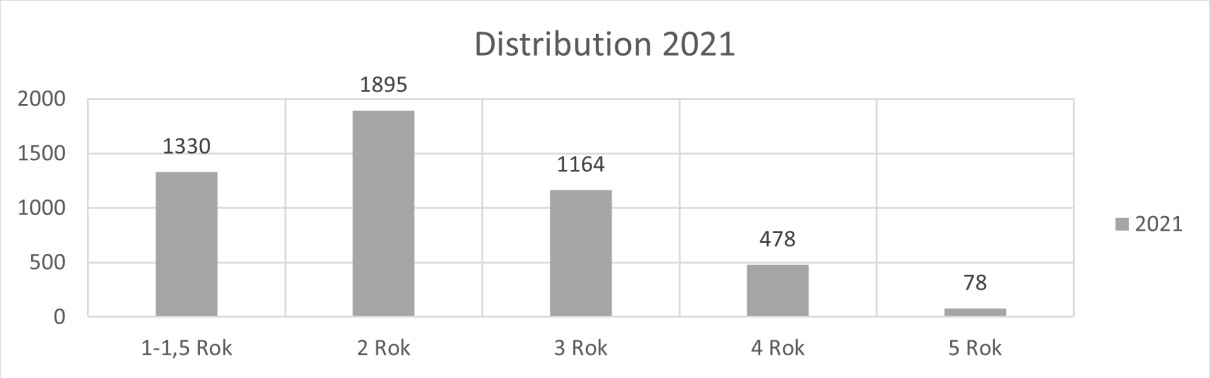


Diagram 2: Showing distribution and amount of added apartments in Gothenburg's municipality according to the building permits granted in 2021.

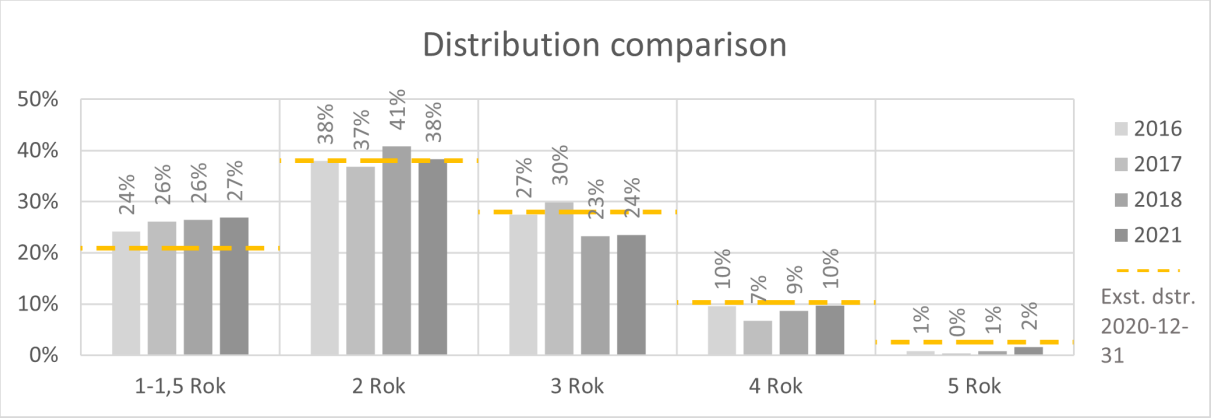


Diagram 3: A comparison with previously examined years. The dotted line indicates the distribution of the existing apartments in Gothenburg as of 2020-12-31.

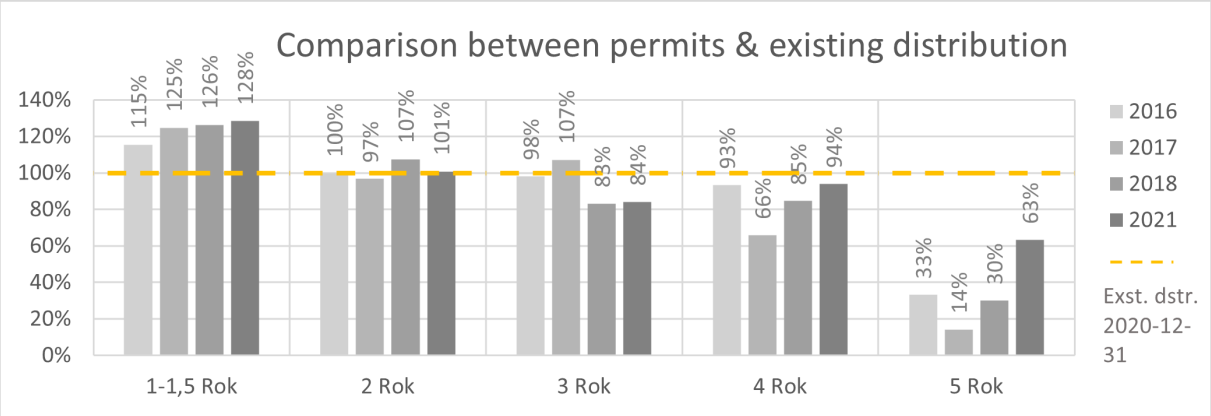


Diagram 4: Dividing the percentual value of the permits with that of the existing distribution in diagram 3. This allows the relatively much lower production of the largest apartments to be visualized. A value above 100 percent indicates an increasing share of the overall distribution, likewise a value below indicates a shrinking share.

Heterogenity

A mixture of size and type allows households to find a suitable apartment in a particular development. Small apartments are generally aimed at single households, while larger sizes cater towards families.

In diagram 5 on the next spread, the heterogeneity of the projects is examined by categorizing them according to the number of apartment-types they contain. It is easy to draw the false conclusion that there is a trend towards a better diversity. This is not the case, since the number of projects increases from 35 projects in 2016 to 59 in 2018, see table 2. Calculating the average, the years are quite close ranging from 2,9 to 3,1 types per project, but the spread is vastly different, see table 4. The median number of apartment-types per project is 3 for all examined years.

Table 5 furthers our understanding of how the increased distribution in spread affects the projects of 2021. The table uses a traffic light analogy, where projects containing 1-2 types are marked with a red color, 3 types with a yellow color and 4-5 types with a green color. As with previous years, there is a concentration of low diversity projects marked with red in the two smallest project categories, XS and S. This is understandable, at least for the smallest category.

One average the diversity increases as the size of the projects increase. Going from 1,4 for the XS projects to 3,1 for S projects, 3,5 for M & L projects to 3,8 for XL projects. Even though the largest projects usually have great conditions for a high diversity, three out of four projects with five types, can be found in the S and M categories. One of the most diverse projects, Amhult 108:4 has five apartment-types divided onto 40 apartments.

The increased spread in distribution is in most cases found in the smaller size-categories, meaning that they affect a relatively small number of apartments. Note previously mention table 2, and that the two largest categories contain approximately two thirds of the apartments. The exception is Lundbyvassen 736:168, with its 124 studio- and one-bedroom apartments (1-2 Rok), found in the L category. This project contains short term rentals, located in Frihamnen. In this case, the lack of diversity is a result of the projects purpose.

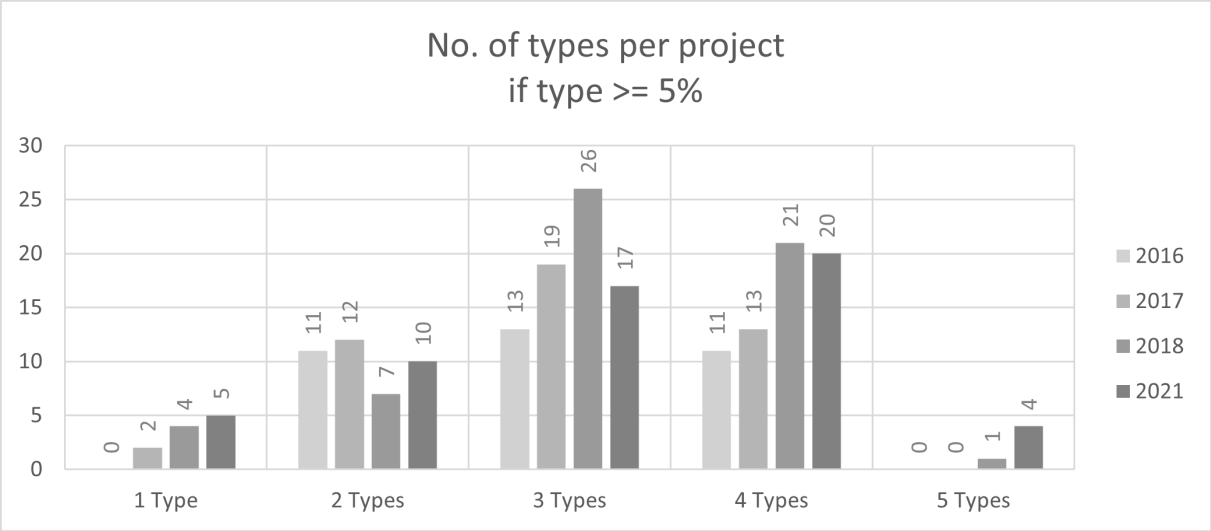


Diagram 5: Examining the heterogeneity of the projects by categorizing them according to the number of apartment-types that exists in them. A threshold of five percent is applied to the data. This means that types containing less than 5 percent of the projects apartments is not counted.

	Heterogeneity of projects – Comparison between years					Average/ median no. of types/project
	1 Type	2 Types	3 Types	4 Types	5 Types	
2016	0%	31%	37%	31%	0%	3 / 3
2017	4%	26%	41%	28%	0%	2,9 / 3
2018	7%	12%	44%	36%	2%	3,1 / 3
2021	9%	18%	30%	36%	7%	3,1 / 3

Table 4: Further exploring the data in Diagram 5 by looking at the percentual distribution and the average and median number of types per project. The trend is not towards better diversity in the projects, but that of a larger spread in the distribution.

To the right, Table 5: Examining the heterogeneity of the projects by categorizing them according to their project size. A red label indicates 1-2 apartment-types, yellow label 3 types and green 4-5 types. A threshold of five percent is applied to the data. This means that types containing less than 5 percent of the projects apartments is not counted.

Heterogeneity of projects – Detailed view of 2021 (values in percent)							
Category	No. Apts.	1-1,5 Rok	2 Rok	3 Rok	4 Rok	5 Rok	Total
XS	4	0	100	0	0	0	100
	4	0	0	100	0	0	100
	4	0	50	50	0	0	100
	6	33	67	0	0	0	100
	6	0	100	0	0	0	100
	8	0	100	0	0	0	100
	8	50	0	0	50	0	100
S	12	0	0	67	0	33	100
	14	21	29	29	21	0	100
	16	0	0	75	25	0	100
	17	41	6	53	0	0	100
	20	5	55	25	15	0	100
	23	35	39	26	0	0	100
	24	0	50	50	0	0	100
	30	80	20	0	0	0	100
	32	0	44	56	0	0	100
	35	63	37	0	0	0	100
	40	20	20	25	23	13	100
	42	21	43	21	14	0	100
	44	0	36	45	18	0	100
	45	38	27	13	7	16	100
	46	13	15	59	13	0	100
	48	0	33	50	17	0	100
M	56	14	14	5	45	21	100
	56	0	100	0	0	0	100
	59	0	41	34	25	0	100
	60	10	38	38	13	0	100
	62	35	34	27	3	0	100
	64	22	33	45		0	100
	75	1	56	27	16	0	100
	85	22	32	29	2	14	100
	88	26	23	34	17	0	100
	89	12	54	8	26	0	100
	91	21	41	20	19	0	100
	93	24	37	28	11	1	100
L	100	10	50	20	20	0	100
	101	57	23	20	0	0	100
	102	31	49	20	0	0	100
	110	0	54	30	16	0	100
	116	11	40	34	15	0	100
	119	22	36	40	2	0	100
	124	81	19	0	0	0	100
	129	45	34	9	9	2	100
	135	10	27	29	24	10	100
	138	14	40	20	24	2	100
	160	43	20	32	6	0	100
	161	20	47	34	0	0	100
	182	24	52	21	2	1	100
	187	32	45	6	17	1	100
	189	50	31	18	0	1	100
	190	43	46	7	4	0	100
	193	28	42	12	15	3	100
XL	205	49	18	19	15	0	100
	275	30	47	23	0	0	100
	297	26	36	30	8	0	100
	326	13	48	28	8	0	100
	4945	27	38	24	10	2	100

GOTHENBURG'S POPULATION CENTER

Heading

Exploring the city's expansion efforts can be done by looking at approximate population centers. This gives a complimentary overview to the deeper analysis in the next chapter. The analysis is based upon three datasets. The first one is the building permits themselves, the number of apartments they contain, the type and coordinates of the project. The second dataset is the last Swedish census from 1990. This is used to calculate the average number of inhabitants per apartment-type in Gothenburg, see Table 6 (Statistics Sweden, 1997). The last dataset is a geopackage over the total population from 2021-12-31 (Statistics Sweden, 2023 D). It contains squares with an area of one square kilometer and the amount of people that lives in that area, for the entirety of Sweden.

Linear algebra was utilized for the calculation of the population centers. The coordinates of the projects/squares were used as a vector direction, and the estimated number of inhabitants/ inhabitants were used as its length. Alternatively, the number of rooms can be used instead of inhabitants when calculating the projects, a variable unlikely to change. The difference in the calculated position for 2021 between these two methods is a mere 34 meters, see table 7.

The calculations shows that the building permits population centers are all southwards of Gothenburg's, see image 4. They are located between 1,4- 2,7 km away, distances significantly larger than the maximum possible errors in the calculations. Further, if Gustaf Adolf's Square is utilized as a symbolic city center, the closest result is still 1,1 km away. This indicates that the densification efforts are not evenly distributed in the city according to its current distribution, but has a skew to the more densely populated south. The conclusion is that city is slowly expanding southwards.

The exploration contains to few years to draw any conclusion about why the spread looks as it does. However, if we speculate there appears to be a clustering effect where 2016/2017 and 2018/2021 are grouped together. This pattern is not unexpected, since a development area add to the overall picture for a few years until fully built. Depending on the overlap in time period between different development areas, this can cause a grouped or a meandering appearance.

	Census 1990 - Gothenburg				
	1 Rok	2 Rok	3 Rok	4 Rok	5 Rok
Avg. no. of inhabitants	1,1	1,3	2,0	2,7	3,0

Table 6: Average number of inhabitants living in a particular apartment-type in Gothenburg. The data is derived from the last census (Statistics Sweden, 1997).

Calculated coordinates for population centers - SWEREF 99 TM						
		2016	2017	2018	2021	Geopackage
Inhabitants	N	6397847	6398202	6399110	6399088	N 6400547
	E	318989	319008	318857	318936	E 318705
Rooms	N	6397785	6398172	6399117	6399098	
	E	318961	319001	318884	318904	
Difference (meters)		68	30	28	34	

Table 7: Calculated coordinates for the examined building permits population centers. Two different sets of coordinates are given depending on if inhabitants or rooms are used for the calculation. Either method yields a similar result. Lastly the coordinates for calculated population center of Gothenburg, (Statistics Sweden, 2023d).

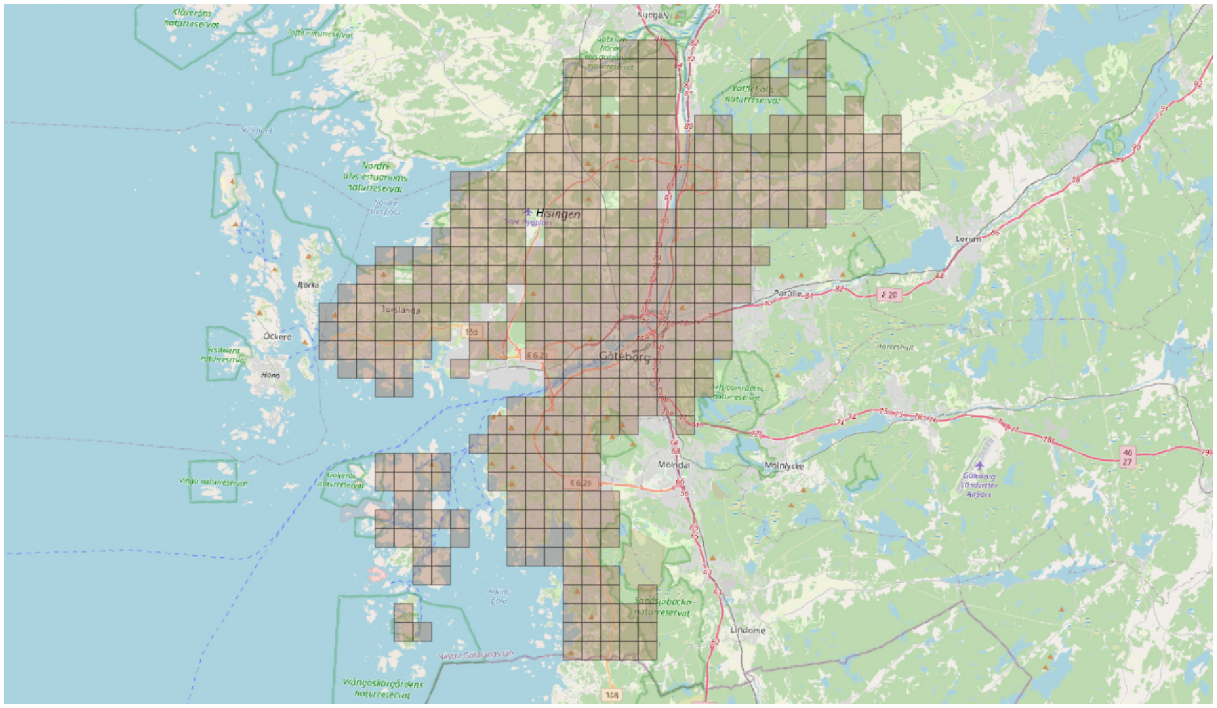


Image 3: Map source © 2023 OpenStreetMap.
Showing the squares that were used for the calculation of the population center of Gothenburg.

Image 4: Map source © 2023 Google.
The result indicates that Gothenburg's population center is located in Frihamnen. The population centers of the building permits are all located south of this, indicating that the city is slowly expanding southwards.

BUILDING PERMITS - ADMINISTRATIVE AREAS

Distribution

Looking at Gothenburg's four administrative areas (Stadsområden) adds nuance to the picture. Most of the apartments, 46 percent for a total of 2282, were located in Centrum. Hisingen with its 1402 apartments stood for 28 percent, Sydväst with its 992 for 20 percent and Nordost a mere 5 percent with its 269 apartments, see image 5. That means that two thirds of all apartments are located south of E20 and Götaälv.

Tabel 8 contains a comparison with previous years. The new administrative areas were established the first of January 2021 (Göteborgs stad, 2023). To be able to compare the data, the years of 2016-2018 is presented according to this geographical division. The data for the existing distribution comes from Gothenburg municipality's online statistics service (Statistikdatabas Göteborgs Stad, 2023).

2016 and 2021 are quite close to each other in terms of distribution. They are also the closest match to the existing distribution of apartments in the city. The biggest difference is the lack of construction in Nordost, in favor mostly for Sydväst. The distribution in 2017 and 2018 is radically different. Sydväst and Nordost accounts for 30 percent of Gothenburg's apartments, but in 2017 they accounted for 46 percent, and 2018 a massive 84 percent of the apartments in the building permits. That number had yet again dropped to 25 percent in 2021. Still Sydväst had approximately double the number of apartments of Nordost during these years. Explaining why the calculated population centers for these years still end up south of Gothenburg's.

Cost indicators

The average rent in Gothenburg in 2021 was 1254 SEK per square meter and year (Statistics Sweden, 2022 C). It can be compared against the values in table 9. The table contains the average and median rent per square meter and year for rental apartments, and the average purchase price per square meter for housing cooperatives in the different administrative areas. It is based on available statistics from Statistics Sweden (2022 D) and from Svensk Mäklarstatistik (2023). Centrum's 1348 SEK per square meter and year equals a 107 percent of the average rent in Gothenburg. The rent in Hisingen and Sydväst are close to the average rent in Gothenburg, while the rent in Nordost is the lowest, at 85 percent of the average. The median value is close to the average in all administrative areas. The least difference, -6 SEK, is found in Centrum, while the-62 SEK in Sydväst represents the biggest difference. Still, the median value equals 95 percent of the average value in Sydväst.

The same trend is seen when looking at the average purchase price for apartments in housing cooperatives, but the difference is larger. The average price per square meter in Centrum is almost twice that of Nordost. While not directly comparable, perspective can be had by looking at the average total building cost per square meter of multifamily residential housing in the greater Gothenburg area. In 2021 that cost were 48 193 SEK per square meter when eventual subsidies (Netto) have been removed from the price (Statistics Sweden, 2022 E).

Distribution among administrative areas - Comparison between years					
	2016	2017	2018	2021	Exst. dstr. 2020-12-31
Centrum	1152 / 41%	1390 / 31%	520 / 11%	2282 / 46%	46%
Hisingen	708 / 25%	1049 / 23%	637 / 14%	1402 / 28%	24%
Nordost	182 / 7%	700 / 16%	1215 / 27%	269 / 5%	16%
Sydväst	738 / 27%	1366 / 30%	2574 / 57%	992 / 20%	14%

Table 8: Showing the added apartments per year according to their distribution among the administrative areas.

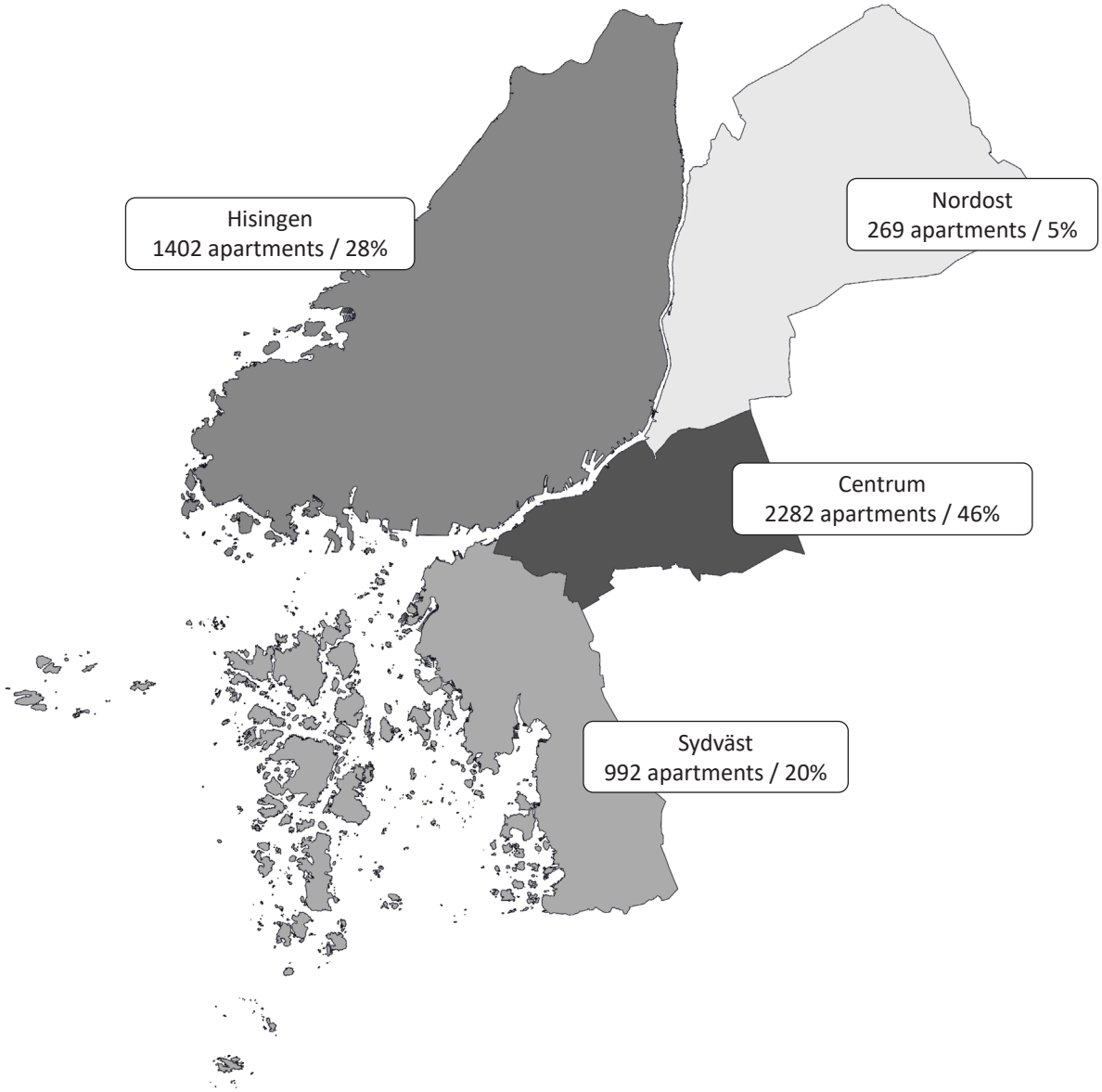


Image 5: Showing Gothenburg's four administrative areas and the number of apartments added to them in the building permits of 2021.

	Indicators of cost of housing - 2021 (SEK)		
	Rent sqm/year (Hyresrätt)		Average purchase price per sqm. (Bostadsrätt)
	Average	Median	
Centrum	1348	1339	63218
Hisingen	1269	1214	42786
Nordost	1067	1032	33321
Sydväst	1240	1178	43583

Table 9: Containing metrics of how expensive housing is in the different boroughs. For rental apartments the average and median rent per square meter and year is shown, and for housing cooperatives the average purchase price per square meter.

Distribution continued

Diagram 6 shows the number and type of apartments added to the administrative areas in 2021 years building permits. Diagram 7 shows the percentual distribution of apartment sizes in the different administrative areas. These are compared against the existing distribution in the administrative areas. The data for the existing distribution comes from Gothenburg municipality's online statistics service (Statistikdatabas Göteborgs Stad, 2023). As seen, the distribution of sizes in Centrum is fairly close to the existing stock, with an increase in the studio apartments (1 Rok). Both Hisingen and Nordost has an increase in studio- and one-bedroom apartments (1-2 Rok) and a decrease of two-bedroom apartments (3 Rok). The biggest difference between them is Nordost's total lack of apartments in the two largest categories.

To add clarity, a relative comparison is presented in diagram 8 between the existing distribution and that found in the building permit. It is constructed the same way as diagram 4, by dividing the different sizes percentual value with that of the actual distribution in the administrative area. A value above 100 percent indicates that the type has an increasing share of the overall distribution in the administrative area. With it, the findings regarding the larger apartments found on the city level can be broken down on the individual administrative areas. Contributing is Hisingen, Centrum and Sydväst. All of them adds three-bedroom apartments (4 Rok) in approximately the same proportions that they already have. The largest category of four or more bedrooms (5 Rok), sees an increase in Hisingen a decrease in Centrum and almost none in Sydväst. However, Centrum with its 47 apartments in this category still adds more apartments to the total than Hisingen with its 28 apartments.

Municipal influence on distribution

In 2014 the municipal council adopted three strategies for the city's expansion. One of them were a strategy where further housing would be added called Strategi för Utbyggnadsplanering. It had a focus on what it calls "mellanstaden", the area outside the city center that has a continuous urban fabric with good public transit. The emphasis is on densification, with the explicit goal to focus on: utilization of existing resources, development of existing local centers, and the somewhat diffuse goal on focus on areas that will make a difference (Byggnadsnämnden, 2014). This strategy was in effect until it was repealed in December 2022 by Byggnadsnämnden. It was not superseded, but the still valid parts incorporated in the municipality's new master plan that had been in development since May 2017 and adopted in May 2022 by the municipal council (Stadsbyggnadskontoret, 2022).

The strategy identifies several clusters/areas that the city should focus their efforts on. The one cluster identified in Sydväst to develop further is that of Marklandsgatan-Axel Dahlströms torg, Frölunda torg and Opaltorget. They are all located along the same tramline in a relatively small geographical area. With a prognosis of approximately 2600-3000 apartments until 2022 and a potential for another 3000-4100 apartments after 2022. In comparison to Nordost where two clusters are identified. The first one is the area around Gamlestads torg, with a prognosis for 2200 apartments until 2022 and a potential for a further 2000 apartments afterwards This area is located in the junction of the tramlines going to Angered and Bergsjön. It continues to Rymdtorget, Gärdsås torg, and Kortedala torg, all located along the tramline to Bergsjön. With a prognosis for a further 400 apartments until 2022 and a potential of 2800-3500 apartments afterwards. The second one is Angereds centrum, Hammarkulletorget and Hjällbo torg, all located along the tramline to Angered. With a prognosis of 700 apartments until 2022 and 3200-4200 afterwards.

In its strategy Byggnadsnämnden (2014) states that the two principal tools a municipality can use to steer the city development with is the ownership of land and the detailed development plan-monopoly. It does not explicitly state how the prognosis was made, but an assumption is that it is partly tied to the municipality's plan-monopoly. If summed up, the prognosis

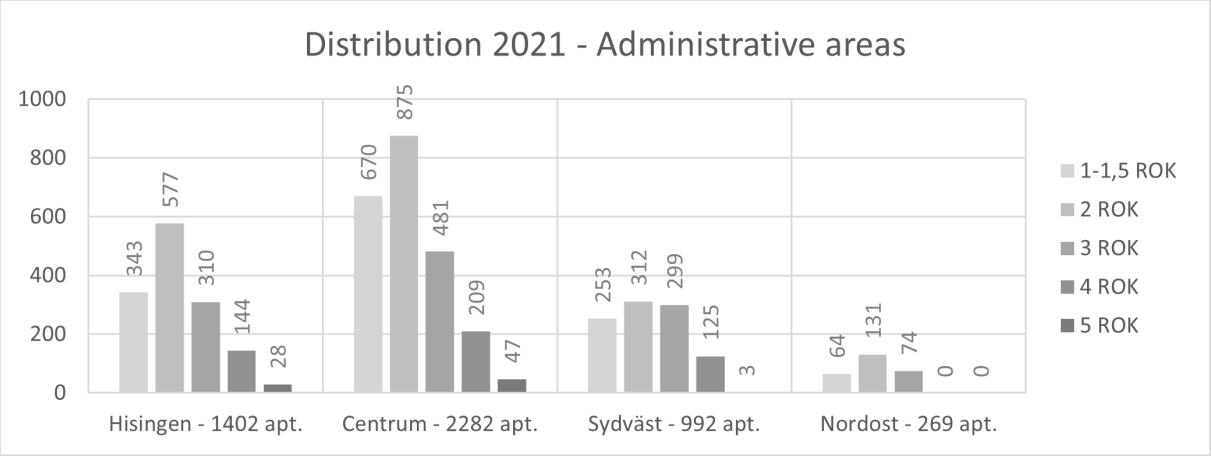


Diagram 6: Shows the distribution of the different apartment-types in the boroughs.

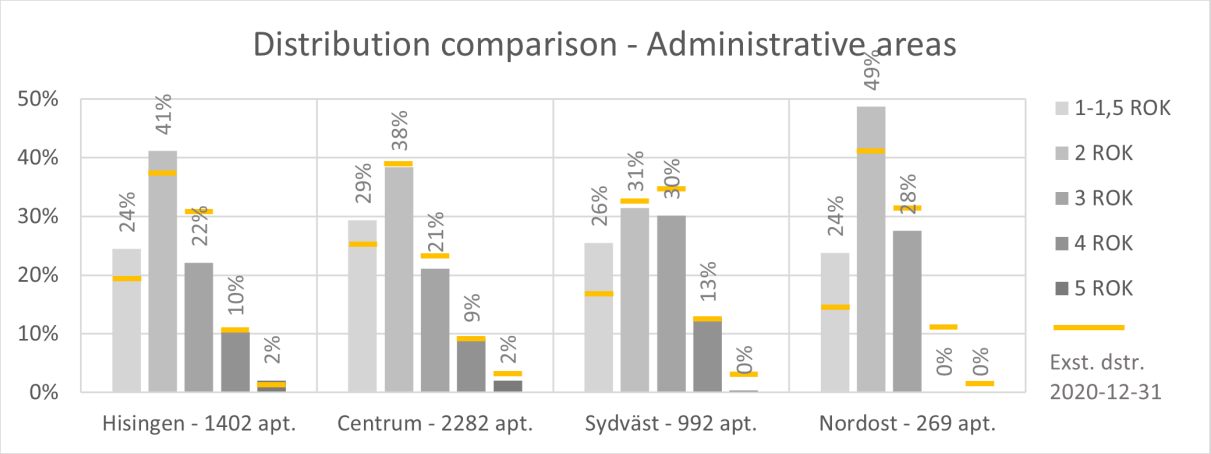


Diagram 7: Compares the percentual distribution of the apartments in the building permits with the distribution of existing apartments in the boroughs (solid line).

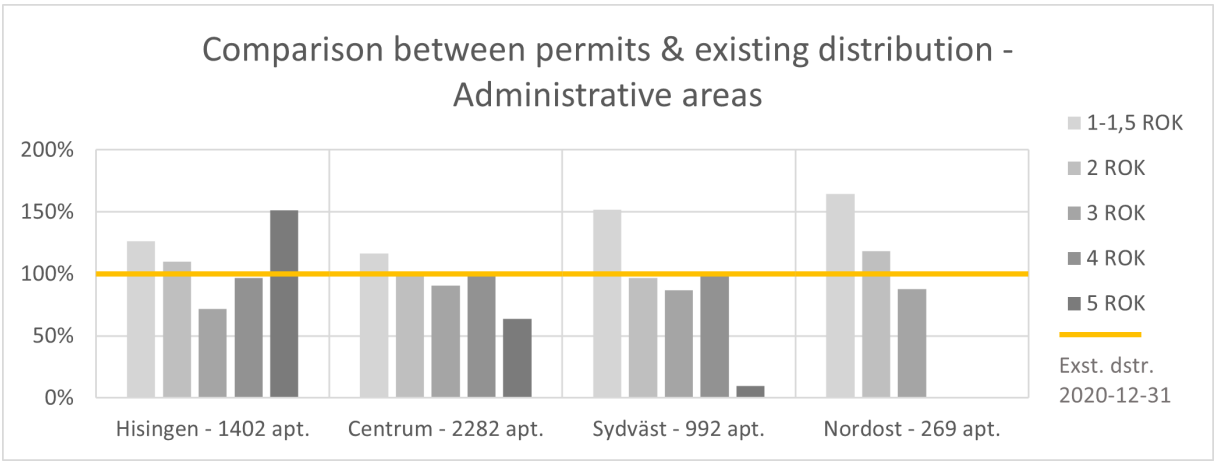


Diagram 8: Dividing the percentual value of the permits with that of the existing distribution in diagram 7. This allows the differences to be visualized. A value above 100 percent indicates an increasing share of the overall distribution in the administrative area.

of Sydväst's 2600-3000 apartments can be compared against Nordost's 3300. The result, excluding 2019 and 2020, is 5670 apartments in Sydväst and 2366 apartments in Nordost, see table 8. Meaning that Nordost likely exceeded the prognosis when 2019 and 2020 is counted. However, the 5668 apartments in Sydväst is approximately twice the amount found in the prognosis, and that is without 2019 and 2020. One explanation for this is that the development in Nordost mainly is located in the areas identified in the strategy. This is not the case for Sydväst that also saw quite a lot of development around Riksväg 158, an area identified as a future development area in the strategy. Of those 5668 apartments, 3016 apartments can be found in the area identified in the strategy.

Another possibility a municipality has to influence where new housing is built, is via an owner's directive to a public housing company. These companies shall operate by commercial principals according to the second paragraph in the law, Lag om allmännyttiga kommunala bostadsaktiebolag (SFS 2010:879). The law is there to stop market distortions brought on by an unfair advantage that these companies may otherwise have, by introducing a profit requirement (Sveriges Allmännytta, 2023). This requirement may limit the potential for the municipality to use public housing companies to fulfill political goals but does not stop it.

Public housing

Gothenburg's municipality owns four public housing companies through Förvaltnings AB Framtiden, hereafter called Framtiden. Together they owned 74 274 apartments in Gothenburg's municipality at the end of 2020, making Framtiden the largest public housing company in Sweden (Förvaltnings AB Framtiden, 2021). At the same time Gothenburg had 236 265 apartments (Statistics Sweden, 2023 A), meaning that Framtiden owned 31 percent of all apartments in Gothenburg. Framtiden also own Göteborgs Egnahems AB, a company that develop housing cooperatives and other ownership dwellings, in areas with a large portion of rental apartments.

After the election in 2018 the new political leadership in Gothenburg used the 2020 budget to launch the goal that no parts of Gothenburg should be on the police's list of (particularly) vulnerable areas after 2025 (Göteborgs stad, 2019). The vulnerable areas in question are Bergsjön, Hammarkullen, Hjällbo, and Lövgärdet in Nordost, Biskopsgården on Hisingen and Tynnered in Sydväst. A part of the efforts to achieve this was delegated by the politicians to Framtiden via their owner's directive. In part, because of Framtiden's large share of apartments in these areas, but also since they have experience of doing so in Gårdsten. Framtiden call these areas development areas, and the aim is to downgrade them from particularly vulnerable areas to risk areas. To achieve this Framtiden set aside 3,5 billion SEK for increased operation and maintenance costs and 7,5 billion SEK for investments in their current housing stock, production of new housing and the implementation of the strategy for the development areas, until 2030 (Förvaltnings AB Framtiden, 2020).

In 2021 Tynnered was downgraded to a risk area by the Swedish police (Polismyndigheten, 2021).

Table 10 contains a comparison between Framtiden and all the other developers in the series. This is not a comparison between tenure, both categories contain rent- and owner-occupied apartments. Likewise, it is not a comparison between public and private developers. Gothenburg's municipality also develops and owns housing directly. As a result of this, Tuve 17:151 with 4 apartments and Järnbrott 77:4 with 8 apartments, are owned and developed by the municipality directly. These apartments can be found in the 2021 years others-category in Hisingen and Sydväst.

As seen in the table Framtiden has no granted building permits in Nordost and Sydväst in 2021. All 297 apartments developed by Framtiden in 2021 on Hisingen can be found in Selmastaden. The 160 apartments found in Centrum belongs Kålltorp 57:5, a project located to the west of Östra sjukhuset.

Much of the data in table 10 predates Framtiden's strategy for the development areas. Looking at 2016-2018 years building permits reveals that there are only two projects that can be found in these areas. Namely Tynnered 7:1 with 154 apartments in 2017 and Bergsjön 61:4 with 108 apartments in 2018. The table also has a column where the compiled result is presented, showing that Framtiden's overall share of new production is low in comparison to their overall share of apartments. This is particularly true when looking at the development areas. In an appendix to their decision, Framtiden lists the number of apartments they have in these areas in relation to the total (Förvaltnings AB Framtiden, 2020). This data shows that Framtiden owns 39 percent of the apartments in Bergsjön, 76 percent in Hammarkullen, 91 percent in Hjällbo, and 44 percent in Lövgärdet. They also own 43 percent of the apartments in Biskopsgården and 48 percent of the apartments in Tynnered.

In a board act from 2017 Framtiden (Förvaltnings AB Framtiden, 2017) presents their view and plan on how to fulfill the previous owner's directive adopted 2015 and amended after a proposition in 2016, regarding the task to strive for a larger mixture in tenure. In it, they strive to achieve a mix where no type of tenure holds a larger share then 50 percent in an area. This might explain the low numbers of new apartments they added to Nordost during the time period up 2020.

Given the problems faced in Nordost and the potential lower earnings in that part of the city, it is not strange that private developers seek options in other parts of the city, as in Sydväst. During the examined years that pattern also appears to extend to Framtiden. The municipality have a clear ambition to better utilize the resources available in Nordost, but the political consensus if Framtiden should be a part of those efforts seems to have changed back and forth. However, Framtiden owns large areas in Nordost and that puts them in a unique position to leverage that fact to produce housing to a lower cost than the public sector. In 2021, the purchase price of the site stood for almost one fifth of the average total production cost of multifamily residential buildings in the greater Gothenburg area (Statistics Sweden, 2022 E).

Construction hotspots

Image 6 shows the location of clusters of construction. The size of the dot indicates the number of apartments in each cluster and the color of the map indicates the total number of apartments in that area. The individual dots can represent a single project, as in Heden, or multiple, as the seven projects in proximity along Litteraturgatan in Selmastaden.

Comparison between Framtiden and other developers (No. of Apt. / Percent of administrative area)						
		2016	2017	2018	2021	Total
Centrum	Framtiden	262 / 28%	236 / 17%	0 / 0%	160 / 7%	658 / 13%
	Others	690 / 72%	1154 / 83%	520 / 100%	2169 / 93%	4533 / 87%
Hisingen	Framtiden	8 / 1%	48 / 5%	140 / 25%	297 / 21%	493 / 13%
	Others	700 / 99%	1001 / 95%	430 / 75%	1101 / 79%	3232 / 87%
Nordost	Framtiden	50 / 27%	193 / 28%	464 / 38%	0 / 0%	707 / 30%
	Others	132 / 73%	507 / 72%	751 / 62%	269 / 100%	1659 / 70%
Sydväst	Framtiden	79 / 11%	733 / 54%	839 / 33%	0 / 0%	1651 / 29%
	Others	659 / 89%	633 / 46%	1735 / 67%	990 / 100%	4017 / 71%

Table 10: A comparison between Förvaltnings AB Framtiden and all other developers. The table shows the number of apartments found in the granted building permits for a particular year and administrative area. Framtiden owns 31 percent of all apartments in Gothenburg.

Selmastaden, or Selma Lagerlöfs torg is together with Brunnsbo torg one of the areas identified in Byggnadsnämndens strategy. With its 297 apartments, a total of 21 percent of the apartments added to Hisingen, it's one of the major expansion areas on Hisingen in 2021. The other being Norra Älvstranden with Karlastaden as the majorhotspot. Karlastaden has three projects in 2021, Lindholmen 2:19 and 2:20 with 275 and 100 apartments respectivly, both part of Karlatornet, and Lindholmen 1:32 with its 56 apartments. The 431 apartments equal 31 percent of all apartments added to Hisingen.

The largest project in Nordost is Gårdsten 7:3 with its 161 apartments accounting for 60 percent of the apartments added to Nordost.

East of Östra sjukhuset lies Sävenäs 131:15 with 297 apartments and to the west, next to each other, lies Sävenäs 175:2 and Kålltorp 57:5 with 59 and 160 apartments respectively. Together their 516 apartments make up 23 percent of the apartments added to Centrum. The area along Mölndalsvägen is another area identified in the strategy. Previous years has seen several projects in this area and 2021 includes one more project, Krokslätt 20:5 with 193 apartments. Next to it, on the other side of E6 is the development of Kallebäcks terrasser, that continues with Kallebäck 18:6, 18:8 and 18:13 with 189, 85 and 182 apartments respectively. The 649 apartments equal another 28 percent of the apartments added to Centrum.
The largest project in 2021 is Heden 22:21 with a total of 326 apartments. South of that, at Carlandersplatsen next to Korsvägen lies Lorensberg 21:3, a project with 190 apartments. Together they add another 516 apartments and 22 percent. The year also sees the start of the development of Masthuggskajen with Masthugget 43:9 and its 129 apartments located on Första Långgatan. Close to this are Masthugget 712:27 and Stigberget 713:204 with 35 and 187 apartments respectively for a total of 351 apartments and 15 percent of the apartments added to Centrum.

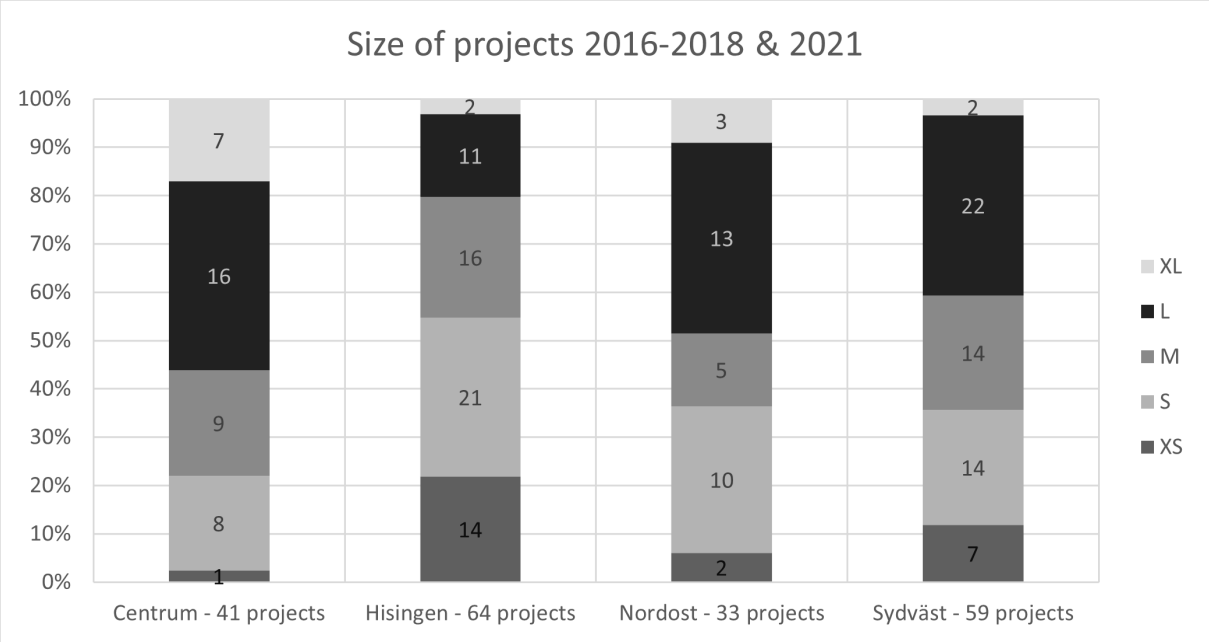


Diagram 9: Shows the percentual distribution of project sizes for the investigated years. Hisingen has the largest percentual share of XS, S- and M-sized projects out of all boroughs. Together the make up 80 percent of all projects found on Hisingen.

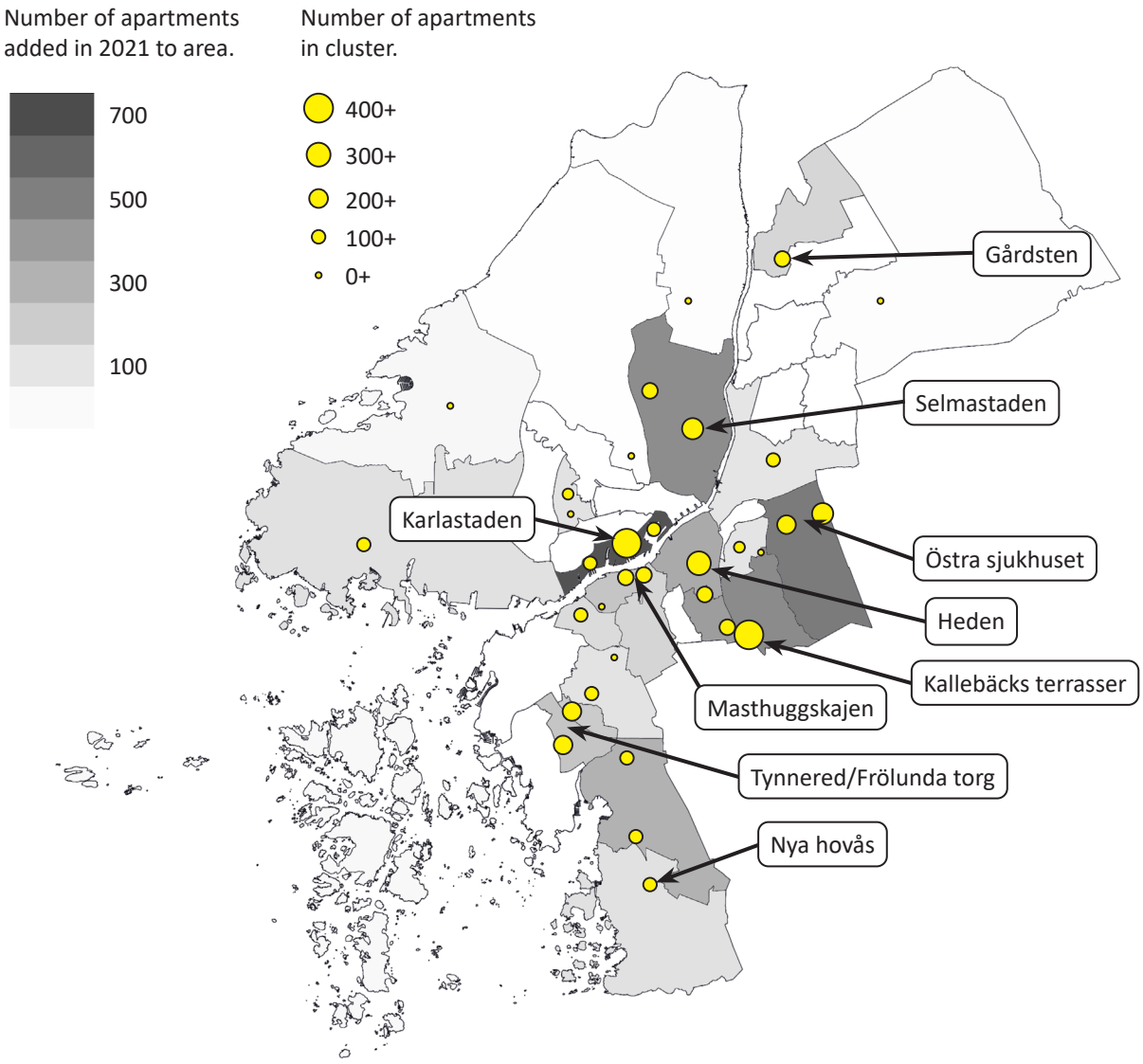


Image 6: Illustrates where in Gothenburg the granted building permits are located. Each dot/cluster indicates one or several projects in close proximity and the approximate number of apartments in it.

In Sydväst, the permits are mostly located along the tramline to Tynnered/Frölunda torg and Riksväg 158. Along the former are, Önnered 45:16 with 110 apartments, Tynnered 761:687 with 119 apartments, Rud 8:18 with 205 apartments and Rud 4:2 with 101 apartments found. Together the 535 apartments make up 54 percent of the apartments added to Sydväst. Previous years has seen a fair bit of projects in Nya Hovås. This year only has one, Skintebo 391:14 with its 116 apartments.

Heterogenity continued

Diagram 9 contains a compilation of the project sizes for the different administrative areas for the investigated period. Centrum had the least percentual amount of smaller size projects, where the categories XS to M stood for 44 percent of the projects. This increases in to 52 percent in Nordost and 59 percent in Sydväst. The largest share can be found in Hisingen with 80 percent of the projects found in these categories. Hisingen also has the largest percentual share of M-, S- and XS-sized projects individually.

Heterogeneity of projects – Detailed view of Centrum - 2021 (values in percent)							
Category	No. Apts.	1-1,5 Rok	2 Rok	3 Rok	4 Rok	5 Rok	Total
XS	8	50	0	0	50	0	100
S	14	21	29	29	21	0	100
	35	63	37	0	0	0	100
M	59	0	41	34	25	0	100
	85	22	32	29	2	14	100
	93	24	37	28	11	1	100
L	129	45	34	9	9	2	100
	135	10	27	29	24	10	100
	160	43	20	32	6	0	100
	182	24	52	21	2	1	100
	187	32	45	6	17	1	100
	189	50	31	18	0	1	100
	190	43	46	7	4	0	100
	193	28	42	12	15	3	100
XL	297	26	36	30	8	0	100
	326	13	48	28	8	2	100
	2282	29	38	21	9	2	100

Table 11: Examines the heterogeneity of the projects in Centrum. A threshold of five percent is applied to the data.

Heterogeneity of projects – Detailed view of Hisingen - 2021 (values in percent)							
Category	No. Apts.	1-1,5 Rok	2 Rok	3 Rok	4 Rok	5 Rok	Total
XS	4	0	100	0	0	0	100
	4	0	0	100	0	0	100
	6	33	67	0	0	0	100
S	12	0	0	67	0	33	100
	20	5	55	25	15	0	100
	23	35	39	26	0	0	100
	30	80	20	0	0	0	100
	32	0	44	56	0	0	100
	40	20	20	25	23	13	100
	42	21	43	21	14		100
	44	0	36	45	18	0	100
	45	38	27	13	7	16	100
	48	0	33	50	17	0	100
M	56	14	14	5	45	21	100
	56	0	100	0	0	0	100
	60	10	38	38	13	0	100
	62	35	34	27	3	0	100
	64	22	33	45	0	0	100
	75	1	56	27	16	0	100
	89	12	54	8	26	0	100
	91	21	41	20	19	0	100
L	100	10	50	20	20	0	100
	124	81	19	0	0	0	100
XL	275	30	47	23	0	0	100
	1402	24	41	22	10	2	100

Table 12: Examines the heterogeneity of the projects on Hisingen. A threshold of five percent is applied to the data.

Heterogeneity of projects – Detailed view of Nordost - 2021 (values in percent)							
Category	No. Apts.	1-1,5 Rok	2 Rok	3 Rok	4 Rok	5 Rok	Total
XS	6	0	100	0	0	0	100
L	102	31	49	20	0	0	100
	161	20	47	34	0	0	100
	269	24	49	28	0	0	100

Table 13: Examines the heterogeneity of the projects in Nordost. A threshold of five percent is applied to the data.

Heterogeneity of projects – Detailed view of Sydväst - 2021 (values in percent)							
Category	No. Apts.	1-1,5 Rok	2 Rok	3 Rok	4 Rok	5 Rok	Total
XS	4	0	50	50	0	0	100
	8	0	100	0	0	0	100
S	16	0	0	75	25	0	100
	17	41	6	53	0	0	100
	24	0	50	50	0	0	100
	46	13	15	59	13	0	100
M	88	26	23	34	17	0	100
L	101	57	23	20	0	0	100
	110	0	54	30	16	0	100
	116	11	40	34	15	0	100
	119	22	36	40	2	0	100
	138	14	40	20	24	2	100
XL	205	49	18	19	15	0	100
	992	26	31	30	13	0	100

Table 14: Examines the heterogeneity of the projects in Sydväst. A threshold of five percent is applied to the data.

Average no. of apartment types per project				
	Centrum	Hisingen	Nordost	Sydväst
2016	3,0	3,4	2,7	2,9
2017	2,9	2,8	3,4	2,9
2018	2,7	3,8	3,5	3,1
2021	3,0	3,6	2,3	3,0
	2,9	3,3	3,2	3,0

Table 15: Showing the average number of apartment types per project, year, and administrative area.

Table 11-14 are excerpts from table 5, where the projects have been grouped in their administrative areas. It uses the same 5 percent threshold and traffic light analogy, where projects containing 1-2 types are marked with a red color, 3 types with a yellow color and 4-5 types with a green color. Just by looking at the color, Centrum can be identified as the administrative area with the most diverse composition of apartment-types per projects. On average, a project in Centrum contains 3,6 different apartment-types. This can be compared to the average of 3,0 for Hisingen and Sydväst, and 2,3 for Nordost, see table 15.

BUILDING PERMITS - BUILDINGS

Podium buildings

The building permits of 2021 contains a previously not seen typology in 6 projects, the podium building. It consists of a building that covers an entire city block and has a purpose other than housing. The roof of the podium building is often used as an elevated courtyard with one or several housing projects built on top of it.

The purpose of the podium varies but can largely be divided into two groups in 2021. That is, buildings that contains some sort of commercial space, or buildings that only contain parking. Backa 264:6 and 264:10 are two projects located along Litteraturgatan in Selmastaden. They belong to the latter category and are drawn by QPG Arkitektur for Framtiden Byggutveckling. They are essentially parking garages with housing on top. Three other projects can be found in Karlastaden. Two of them, Lindholmen 2:19 and 2:20 are parts of Karlatornet itself and the third, Lindholmen 1:32 are part of a neighboring city block. The last project, Rud 4:2, is found at Altplatsen in Högsbo. These four projects primarily have commercial space in their podium.

Effects of the podium

The category that primarily contains commercial space does not differ that much from a regular city block with commercial space at street level. They add life, activity, and services to the area, and helps to frame the streetscape. In some way the podium maintains the language of the closed city block while still allowing for tall solitaire buildings to be erected. However, they do differ in one major aspect. They allow for a lot larger commercial spaces, suitable for other types of businesses than the usual small shops, restaurants, and cafes. An example of this can be found in Rud 4:2 that has a large portion of its podium reserved for a grocery shop.

The two building in Selmastaden does none of that though. At best, they add parking. They look like parking garages, and they are called parking garages in the building permit application. In general, a housing block with underground parking adds a quality to its residents. The vehicles are safely stored, out of sight, warm and dry with convenient access from the apartment via a lift. An important question that should have been asked by Framtiden, a public housing company owned by the municipality, is what sort of quality is added to the residents by living on top of a parking garage?

Typology

Out of the 56 projects, 40 contains one building typology, 15 contains two typologies and one projects contains three typologies. Of the 16 projects that contains more than one typology, 5 have a combination of tower blocks (punkthus) and angled blocks (vinkelhus) and 3 have a combination of tower blocks and podium. The remaining 8 have either a tower block, an angled block or a podium in combination with some other typology.

The most common typology is the tower block, which is found in 34 percent of the projects, followed by the angled block found in 27 percent. The gallery building (loftgång), linear block (lamellhus) and villa (stadsvilla) are found in 20, 16 and 14 percent of the projects. The new typology of podium buildings is found in 11 percent of the projects, making it more common than the central corridor (mittkorridor) and urban infill (gathus) typologies that are found in 7 and 2 percent of the projects respectively, see table 16.

The distribution of apartments in the different building typologies can be viewed in table 17. Most of the apartments are unsurprisingly found in tower blocks or angle blocks, both containing 30 percent of the apartments respectively. This is followed by the linear block, gallery building and central corridor with 18, 10 and 9 percent of the apartments. The two typologies with the fewest number of apartments are that of the villa and urban infill with a mere 3 and 1 percent. The largest observed difference between table 16 and 17 are found when looking at gallery buildings and villas. They contain 10 and 3 percent of the apartments, but as previously mentioned make up 20 and 14 percent of the projects. The reason

can be found in table 18, and the fact that they on average contains fewer apartments per building.

Most projects contain one or two buildings per typology. However, there are exceptions to this in the typology of tower blocks, gallery buildings and villas that all has several projects with multiple buildings. Examples of this is Hovås 2:60, with 138 apartments housed in 4 tower blocks, or Styrsö 2:645, with 24 apartments housed in 4 gallery buildings. Disregarding the fact that the villa by definition is a small building with few apartments, this partly helps to explain the lower average number of apartments per building in these typologies, as seen in table 18. In the case of the gallery building, another contributing factor is that 6 out of the 11 projects are found in the XS or S-size project category.

Building typologies - 2021 (No. Proj. / Percent of Proj.)							
Punkthus	Vinkelhus	Loftgång	Lamellhus	Stadsvilla	Podium	Mittkorridor	Gathus
19 / 34%	15 / 27%	11 / 20%	9 / 16%	8 / 14%	6 / 11%	4 / 7%	1 / 2%

Table 16: Showing the number and corresponding share of projects that contains a particular building typology. Note that many project often contains more than one building typology.

Distribution of apartments in different building typologies - 2021 (No. of Apt. / Percent of Apt.)						
Punkthus	Vinkelhus	Loftgång	Lamellhus	Stadsvilla	Mittkorridor	Gathus
1466 / 30%	1476 / 30%	511 / 10%	885/ 18%	136 / 3%	436 / 9%	35 / 1%

Table 17: Showing the number of apartments and their corresponding share, found in each building typology.

Average No. of Apt. per typology - 2021						
Punkthus	Vinkelhus	Loftgång	Lamellhus	Stadsvilla	Mittkorridor	Gathus
48,9	86,8	24,3	80,5	6,8	62,3	35,0*

Table 18: Showing the average number of apartments found in each building typology. Note that the urban infill typology only contains one building in 2021. It therefor has an exact value and not an average.

Mixed-use developments

19 out of the 56 projects can be classified as mixed-use development. That means that they contain some sort of commercial space to a varying degree somewhere in the project at street level. There has been a steady increase in these projects over the investigated period. Rising from 6 percent in 2016 to 34 percent in 2021. This increase is in line with the previously mentioned strategy for the city's development.

The majority, 9 projects, are located in Centrum, followed by 6 projects on Hisingen. Sydväst has 3 projects and Nordost 1.

The strategy (Byggnadsnämnden, 2014) mentions a few underlying reasons for the strive towards mixed-use developments. An important one is to create an attractive urban environment that reduces car dependency. That is, a city that accommodates services, jobs, and activities within walking distance from one's home. The expected population growth is predicted to create a large portion of new jobs in the service sector. Many of these are dependent on small commercial spaces in, or near population centers. In its strategy, the municipality concludes that the city is lacking a sufficient number of these in many areas, and that the densification effort can help alleviate this.

Staircases

There are three major categories or ways to enter an apartment found in the permits. Either via a separate entrance (separat), or the most common one, via a staircase (spännare), or lastly, via a gallery entrance (loftgång). Diagram 10 sort the apartments into these categories. It also expands the staircase category by having one bar each, for the different number of apartments per level.

The most common category is that of the staircase. It contains 88 percent of the apartments. Of those, the alternative with 4 apartments per level make up 25 percent of all apartments. Closely followed by 6 and 5 apartments per level with 16 and 15 percent of the apartments. The rest of the staircase category all have a share of 10 percent or less. The gallery entrance has a share of 9 percent of the apartments and the separate entrance has a share of 3 percent.

Of the 151 apartments with a separate entrance, 71 are closely tied to the category of the gallery entrance. These projects have utilized the possibility to create a more private entrance for the apartments on ground level. Another 58 apartments are found in Skogome 7:18, 7:19 and Hovås 57:38. These three projects are made up by several small buildings with 4-8 apartments each, where the ground level have a separate entrance to each unit. The rest of the apartments are spread out over a large number of projects, where apartments have been added to areas that would other vise have been occupied by commercial space or a residential shared space.

Apartments with a separate entrance are by definition not connected to a staircase. Excluding them means that the remaining 4794 apartments are retched via at least one of the 190 staircases found in the building permits. Diagram 11 show staircases grouped after the number of apartments they have, in intervals of five apartments. Diagram 12 presents how many apartments these groups contain. The large number of staircases found in the interval of 1-4 can be attributed to the three previously mentioned projects, the three smallest projects in the XS project category and Styrsö 2:645, a gallery entrance project made up of four buildings.

Most apartments are found in staircases that reach 15-19 apartments. The 34 staircases in this interval have 571 apartments, which equals 12 percent of all apartments. The number of staircases in each interval gradually decreases after this. Together, the four most numerous intervals, that is from 15-19 to 30-34, contains 47 percent of the staircases and 40 percent of all apartments. In contrast to this the four largest intervals only contains four staircases, or 2 percent, while reaching 10 percent of all apartments.

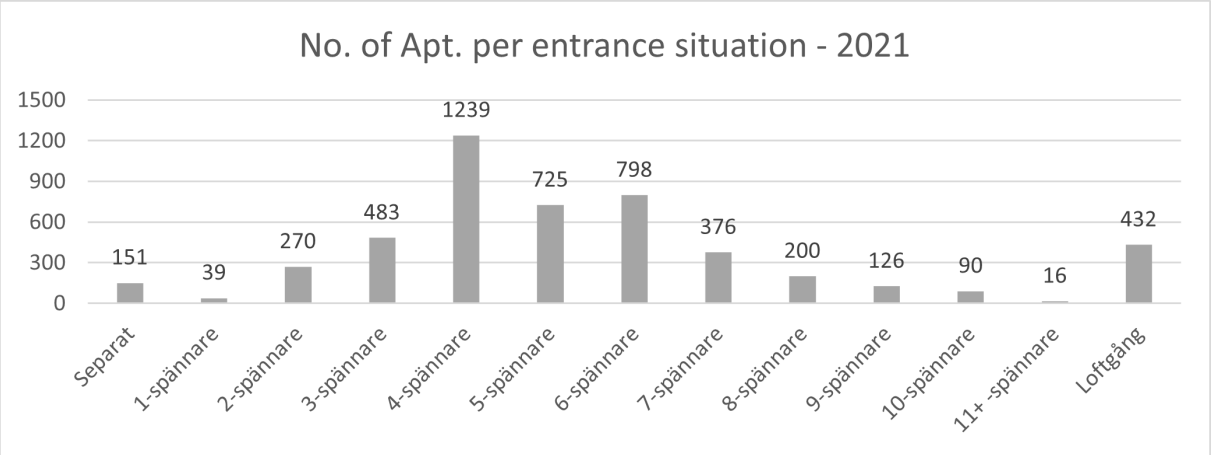


Diagram 10: Shows the number of apartments per entrance situation. There are three major to enter an apartment, either via a separate entrance (Separat), a stairway (Spännare) or a gallery entrance (Loftgång).

Corridors

There is a sequence of gradually increasing privacy going from the public street to the private apartment. This increase in privacy usually consists of a semi-public space, in many cases the courtyard, and a semi-private space, the staircase.

A consequence of a large number of apartments per level in a staircase is that the entrance hall gradually turns from a rectangular shape to an elongated corridor. The result is a change in the character of the space, to one that resembles an institutional building or an office more than an apartment building. Depending on the height of the staircase there may also be an increase in the number of individuals living in each staircase. Both factors contribute to a decrease in privacy level of this shared space.

Excluding the gallery entrances, a total of 1940 apartments, or 39 percent of the apartments is found in corridors where the width to length ratio is at least 1/6. However, the average proportion in this group is 1/11, a fair bit higher. Together with the 511 apartments found in the gallery entrance category, they make up 50 percent of all apartments. This hints to what type of spatial qualities and privacy level can be expected when entering in half of all apartments.

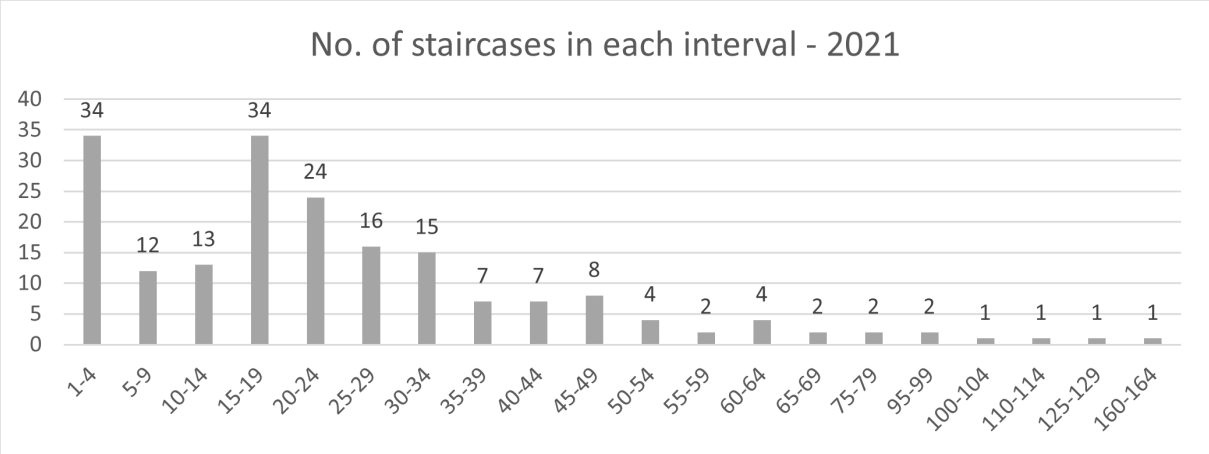


Diagram 11: Shows the number of staircases, grouped in intervals according to the number of apartments that are reached by them.

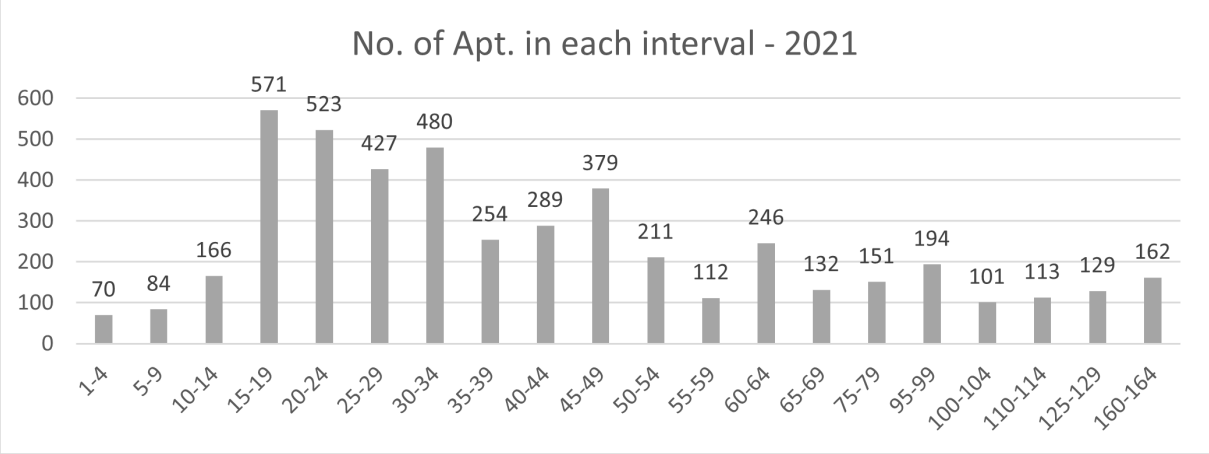


Diagram 12: Shows the number of apartments in each interval.

BUILDING PERMITS - APARTMENTS

Regulations

Boverket's building regulations (Boverket, BFS 2011:6) impose several requirements on new apartments. Some of these are difficult to fulfill when the size of the apartment is reduced. To adjust for this, and not effectively ban small apartments, it includes relaxations of the requirements for apartments that are 55 square meters or smaller, and further relaxations for apartments 35 square meters or smaller.

According to the regulations, all functions should have their own room, or be a separable part of a room that can be partitioned of if required. The separable part should have a window facing the open and should be designed in such a way that this function is retained if partitioned of. Apartments that are 55 square meters or less are exempted from this. In these, it is enough that either the area for sleep, or the kitchen is a separable part of a room. This effectively means that the kitchen has lost its daylight requirement and can be located at the back of the room if it is collocated with other functions. This is further expanded for apartments that are 35 square meters or less. In these, all functions except the sanitary room, may partly or wholly overlap. Functions, like sleep, and social contact can therefore be fulfilled by a single sofa bed, a coffee table, and an armchair. There is no longer a requirement to be able to furnish the apartment with all expected functions, like a separate sofa and bed. These apartments also have relaxed requirements for amount of storage and kitchen cabinets (Svensk Standard, SS 91 42 21:2006).

Average size

The average size of the studio apartment in 2021 is 32,2 square meters, se table 19. A total of 1036 apartments, or 78 percent of the apartments are 35 square meters or smaller, see table 20. For the one-bedroom apartments the average size is 50,9 square meters, and a total of 1507 apartments, or 80 percent of them, are smaller than or equal to 55 square meters. The average size for two- to three-bedroom apartments is 73,3 and 92,7 square meters. The largest category contains apartments that have four- or more bedrooms. The average size is 132,3 square meters, but it is worth noting that this group contains twelve very large co-living apartments in Kallebäck 18:8, designed for 5 to 11 individuals. If these are removed from the group the average size is a more reasonable, but still large, 116,8 square meters.

Further insight can be had by studying diagram 13-22. Every apartment type has two individual diagrams that are meant to be read together. The first shows the number of apartments of a particular size. The second diagram shows the aggregated percentual share of the apartments. The data is presented as a line that can be compared against the existing apartment stock in

Average size of apartment types - 2021 (square meters)					
1-1,5 Rok	2 Rok	3 Rok	4 Rok	5 Rok	5 Rok*
32,2	50,9	73,3	92,7	132,3	116,8

*Table 19: Showing the average size of each apartment type. The largets type, 5 Rok, contains apartments with four or more bedrooms. * The average value if Kallebäck 18:8 and its twelve large co-living apartments designed for 5 to 11 individuals are removed from the group.*

No. of Apt. in (BBR) size intervals - 2021 (No. of Apt. / Percent of Atp. size)					
	1-1,5 Rok	2 Rok	3 Rok	4 Rok	5 Rok
Apt. <= 35	1036 / 78%	42 / 2%	0 / 0%	0 / 0%	0 / 0%
35 < Atp. <= 55	293 / 22%	1465/ 77%	19 / 2%	0 / 0%	0 / 0%
55 < Apt.	1 / 0%	388 / 20%	1145 / 98%	478 / 100%	78 / 100%

Table 20: Showing the number of apartments present in the intervals found in Boverket's building regulations.

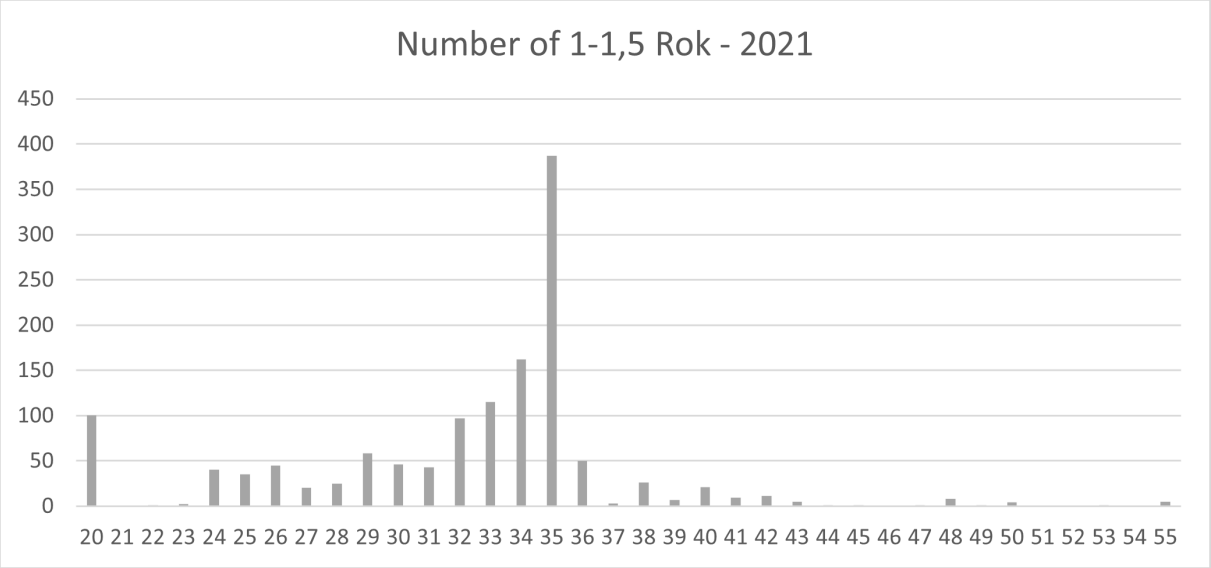


Diagram 13: Shows the number of studio apartments groped according to their size.

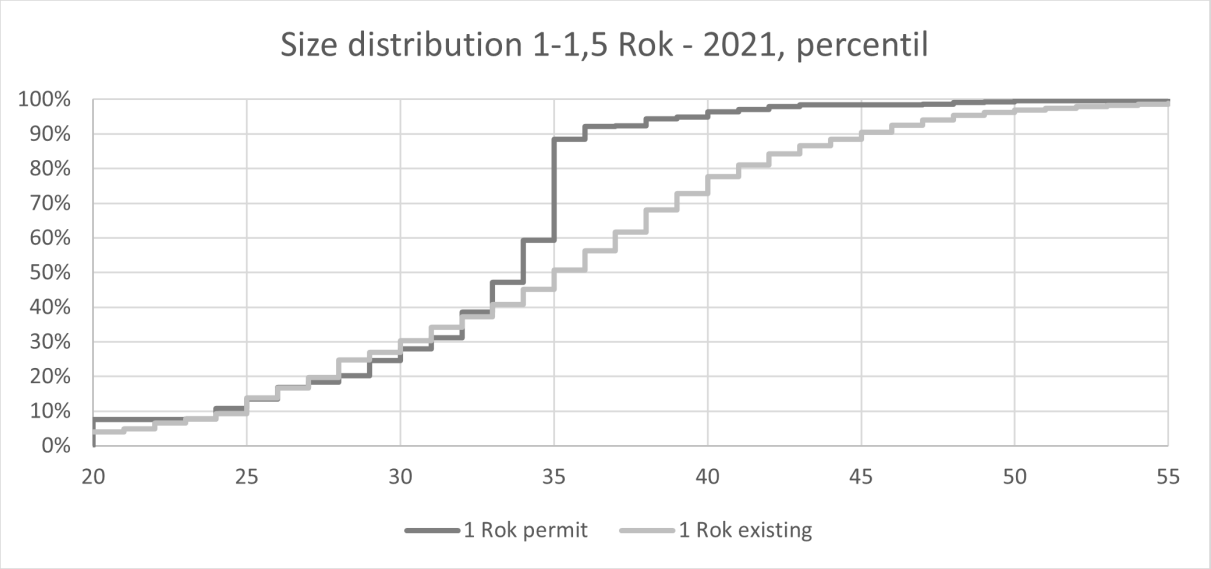


Diagram 14: Shows the aggregated percentual share of studio apartments up to a certain size. The data is compared to that of the existing housing stock.

Gothenburg. Note that the data in the diagrams is truncated, that is, the individual value rounded to the nearest full square meter.

Studio apartments, 1-1,5 Rok

Studying diagram 13, two bars stand out. The first one with apartments that are 20 square meters large. It holds 100 apartments and belongs to a temporary building permit in Lundbyvassen 736:168 drawn by AndrénFogelström for Svenska Hem Entreprenad. The second, is the one with apartments that are 35 square meters. It holds 387 apartments from 24 different projects.

The two lines in diagram 14 follow each other fairly well up until 33 square meters. This means that the proportion of the smallest studio apartments found in the permits match that of the existing housing stock. At 34 and in particular

35 square meters the lines deviate from each other. The jump is caused by the corresponding large number of apartments seen in diagram 13 at this particular size. A total of 88 percent of the apartments, that is 1176, are 35 square meters or less. This should be compared to the 51 percent of the apartments in the existing stock.

Overall, the data suggest that the amount of smaller studio apartments have not shrunk in comparison to the existing stock, however the larger size studio apartments have all but disappeared. An apartment in the 90th percentile is 36 square meters in the permits, but 45 square meters in the existing stock. A reduction of 20 percent in size for the largest apartments. This phenomenon is likely caused by the relaxations of requirements that is found in Boverket's building regulations, and can be viewed as clear evidence that the market aims for the minimum requirements found in them.

Studio apartments - 35,1-35,4 m^2

The 10 percent difference between diagram 14 and table 20 comes from truncation of the data. Because of this, the bar with 35 square meter large apartments in diagram 13 contains apartments ranging from 34,5 to 35,4 square meters.

Boverket are clear in its regulations, the relaxations are for apartments with a size of 35 square meters or less. The 10 percent, or 140 apartments, found in the range of 35,1 to 35,4 should therefor adhere to the requirements imposed on apartments that are 55 square meters or smaller. However, this is a grey area. The areas presented in the drawings are always rounded of. Most projects round of to the nearest full square meter, while some retain one or more decimals.

In this case, the studio apartments found in the range of 35,1-35,4 belongs to six projects, Kallebäck 18:6, 18:8 & 18:13 and Lorensberg 21:3, drawn by various architects and developed by Wallenstam, and Rud 8:18, drawn by White and developed by Balder. These permits all contain some sort of indication that the original goal was to erect buildings containing rental apartments. A speculation is that the precisely specified area of the apartments, may be a result of not wanting to lose rental income.

The compliance for this group of apartments varies. Some fulfill the more stringent 55 square meter requirements, while others don't. However, none of the apartments have a dotted wall, or some other indication of how this could be achieved. It is hard to interpret that as anything other than the intention to utilize the relaxations for apartments that are 35 square meters or smaller.

It is possible that the compliance also varies for apartments between 35,5-35,9 square meters, but unlikely that is does for apartments that are 36 square meters or larger. However, this group have not been examined.

Image 7 contains two examples of floorplans from Kallebäck 18:8. The project is drawn by Liljewall Arkitekter for Wallenstam. The apartment to the left don't fulfill the 55 square meter requirements since it is not possible to partition of a part of the room while maintaining access to daylight and views in both areas. The second one does. The alcove is possible to separate with a wall along the dotted line belonging to the bed. The area is big enough to fit a single bed at the basic level of accessibility according to the standard (Svensk Standard, SS 91 42 21:2006). As seen in the drawing, the remaining area is also large enough to fit a bed according to the enhanced level of accessibility. Moving the bed to a room other than the bedroom is an approved exception for apartments smaller than 40 square meters according to the standard. Both apartments fulfill the requirements on storage and kitchen according to the standard.

Image 8 contains two more examples of floorplans from this group. These are drawn by Erséus Arkitekter for Wallenstam. The apartment to the left fulfills the requirements by simply extending the room dividing wall slightly. The resulting kitchen is large enough to fit a bed according to the enhanced level of accessibility. The other apartment falls short on only having one large window section that can't be divided.

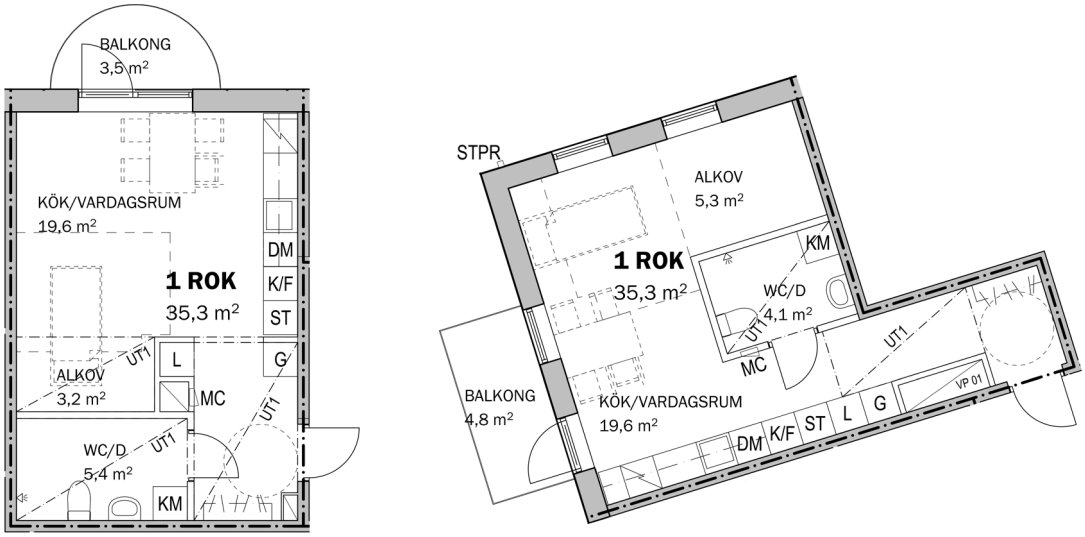


Image 7: © 2020 Liljewall Arkitekter
Two different floorplans of studio apartments in the examined interval of 35,1-35,4 square meters. These are from Kallebäck 18:8, drawn by Liljewall Arkitekter for Wallenstam. The apartment to the right fulfils the requirements imposed on apartments smaller than 55 square meters.

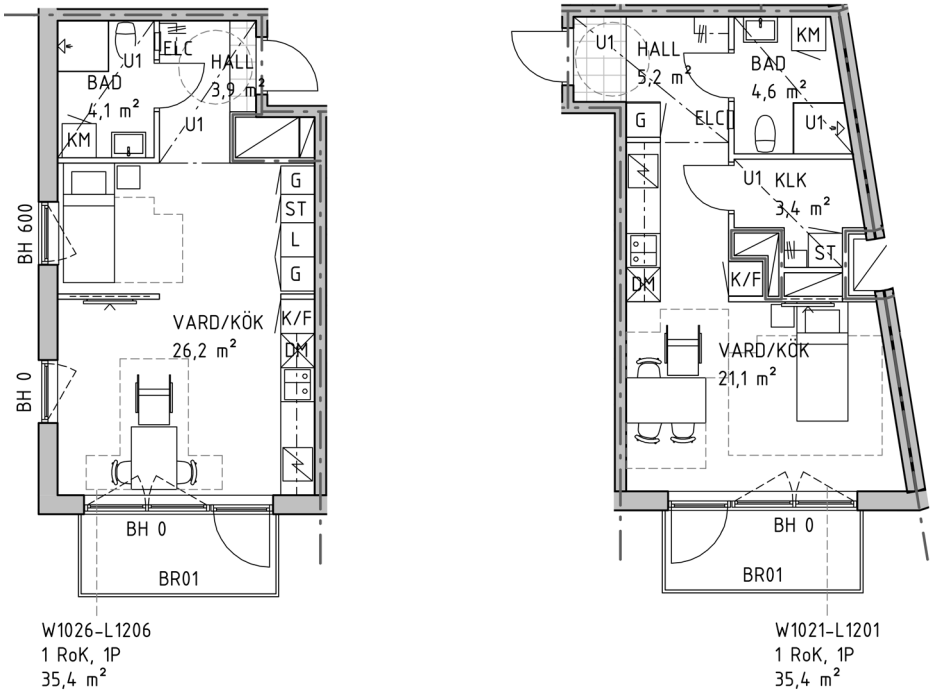


Image 8: © 2021 Erséus Arkitekter
Two different floorplans of studio apartments in the examined interval of 35,1-35,4 square meters. These are from Lorensberg 21:3, drawn by Erséus Arkitekter for Wallenstam. The apartment to the left fulfils the requirements imposed on apartments smaller than 55 square meters.

One-bedroom apt. - 2 Rok

Unlike the studio apartments, there is a general trend towards smaller one-bedroom apartments in the entire spectra, see diagram 16. The 10th percentile apartment has shrunk from 48 square meters in the existing housing stock down to 41 square meters in the permits. The 50th percentile has gone from 57 square meters down to 51 and the 90th from 67 to 59. Looking at the entire spectra from the 10th to the 90th percentile, the apartments have on average become 9-15 percent smaller.

The phenomenon of aiming for the minimum requirements in the regulations is also present in the one-bedroom apartments. 81 percent of the apartments found in the permits are 55 square meters or smaller. That is an increase of 37 percent when compared against the 44 percent found in the existing stock. An increase on par

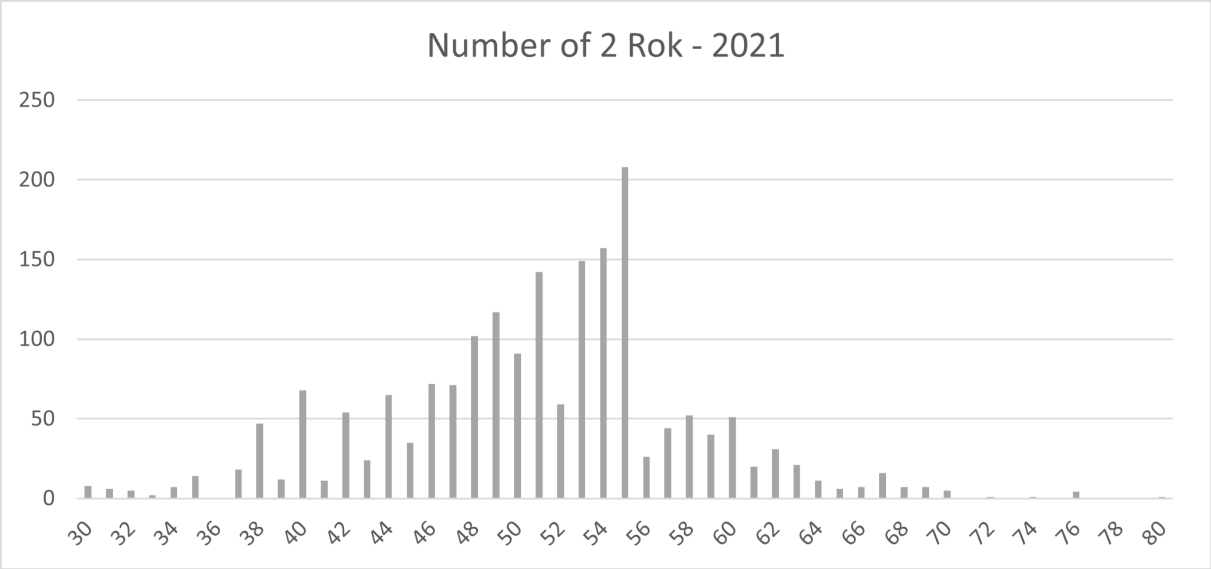


Diagram 15: Shows the number of one-bedroom apartments groped according to their size.

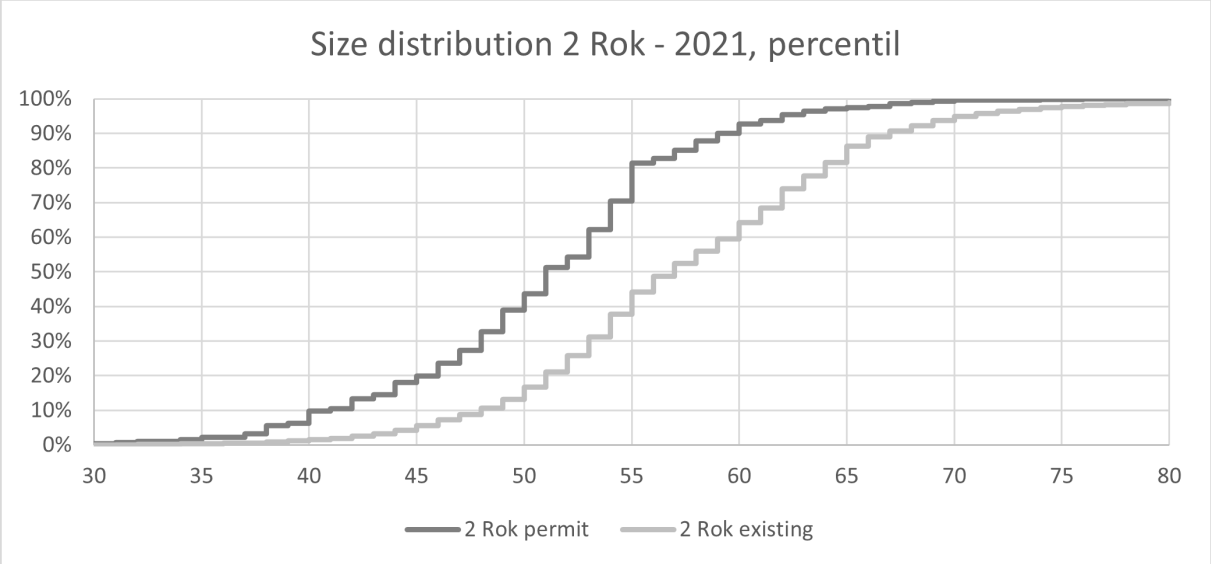


Diagram 16: Shows the aggregated percentual share of one-bedroom apartments up to a certain size. The data is compared to that of the existing housing stock.

with that of the studio apartments. It is also clearly illustrated by the large peak of apartments that are 55 square meters, seen in diagram 15.

One-bedroom apt.- 55,1-55,4 m^2

Comparing diagram 16 and table 20, a difference of 2 percent is found for the one-bedroom apartments. Or more precisely 37 apartments found in four projects. These are Lindholmen 1:32 & 2:19, Amhult 108:6 and Kallebäck 18:8. They are drawn by four different architects for four different developers. It is worth noting that the two projects at Lindholmen have a common denominator in Serneke. Both are built by Serneke, they are also the developer of Lindholmen 1:32 and a shareholder of Karlastaden Utveckling, the developer of Lindholmen 2:19.

Compliance for this group varies. In 17 of the apartments, it is technically possible to separate the kitchen. This is shown in drawings for Amhult 108:6 by Smideman Arkitketer. However, these walls are clearly not meant be erected. The other apartments are found in Lindholmen 1:32 & 2:19 and has no markings of how a separation could be achieved. Implementing one would also severely affect the floorplan and its qualities. Lindholmen 1:32, by Studio Ekberg Arkitektur, has an additional 14 apartments where the kitchen is placed in the dark rear section of the combined kitchen/living room, and therefore can't be partitioned off.

Image 9 shows two different apartment types found in Kallebäck 18:8, the previously mentioned project by Liljewall Arkitekter. One is 55,3 square meters and belongs to this group with a total of six apartments, the other type is 55,9 square meter and does not. The larger apartment has a partition of the kitchen clearly indicated in the drawings and placed in such a way that most of the qualities found in the floorplan are preserved. But the smaller one does not. In the smaller one it is still possible to separate the kitchen with a wall in a similar way with a slight adjustment of the refrigerator. The window placement becomes a bit more awkward, but most of the qualities are retained. These are the only apartments that an implementation is deemed to be possible, meaning that the disadvantages may be outweighed by the advantages for an individual tenant.

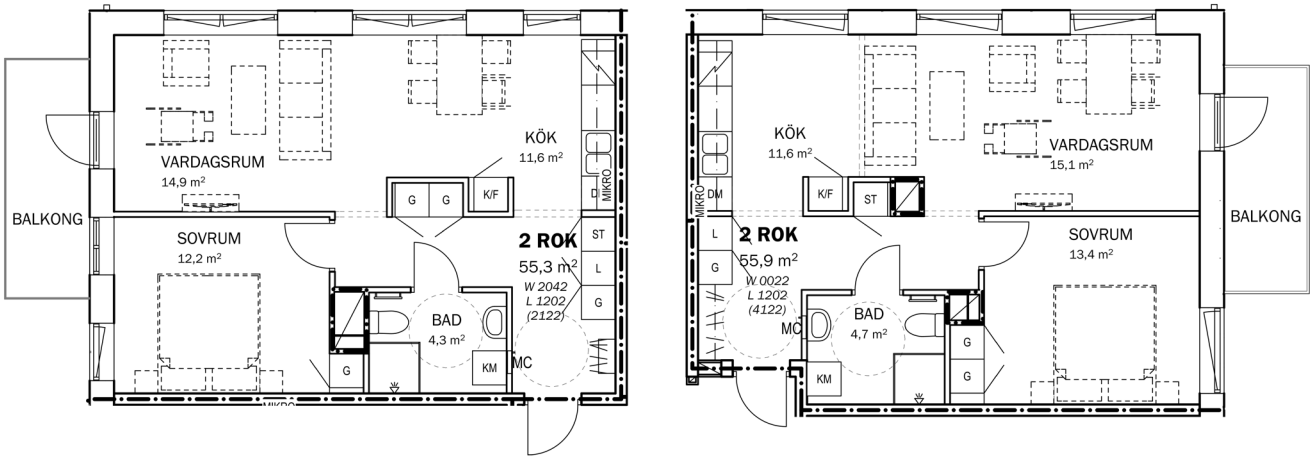


Image 9: © 2020 Liljewall Arkitekter
Two similar floorplans of one-bedroom apartments found in Kallebäck 18:8, drawn by Liljewall Arkitekter. The one to the left belongs in the examined interval of 55,1-55,4 square meters. Even though it doesn't indicate how the kitchen can be separated from the living room, a similar solution as that found in the slightly larger version to the right is possible.

Two-bedroom apt. - 3 Rok

The proportions of the two-bedroom apartments up to the 30th percentile match that of the existing stock well. After the 30th percentile, the two-bedroom apartments see a general reduction in size over the rest of the spectra. The 50th percentile has gone from 76 square meters in the existing stock to 73 in the permits, and the 90th have gone from 87 to 82. Over the span from the 40th to the 90th percentile the reduction is between 4 and 7 percent.

There are 35 large apartments, with a size of 93 square meters or more. 24 of them are arranged in two storeys. 10 of them are found in Lindholmen 2:20 and are a part of the standard floorplan for that project. The rest of them utilizes attic space to create the second floor.

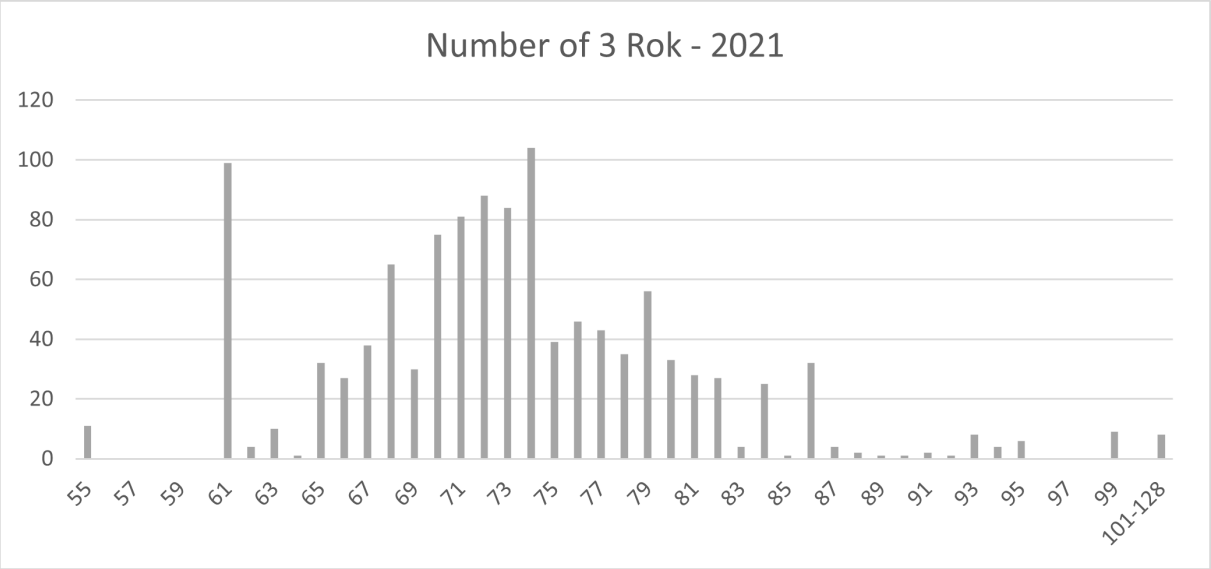


Diagram 17: Shows the number of two-bedroom apartments groped according to their size.

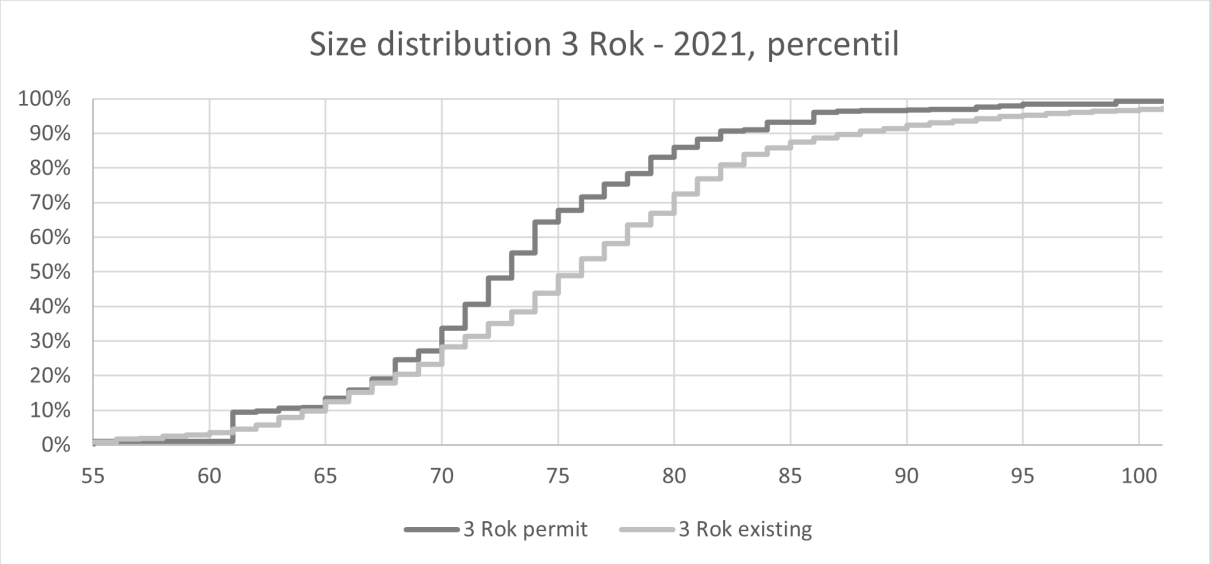


Diagram 18: Shows the aggregated percentual share of two-bedroom apartments up to a certain size. The data is compared to that of the existing housing stock.

Two-bedroom apt. 61 m^2

The 99 apartments seen in diagram 17 make up 9 percent of all two-bedroom apartments. They are found in six different projects, Skogome 7:18, 7:19 & 7:24, Kålltorp 57:5, Skintebo 391:14 and Tynnered 761:687. The two projects at Skogome 7:18 & 7:19 have the same architect, developer, and the same floorplan. The remaining four projects are drawn by four different architects for four different developers.

Given the very small floorplan, corresponding to the 9th percentile in the permits and 4th percentile in the existing stock, one would assume that these apartments have a lot in common. But besides the area, the only thing they all have in common is that they are all corner apartments. The floorplans found in Skintebo 391:14 and Skogome 7:24, share the same disposition with slight variance in the details. Besides this, the placement of the different functions varies between the floorplans. Out of the five different floorplans there are therefore four distinctively different ones.

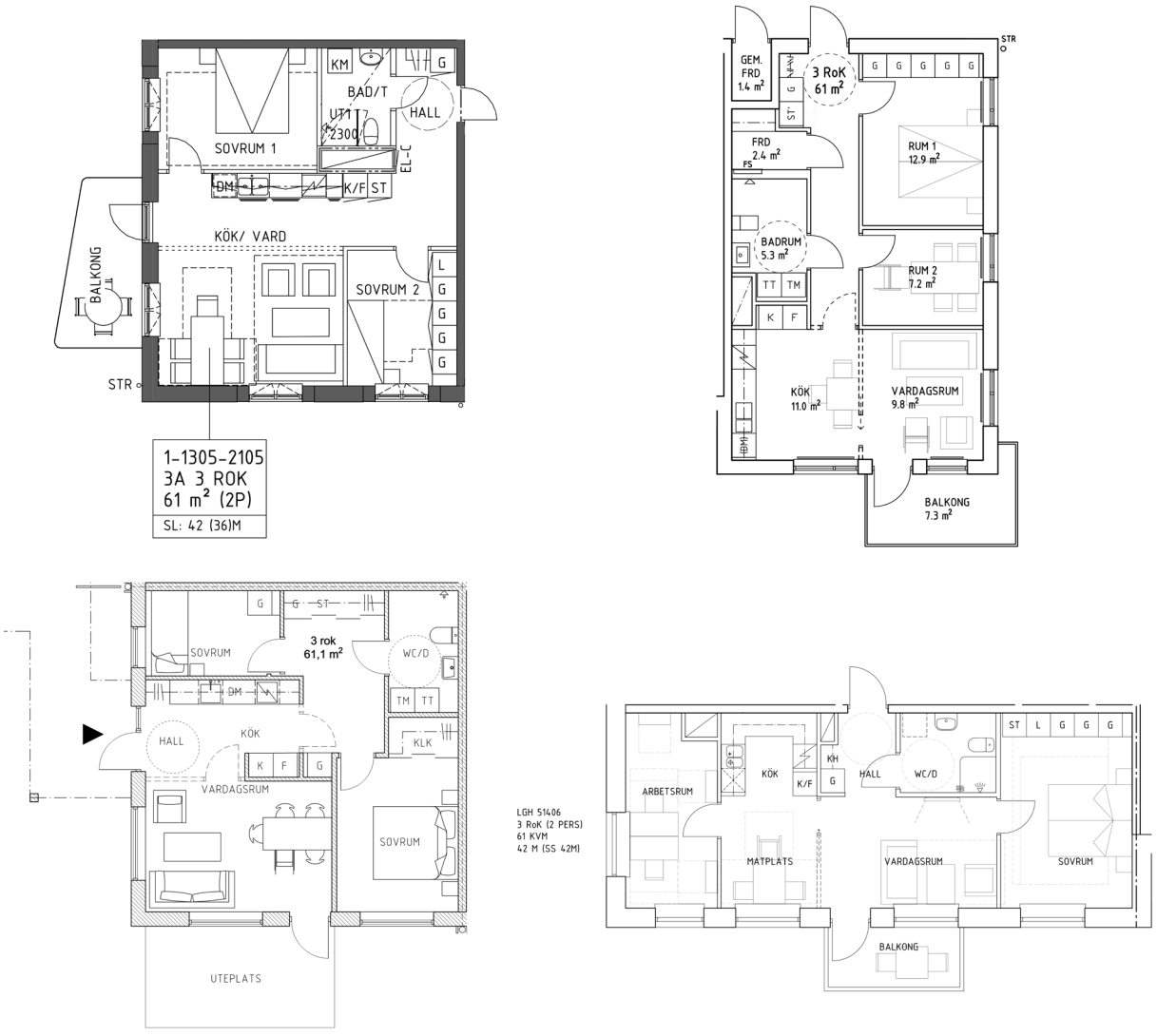


Image 10: Top left © 2021 Här! - Tynnered 761:687. Top right © 2021 Nylin & Myhrberg - Skogome 7:24. Bottom left © 2020 Borstein Lyckefors - Skogome 7:19. Bottom right © 2020 Arkitekturkompaniet - Kålltorp 57:5.

Examples of four small two-bedroom apartments with a distinct difference in character.

Three-bedroom apt. - 4 Rok

Eight projects make up the large peak of 63 apartments that are 90 square meters, seen in diagram 19. The curve in diagram 20 shows similarities with that found in diagram 18. The average reduction in size between the 50th and 90th percentile is 4-8 percent.

Anomalies and noisy curves

As previously mentioned, the 478 three-bedroom apartments make up 10 percent of the apartments found in the permits. The lower number means that individual projects have a larger influence on diagram 17 & 18. This shows up as noise, making accurate generalized conclusions about the group more difficult. Examples of this is the 73 and 76 square meter bars. The 73 square meter bar contains apartments from Skogome 7:18 & 7:19 that utilizes identical floorplans, and the 76 square meter ones are found in Önnered 45:16.

The S-shaped curve of the existing apartments seen in diagram 14, 16, 18 and 20 can be translated back to a bar diagram. In those cases, the bars approximate the shape of a normal distribution curve. In the case of the studio- and

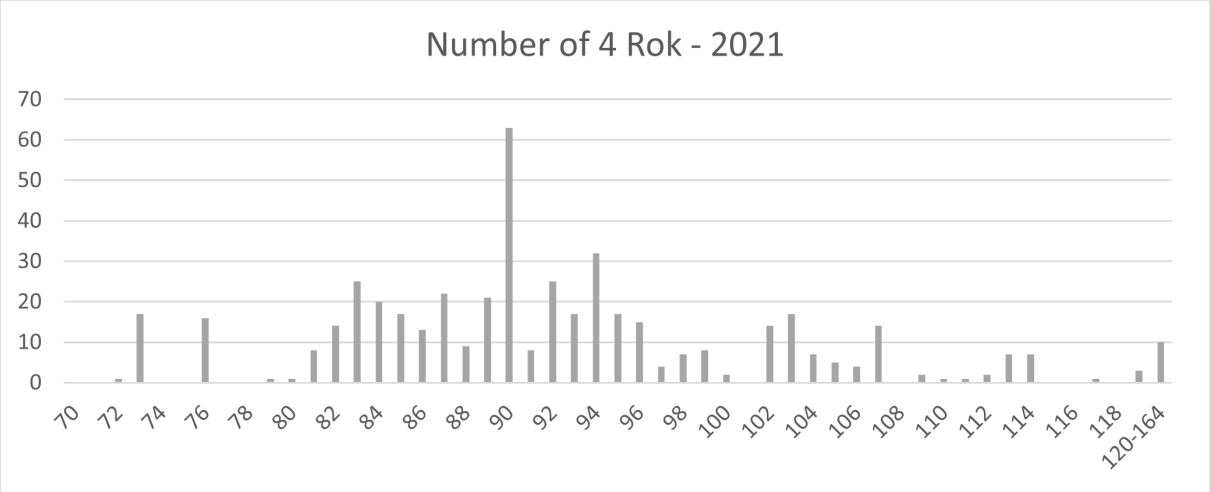


Diagram 19: Shows the number of three-bedroom apartments groped according to their size.

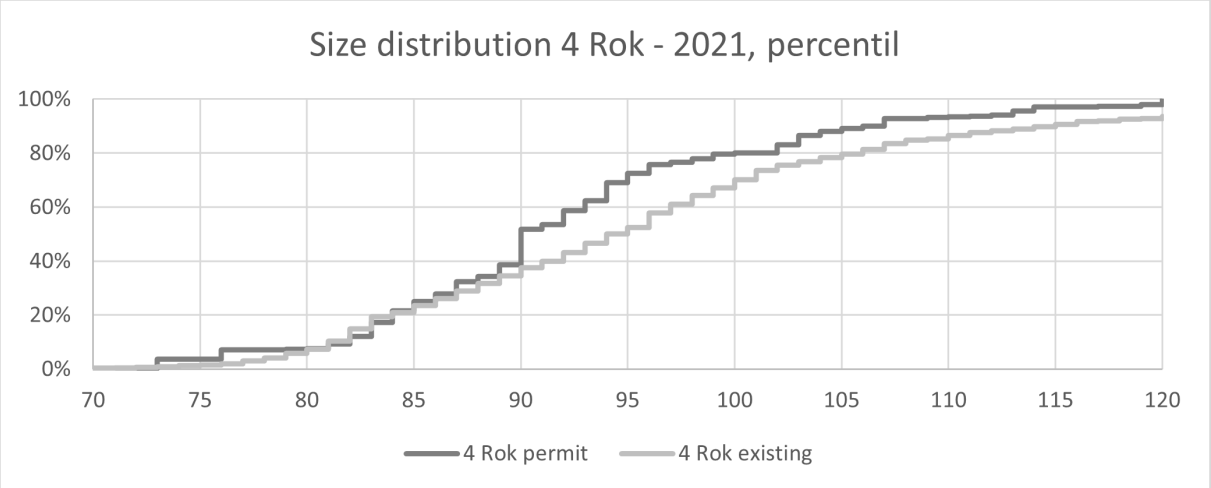


Diagram 20: Shows the aggregated percentual share of three-bedroom apartments up to a certain size. The data is compared to that of the existing housing stock.

one-bedroom apartment there are incentives in place that disturbs that pattern in the permits. No incentives have been found for the larger types of apartments. This means that the bars at 61 and 90 square meters seen in the two- and three-bedroom apartments, both made up of several projects, are anomalies. Their effect on the curves is local, and both are compensated by the lower number of apartments in the adjacent sizes. The difference between them, is that the shape of the normal distribution curve is visible in the bar-diagram for the two-bedroom apartments. This is not the case for the three-bedroom apartments. This is interpreted as further evidence of excessive noise. To combat this and draw accurate conclusions about trends for the larger apartments, several years need to be grouped together.

Four- or more-bedroom apt.

The general trend of shrinking apartments also seems to affect the largest group of apartments. This group is made up of apartments with 4 to 11 bedrooms, and the data is excessively noisy. That means that no definitive conclusions should be drawn from it.

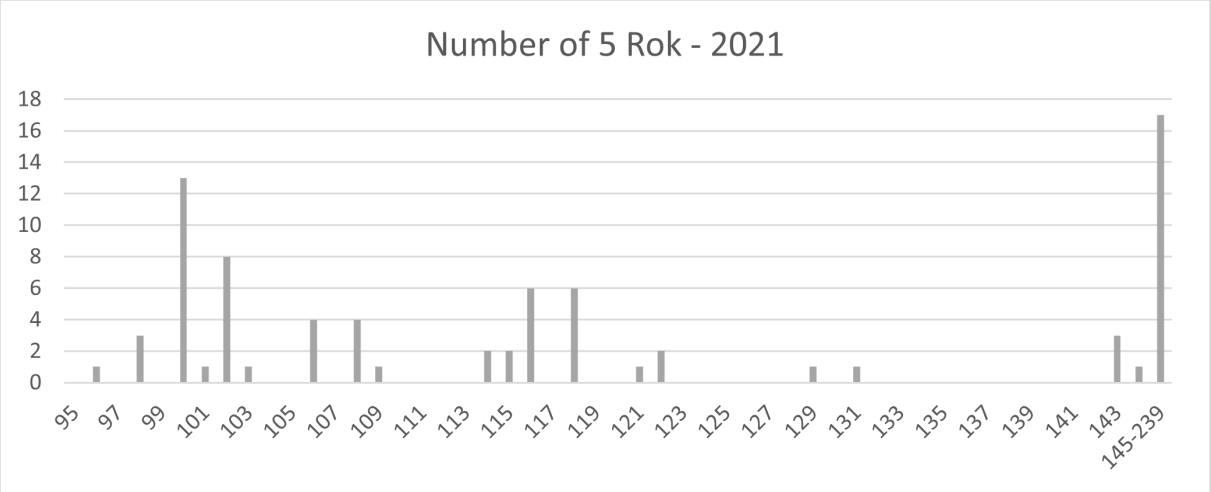


Diagram 21: Shows the number of four- or more-bedroom apartments groped according to their size.

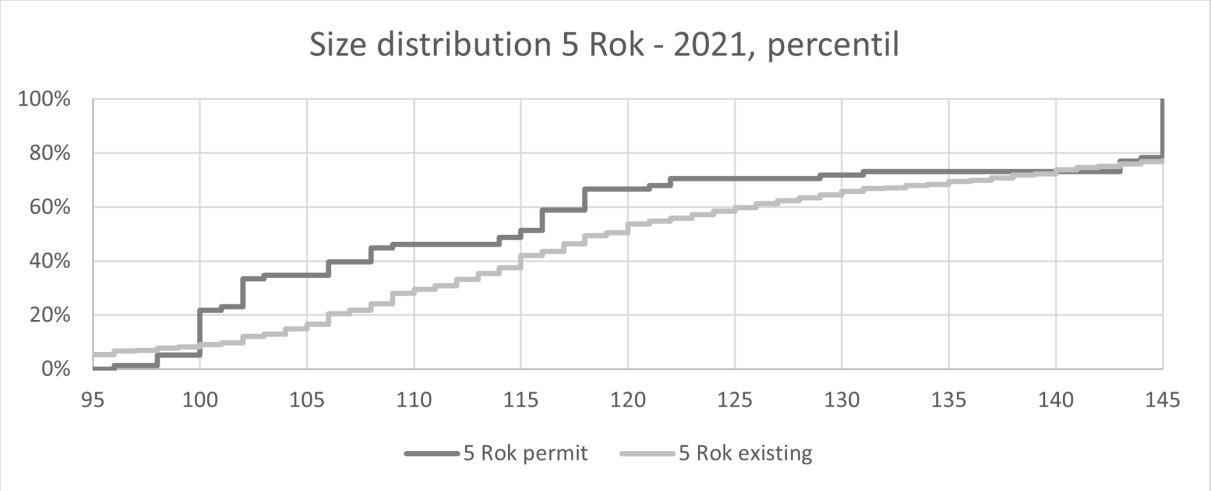


Diagram 22: Shows the aggregated percentual share of four- or more-bedroom apartments up to a certain size. The data is compared to that of the existing housing stock.

Cardinal directions

A large number of apartments per floor have consequences for the floorplan of the apartments. This is particularly true for the smallest of the apartments. In 2021, 10 percent of the studio apartments are corner apartments with views in two adjacent cardinal directions. These apartments are found in 18 projects, with 3 projects accounting for 53 percent of them. The vast majority, 90 percent, are however single sided. The previously common double-sided studio apartment, with views in opposite cardinal direction, is non existing in the permits, see table 21. In terms of views, the one-bedroom apartment have a better situation. 29 percent of them are corner apartments and 17 percent are double sided. Still, half of them are single sided.

The single sided apartments start to disappear with two-bedroom apartments. Of these, 6 percent are single sided, found in 8 different projects. The size of these apartments varies from 55 square meters in Tynnered 761:687 drawn by Här! to 90 square meters in Lindholmen 2_20, whose floorplan is drawn by KUB arkitekter. 45 percent is corner apartments, 31 percent are double sided, and 18 percent are apartments with views in three cardinal directions. The two-bedroom apartment therefor marks the point where dwellings go from primarily being single sided to offering views in multiple directions.

The trend continues with three- and four- or more-bedroom apartments. For these, apartments with views in three directions account for 46 and 56 percent respectively. They also have a small share of apartments with views in four different directions, accounting for 6 and 14 percent.

Views in no. of cardinal directions - 2021 (No. of Apt. / Percent of Atp.)					
	1-1,5 Rok	2 Rok	3 Rok	4 Rok	5 Rok
1	1198 / 90%	951 / 50%	71 / 6%	2 / 0%	0 / 0%
2 Adjacent	129 / 10%	544 / 29%	521 / 45%	109 / 23%	5 / 6%
2 Opposing	0 / 0%	329 / 17%	357 / 31%	122 / 26%	18 / 23%
3	3 / 0%	71 / 4%	211 / 18%	218 / 46%	44 / 56%
4	0 / 0%	0 / 0%	4 / 0%	27 / 6%	11 / 14%

Table 21: Showing the number of apartments that have views in different number of directions. Unsurprisingly, larger apartment types tend to have views in more directions. More surprisingly is the large number of single sided studio and one-bedroom apartments.

The definition of a room

The rules that define what is classified as a room have changed during the years. Paragraph 61 in the seventh chapter of 1947 years Byggnadsstadga (Svensk författningssamling, 1947 Nr.390), states that the minimum size of a room is 18 square meters. If a separate bedroom is present, it must be at least 10 square meters. If a second bedroom is present, it must be at least 7 square meters. A combination of paragraph 59 and 61 also specifies that all rooms and kitchens must have a window against an open area that lets ample daylight in.

These rules were largely carried over to the new regulations, Svensk Bygg Norm (Statens planverk, 1975). One difference being that the large room was now specified as a living room. It also introduced the notion that bedrooms were specified for one or two individuals. For one-bedroom apartments or larger, the size of the living room and one bedroom, was increased to 20 and 12 square meters respectively. It also introduced a set of minimum widths for these rooms. In the case of the smallest bedroom intended for one individual, that width was 1,95 meters. When superseded by Boverkets

Nybyggnadsregler that minimum width was increased to 2,1 meters (Boverket, BFS 1988:18).

This marks a period in Swedish construction history from 1947 to the last December 1993, were the smallest room allowed were effectively 7 square meters large.

The first iteration of our current regulations, Boverkets Byggregler, BBR, entered into force the first of January 1994. This marked an end to the previous mindset of precisely specifying the size of functions in the regulations. Instead, a lot of these were moved to standards. However, the minimum size of rooms was abolished. Building permits could therefore be granted to apartments with bedrooms smaller than 7 square meters.

However, this is not the whole truth. Even if the direct requirements of room sizes are removed from BBR, they do still exist. It comes from the fact that the Land Survey's definition of a room largely coincides with the previous regulation.

That is, a size of at least 7 square meters with access to views and daylight (Lantmäteriet, 2023). This definition is used in the apartment register that hold information of all dwellings in Sweden. The developer and later the owner of a building, is by law (Sveriges Riksdag, 2006:378) required to keep the information in the register up to date.

Fastighetsmäklarinspektionen, the authority that governs real estate agents, also use the Land Survey's definition and the apartment register. It is not mandatory to provide information about the number of rooms in a listing. But if such information is stated, it should be in accordance with what is listed in the apartment register. Otherwise, the real estate agent risks receiving a warning (Fastighetsmäklarinspektionen, 2023). It is therefore of importance for developers, owners of buildings, real estate agents, and potential dwelling-buyers that the information given by the architects about the apartments, are in accordance with the definition used by the Land Survey.

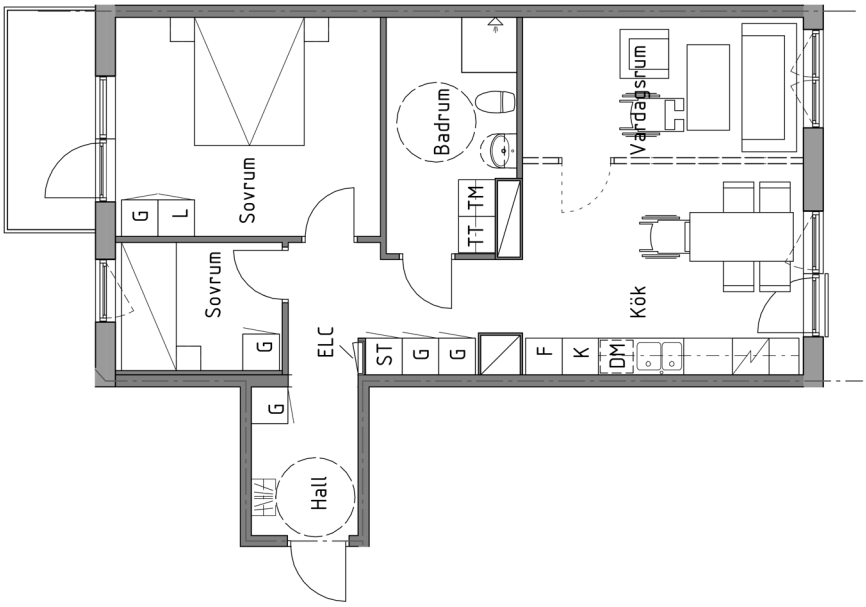


Image 11: © 2020 Voten Konsult / Cream Arkitekter
An apartment with an area of 69,9 square meters found in Kallebäck 18:13. The small "bedroom" have the approximate measurements of 2,1x2,75 meters, equaling a floor area of 5,8 square meters. In comparison the bathroom has a generous floor area of 7,8 square meters. According to the Land Survey, this apartment should be classified as a one-bedroom apartment, however it is classified as a two-bedroom apartment by the architect.

The room that is not a room

17 projects out 56, that is 30 percent of the projects contains apartments with areas counted as rooms even though they do not fulfill the Land Survey's definition of a room. The problem becomes more prominent with the larger apartment-types. Going from 4,2 percent of the two-bedroom apartments to 26,9 percent of the apartments with four- or more-bedrooms, see table 22. There are also 7 and 6, three- respectively four- or more-bedroom apartments that have two "rooms" smaller than 7 square meters.

Diagram 23 shows the total number and size of these areas. All but one is found in the range of 5,8-6,9 square meters. Two thirds of them are 6,5 square meters or larger and could likely easily be enlarged to meet the 7 square meter requirement, see diagram 23.

The size of these apartments is examined in diagram 24-26 by overlaying then onto the previously show percentile distribution curves. The largest peak seen in diagram 24 for the two-bedroom apartments, is made up of 17 apartments with a size of 76 square meters. In the permits these correspond to the 72th percentile and in the existing stock to the 54th percentile. In either way, they are by no means small. The average size of two-bedroom apartment in this group is 72 square meters, equaling 48th and 35th percentile. The average three-bedroom apartment in this group have size of 82 square meters, equaling 12th and 15th percentile. The average four- or more-bedroom apartment in this group have a size of 105 square meters, equaling 35th and 16th percentile.

No. of Apt. with rooms smaller then 7 sqm. (No. of Apt. / Percent of Apt.)				
1-1,5 Rok	2 Rok	3 Rok	4 Rok	5 Rok
0 / 0%	7 / 0,4%	49 / 4,2%	46 / 9,6%	21 / 26,9%

Table 22: Showing the number of apartments with areas counted as rooms even though they are smaller than 7 square meters.

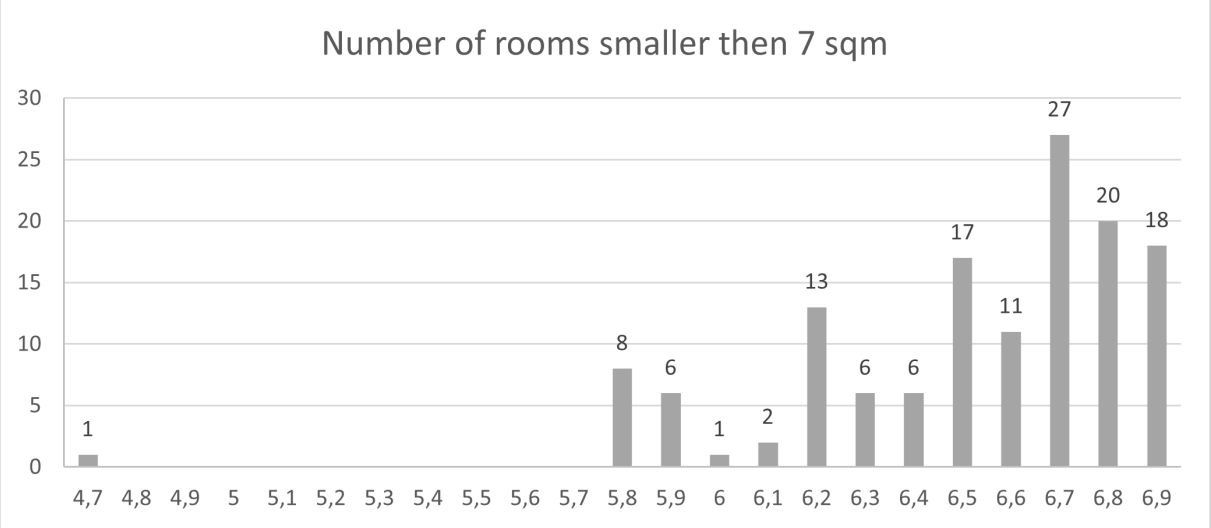
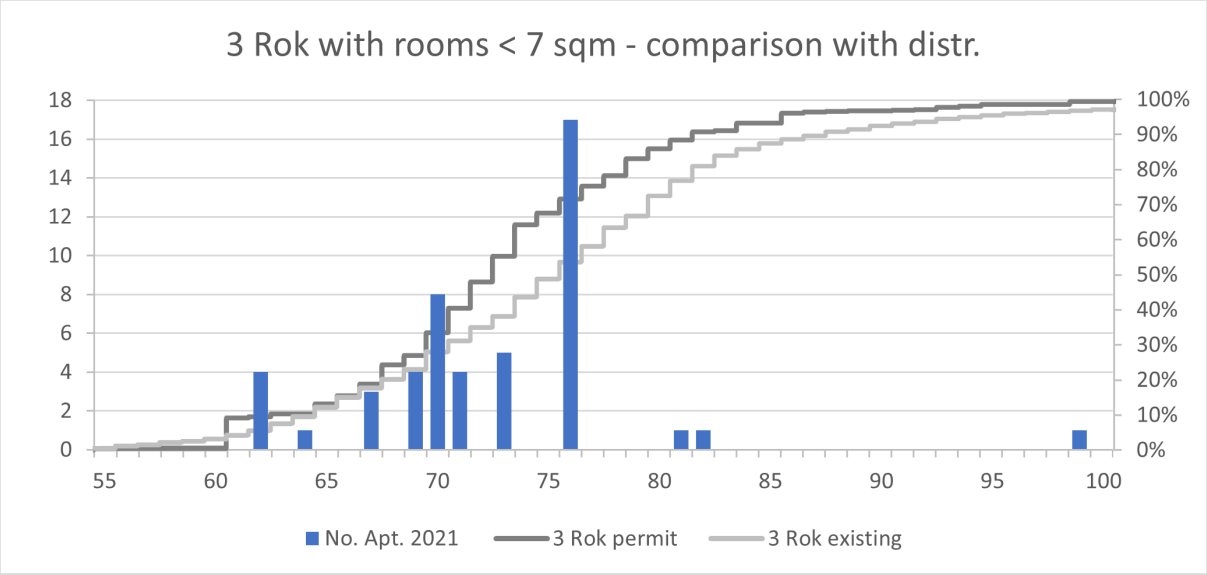
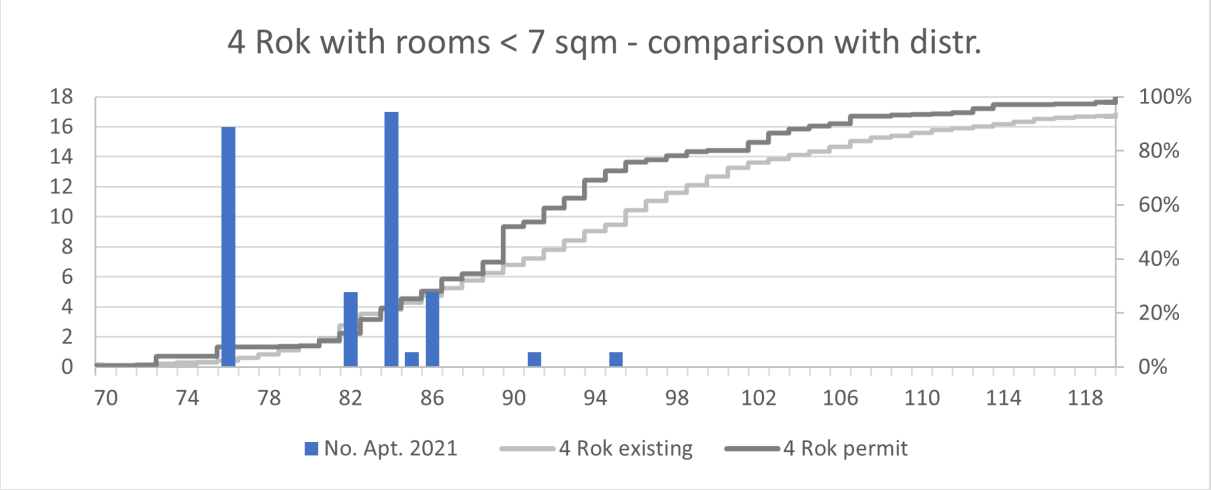


Diagram 23: Shows the number of "rooms" smaller than 7 square meters that exist in the permits, grouped according to their size. A total of 136 of these areas are present, distributed onto the 123 apartments. This means that 13 apartments have two such spaces in their floorplan.





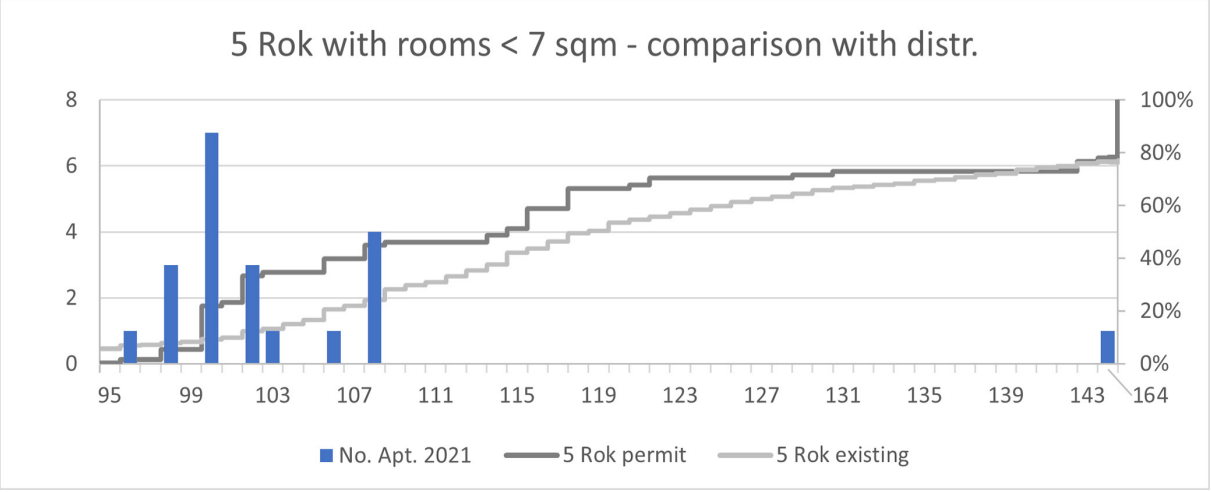


Diagram 24-26: Shows the number of apartments that contains these "rooms", grouped according to their type and size. Overlaid onto the previously shown percentile distribution curves, giving information about where in the size span these apartments exist.

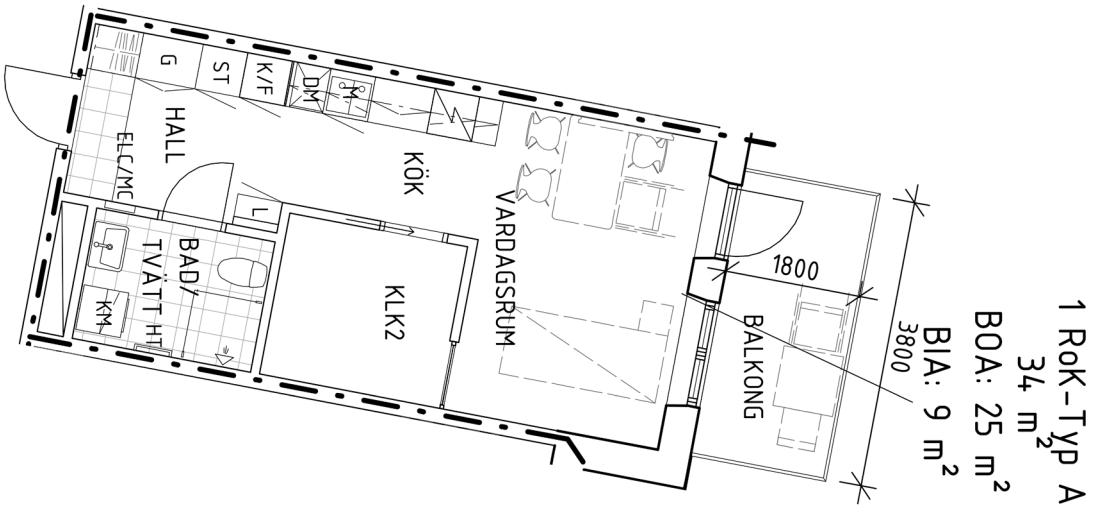
The wardrobe that is not a wardrobe

8 projects out of 56, that is 14 percent of the projects contains a large wardrobe intended for sleep, or designed in such a way that it can be utilized for other purposes. These are found both as daylight lit and entirely dark.

A majority of these are found in studio apartments that belongs to three projects, Masthugget 43:9, Rud 4:2 and Stigberget 713:204 with 34, 20 and 52 apartments respectively. Together with two other apartments, the 108 apartments make up 8,1 percent of all studio apartments, see table 23.

No. of Apt. with wardrobes intended for alternative usage (No. of Apt. / Percent of Apt.)					
	1-1,5 Rok	2 Rok	3 Rok	4 Rok	5 Rok
Daylight lit	54 / 4,1%	31 / 1,6%	2 / 0,2%	19 / 4,0%	1 / 1,3%
Dark	54 / 4,1%	12 / 0,6%	0 / 0%	0 / 0%	0 / 0%
	108 / 8,1%	43 / 2,3%	2 / 0,2%	19 / 4,0%	1 / 1,3%

Table 23: Showing the number of apartments with wardrobes intended for other usage then storage, such as sleep or separate home office.



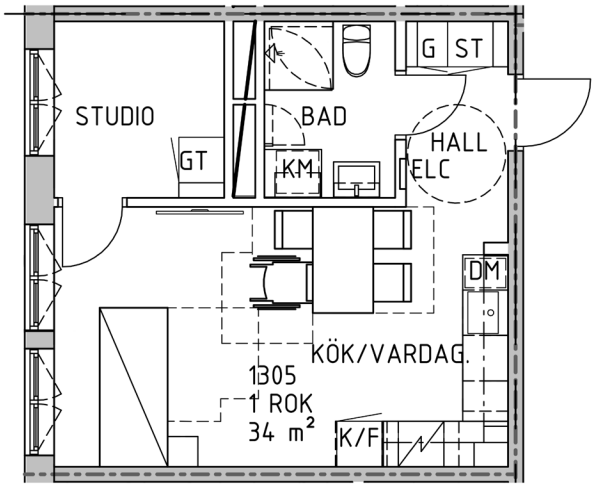


Image 12, above: © 2021 ABAKO Arkitektkontor
A studio apartment in Stigberget 713:204. The wardrobe is according to the sales brochure intended for sleep and should be seen as a solution to create something in between of a studio- and a one-bedroom apartment.

Image 13, left: © 2021 Krook & Tjäder
A studio apartment in Masthugget 43:9. The so-called studio is in the sales brochure furnished with a bed and the rectangular shape of the apartment allows this area to be daylight lit. The combined living room and kitchen have an area of approximately 20 square meters, with a furnishable disposition.

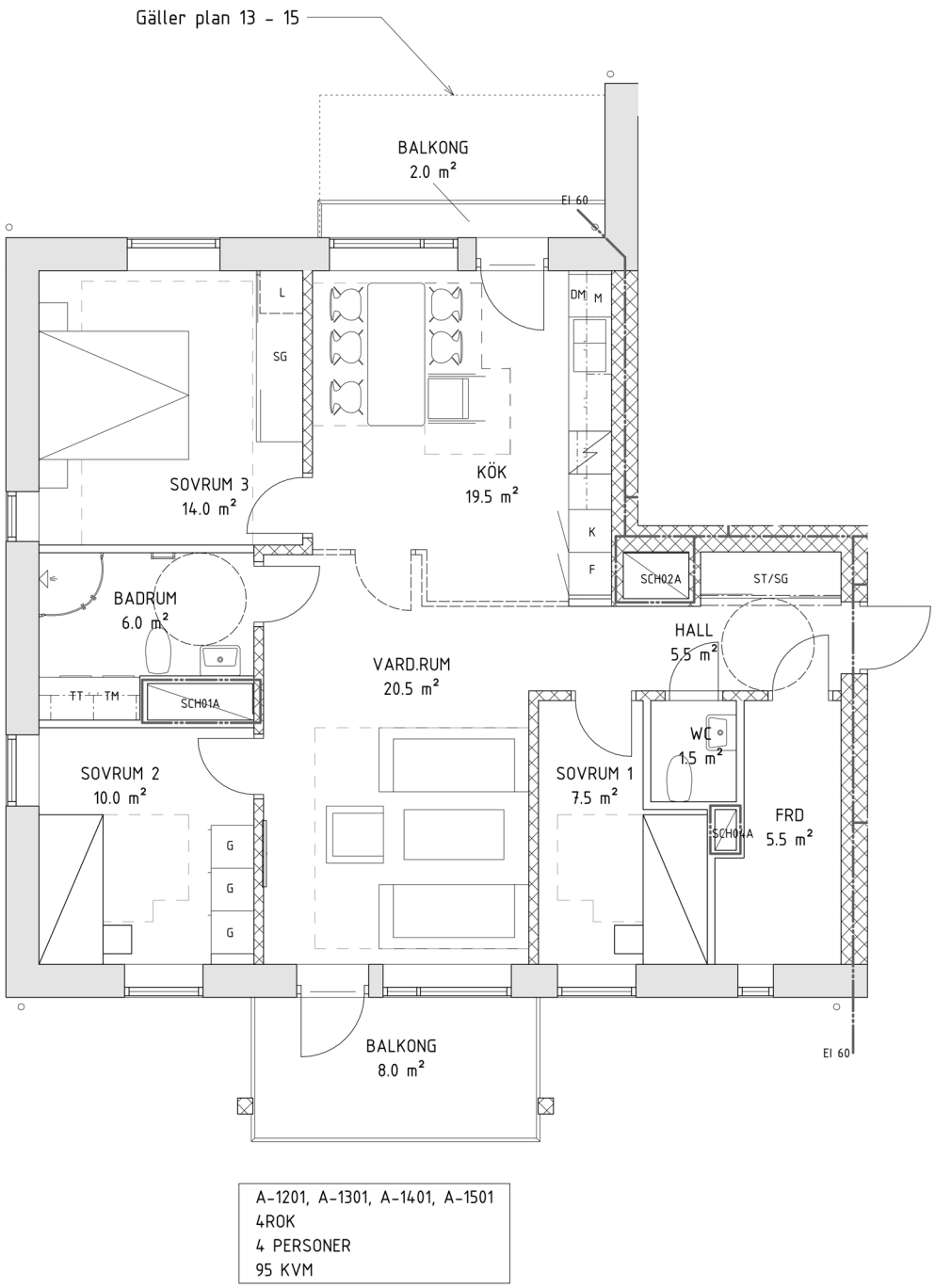


Image 14: © 2020 F O Arkitektkontor
A three-bedroom apartment in Sävenäs 175:2. The storage area next to the door is conveniently located to store strollers, bikes etc. But by adding a niche (approx. 1,5 m wide) and a small window, it can also serve as a small home office with enough space for a desk a chair and a couple of book shelfs. A simple solution to make the space multi-functional.

RESULT

Recapitulation

The following questions were asked in the introduction:

- *Where is Gothenburg developing? Is there a pattern to it, is it evenly distributed across the municipality and is there a focus on certain aspects?*

- *What trends can be seen in the approved building permits from 2021 for multifamily residential buildings in Gothenburg, are there projects that stand out for any particular reason, and what can we learn from those?*

- *How are our buildings and apartments developing? Can the trend of shrinking apartments, that is the reduction in the number of square meters per apartment, be seen in Gothenburg? And if so, what are the effects of it?*

To answer them in a clear manner, each question gets a separate section containing a summary of what is found in the previous chapters. The text refers to the sections and sources used in the previous chapters. No new sources are used.

Gothenburg's development

Gothenburg is growing. 2017, 2018 and 2021 sees the addition of 4 500-5 000 apartments per year (Table 2). That pace seems to be the upper boundary of what is possible to achieve at the moment for the municipality and the construction industry present in the region.

Looking at the city over time, the number of apartments added to the different administrative areas varies greatly between the years. A fairly consistent trend is that roughly two thirds end up in the southern parts of the city (Centrum and Sydväst, see Table 8). This have not always been the case. Demographically, this can be seen in the fact that the population centers for the added construction is 1,4-2,7 km south of the city's population center (Image 4). This division, present in the city at the moment, can also be seen when examining the municipality's goals for the number of new apartments during this period. The goals are likely met in the entire city, but it is hard to disregard the fact that the southern parts of the city outperforms them. An example of this is Sydväst adding approximately twice the number of apartments in a shorter time frame (Municipal influence on distribution).

The city had a focus on utilizing existing resources. In the municipality's strategy for the city's expansion (Byggnadsnämnden, 2014), several areas along major public transit routes were identified as suitable for densification. Most of the construction have taken place in these areas, or in neighboring parts. An exception of this is the construction that has taken place along Riksväg 158, an area only identified as a future development area in the strategy. Several of these areas are found in the physically larger northern parts of the city. Nordost standing out as particular under-utilized, with two major clusters located along the tramlines from Gamlestads Torg towards Angered and Bergsjön.

There is potential to add a lot of affordable apartments in Nordost. Apartments that utilize existing communication and services. Förvaltnings AB Framtiden have a unique position for this, not only being the largest public housing company in Sweden, but the major owner of existing housing in the area. In 2021, almost one fifth of the total average production cost for multifamily residential buildings in the greater Gothenburg area came from the purchase of the site. By developing its existing areas in Nordost, Framtiden could produce a lot more affordable housing. One hindering circumstance for this is a writing in the owner's directive, that Framtiden should strive for a mixture of tenure in the city. This is interpreted as a strive for a mixture where no type of tenure holds a share larger than 50 percent in an area. Framtiden alone holds a share close to this, or larger, in several areas in Nordost. (Public housing)

Image 6 tells the story of where the projects in the permits of 2021 are located in the city. As seen, Norra Älvstranden is the most expansive area in Gothenburg. This is largely because of

Karlastaden, with its 431 apartments divided onto three permits. Another large development on Hisingen is Selmastaden, with 297 apartments along Litteraturgatan in seven different projects (Construction hotspots). A total of 1 402 apartments are added to Hisingen in the permits of 2021. This can be compared against Nordost that only receives 269 apartments (Image 5).

With its 2 282 apartments, Centrum is the administrative area in Gothenburg that by far sees the most added apartments. 516 of these are found in three projects around Östra sjukhuset. Another 649 can be found in four projects on both sides of E6, in, and next to Kallebäcks terraser. Centrum also have the largest individual project of 2021. It is Heden 22:21, with a total of 326 apartments.

Most of the permits in Sydväst is located along the tramline to Tynnered/Frölunda. Four projects with 535 apartments make up a bit more than half of the 992 apartments found in Sydväst.

Different trends found in the permits

The year of 2021 is made up by 56 permits containing a total of 4 945 apartments. The projects are divided into five different groups depending on the number of apartments. From XS projects with 1-9 apartments, to S projects with 10-49 apartments, M with 50-99, L with 100-199 and XL projects with 200 or more apartments. Approximately two thirds of the apartments are found in the two largest groups. This trend is consistent throughout the examined years. Both the mean and median value are found in the M group for all years, but the largest projects tend to raise the mean value well above the median. (Table 2)

There is a correlation between project size and which administrative area the project is located in. A project on Hisingen is almost ten times more likely than one in Centrum to be a XS project. In fact, Hisingen has the largest percentual share of XS, S and M size projects of all administrative areas during the evaluated period. Together they make up 80 percent of the projects found on Hisingen. This number is 59 percent in Sydväst, 52 in Nordost and 44 percent in Centrum. Centrum also have the largest share of XL projects, both percentual and absolute numbers. (Diagram 9)

In the permits of 2021, there was 1 330 studio apartments, 1 895 one-bedroom apartments, 1 164 two-bedroom apartments, 478 three-bedroom apartments and 78 four- or more-bedroom apartments (Diagram 2). This corresponds to approximately 27, 38, 24, 10 and 2 percent, meaning that two thirds of the apartments are studio- and one-bedroom apartments. These numbers are also fairly consistent over the years (Diagram 3).

By comparing them against the existing distribution in the city, further insight can be had. Diagram 4 shows that the share of studio apartments is consistently higher, while the share of the one-bedroom apartments roughly is the same. This is offset by a lower share of larger apartments. Troublesome since these apartments generally cater towards families, and the lower share may lead to an increase in overcrowding. On a positive note, there seems to be a reduction in that gap happening for the two largest apartment types, but without the data for 2019 and 2020 it is difficult to declare if this is the beginning of a trend with more large apartments.

Generally, a mixture of apartment types should be viewed as something desirable in project. It increases the chance for different households to find an apartment that suits their needs in an area. In the examined period, a project on average have 2,9-3,1 types of apartments with the median value of 3. However, the spread differs and is increasing. 2016 saw projects with 2-4 types. In 2021, 9 percent of the projects had one type, but 7 percent also had five types. Entire projects containing one apartment-type can only be described as monocultures. An evolution that might cause problems. (Table 4)

Table 5 breaks this down further, by showing the individual projects sorted after size. On average the diversity increases as the size of the projects increase. Going from 1,4 for the XS projects

to 3,1 for S projects, 3,5 for M & L projects to 3,8 for XL projects. The monocultures are primarily found in the smallest category, limiting their effect on the area they are present in. An exception to this is Lindholmen 1:32, a M sized project consisting of 56 one-bedroom apartments located in Karlastaden. In contrast, three, out of the four most diverse projects exist in the S and M sized groups. Another project that stands out is Lundbyvassen 736:168. A temporary building permit in Frihamnen, consisting of 124 studio- and one-bedroom apartments. These are short term rentals. The lack of diversity is a result of the projects purpose.

The buildings and apartments

Most projects contain one building typology. 15 out of 56 contains two, and one project contains three (Typology). The most common typologies are tower blocks, angled blocks, gallery buildings, and linear blocks, found in 34, 27, 20 and 16 percent of the projects respectively (Table 16). The average number of apartments varies between the typologies. This causes a shift in the distribution of apartments where 30, 30, 10 and 18 percent of the apartments are found in the above-mentioned typologies. (Table 17)

A new occurrence is the addition of a podium. The typology it is found in 6 projects, that is 11 percent of them. It consists of a building that covers an entire city block and has a purpose other than housing. The roof of the podium building is often used as an elevated courtyard with one or several housing projects built on top of it. (Podium buildings)

There is also an increasing number of mixed-use developments. In 2016 a mere 6 percent of the projects contained some sort of commercial space. This had increased to 34 percent in 2021. This is in line with the previously mentioned strategy. In it, the municipality concludes that there is a lack of small commercial spaces near services and housing and that the current densification efforts can help alleviate this. (Mixed-use developments)

The most common way to enter an apartment is from a staircase. 88 percent of the apartments are reached this way. Another 9 percent is reached via a gallery and the last 3 percent have a separate entrance. Looking at the staircase, 25 percent of all apartments are found in an entrance situation with 4 apartments per level. If the two groups with 5 and 6 apartments per level is included, that number have grown to 56 percent of all apartments (Staircases). Another 16 percent can be found in staircases with 7 or more apartments per level (Diagram 10). Similarly, 22 percent of all apartments are found in staircases with 15-24 apartments and 18 percent in staircases with 25-34. The year also see a six very large staircases, containing between 95-162 apartments each. Together these six staircases house 14 percent of all apartments in 2021 (Diagram 12).

A consequence of a large number of apartments per level is that the entrance hall gradually turns from a rectangular shape to an elongated corridor. This affects the spatial qualities of the space, to one that more resembles an institutional building or an office. Excluding gallery entrances, a total of 39 percent of the apartments are found in corridors with a ratio of at least 1/6. The average proportion in this group is however 1/11. Combined with the gallery entrance apartments, this group makes up 50 percent of all apartments. This hints to what type of spatial qualities and privacy level can be expected in the entrance situation for a majority of the future inhabitants. (Corridors)

Another consequence is a reduction in the number of cardinal views the apartments have. A total of 90 percent of the studio apartments are single sided and the remaining apartments are corner apartments. One-bedroom apartments have a slightly better situation with 50 percent single sided apartments, 29 percent corner apartments and 17 percent double sided. The single sided apartments start to disappear with the two-bedroom apartments. These primarily have views in two directions. Apartments with three- or more-bedrooms primarily have views in three or more cardinal directions. (Table 21)

When comparing the size of the apartments found in the permits with that of the existing stock, a general trend towards smaller apartments can be seen. The trend is not unison, the apartment-types are affected differently.

In the permits a total of 88 percent of the studio apartments are 35 square meters or smaller, the same number is 51 percent in the existing stock (Studio apartments, 1-1,5 Rok). Effectively, the large studio apartment has basically disappeared. An apartment in the 90th percentile have gone from 45 square meters down to 36. A reduction of 20 percent. Interestingly, the distribution curves of the permits and the existing stock match each other quite well up to 33 square meters (Diagram 14). The measured difference of 37 percent, developed over the span of 33-35 square meters, is likely caused by the relaxations of requirements for apartments that are 35 square meters or smaller. This is evidence that the market aims for the minimum requirements found in Boverket's building regulations. (Studio apartments, 1-1,5 Rok).

Unlike the studio apartment, the one-bedroom apartment sees a general reduction of 9-15 percent in size between the 10th and the 90th percentile. The markets aim to utilize the reduction of requirement found in the regulations is also present, with 81 percent of the apartments being 55 square meters or smaller. The corresponding number in the existing stock is 44 percent, a reduction of yet again 37 percent. (One-bedroom apt. – 2 Rok)

For the larger apartments the picture is a bit different. The two-bedroom apartments see a reduction of 4-7 percent between the 40th and 90th percentile (Two-bedroom apt. – 3Rok) and the three-bedroom apartments are almost identical with a reduction of 4-8 percent between the 50th and 90th percentile (Three-bedroom apt.- 4 Rok). The largest apartments with four- or more-bedrooms appears to be shrinking, but the data is excessively noisy making generalized conclusions difficult (Four- or more-bedroom apt.).

Boverket's building regulations are clear. But in reality, a grey zone exists where apartments slightly larger than 35 and 55 square meters use the relaxations (Studio apartments – 35,1-35,4 m2)(One-bedroom apt. – 55,1-55,4 m2). This is one example of rule-bending found in the projects. Another example is the deliberate disregard of the 7 square meter requirement found in the Land Survey's definition of a room. This constitutes an indirect requirement, not tied to the building permit application, but to the fact that the developer is obligated to submit correct information to the apartment register. In 17 projects, apartments were found that contained one or two bedrooms that are smaller than 7 square meters. Two thirds of them are 6,5 square meters or larger and could likely easily be enlarged to meet the 7 square meter requirement (The room that is not a room).

Another interesting development is the wardrobe/storage area intended for sleep, or other purposes. These are found in 8 projects, both as daylight lit and entirely dark. A majority of them, 62 percent, are found in studio apartments. (The wardrobe that is not a wardrobe)

CONCLUSIONS AND DISCUSSIONS

Inference

Looking at the data presented in this thesis, several conclusions can be drawn.

Firstly, Gothenburg is in many ways a divided city. This division exists primarily between northern and southern parts of the city, separated by Göta älv and E20. The investigated period has mostly been a prosperous one. Among other, seen in the large number of planned apartments and that all parts of the city are growing. However, that growth is not evenly distributed, with two thirds of it ending up in the southern parts of the municipality. There is an apparent risk that future economic downturns exacerbate this division, primarily affecting Nordost as times get harder. Framtiden's stable revenue stream and considerable real estate portfolio could be leveraged to specifically develop existing assets in Nordost during economic downturns. This could help lessen the effects but would require political consensus to use Framtiden as a political tool.

The staircases are also getting bigger. This primarily affects two metrics. The first, is the number of apartments that are reached via a corridor which is 39 percent in 2021. The second is a change in number of cardinal views an apartment have. Frankly, this development has led to the rise of the single sided apartment. Particularly present in the two smallest apartment-types, where 90 percent of studio apartments and 50 percent of the one-bedroom apartments are single sided. If summed up, 2 222 apartments are single sided, or 45 percent of all apartments found in the permits of 2021. A worrying number considering the scarcity of light during the winter months. An aspect of this, not explored in the thesis are the effects found on the floorplans. In particular, a lot of studio apartment suffer from an unfavorable ratio, being narrow and deep. The question is, how much of these apartments really are daylight lit?

Another conclusion is that all apartment-types are shrinking in size when compared against the existing stock. The key words being the existing stock. This is an amalgamation of over 100 years of construction, with varying standards and size requirements. However, the shrinkage is mostly seen in the two smallest types, the studio- and one-bedroom apartment. While the percentage of small studio apartments found match that of the existing stock, the large studio apartment has all but disappeared. In contrast, the one-bedroom apartment sees a general reduction over the entire spectra. Both types are affected by the markets strive to use the relaxations found in Boverket's building regulations, with 88 and 81 percent being smaller than the threshold values.

The industry also seems to have a tendency to circumvent or bend the rules. An example of this is that 17 out of 56 projects contains apartments with bedrooms smaller then 7 square meters. In doing so, they disregard the Land Survey's definition of a room. This leads to incorrect information being entered into the apartment register, potentially causing problems for the developer, real estate agents and potential buyers.

This tendency can and most likely will increase if further reduction of the apartments-size takes place and the current regulatory framework remains valid. There are many examples that could be investigated. The building permits series have previously investigated the development of the kitchen. Tying into that are examples of unrealistic partitioning walls to separate an open floorplan and dark windowless kitchens in apartments larger than 55 square meters. The latter case is possible to achieve by using a larger second bedroom in the drawings for the necessary social areas and simply skip the division of the open plan living room and kitchen. To put it simply, how large is the share of apartments doesn't comply with the spirit of the current building regulation?

On a positive note. The investigated period has seen a quite substantial increase in the number of mixed-use developments. The heterogeneity of the projects is on average unchanged, but good. In particular for the largest categories, that contains the majority of apartments. Projects with five apartment-types have also started to emerge. Likewise, the production of large apartments

seems be recuperating. The share is still lower than in the existing stock, and without the data for 2019 & 2020 its difficult to assess if this is the start of a trend with a greater share of large apartments. But there are reason to be optimistic, at least in the short perspective.

The reserch questions

Patterns, distribution, and focus aspects have all been discussed, answering the first question. Improvements could of course be made, particularly regarding the focus aspect. Here the municipality's focus on densification and utilization of existing resources are well examined. But aspects regarding the market's focus have not been touched. The reason behind it is that market is made up of a large number of individual stakeholders. Gathering data from those, regarding their focus during the period would be interesting but very time consuming.

There are several projects that stand out for different reasons, and a majority of them are not mentioned in this thesis. The second question ask what we can learn from these projects and the short answer is, not a lot. They are too numerous to do case studies on, which in itself, is another thesis subject. And to extract data from them they would need to be categorized, and several years would need to be grouped together to form some sort of data set.

The last question can't be answered fully, it is simply too wide. The thesis describes some aspects of how our buildings and apartments are developing and that the trend of shrinking apartments is present in Gothenburg. But the effects of it is numerous, and it highlight the major shortcoming of this thesis. That it doesn't properly explore the floorplans.

A final word

All things come to an end. The scope of this thesis contains several interesting aspects that can only be described as rabbit holes. Highly interesting questions that have both width and depth to them, but ultimately leads nowhere.

But the strength of the thesis doesn't lie there. It lies in the overview, where different aspects can be connected. It lies in its use of statistics drawn from a large rigorous dataset that lends weight to the conclusions.

The basic premise of this thesis is that it deals with building permits. It is a prerequisite to be able to gather large amount of information from a single source. This is also a big weakness. There is no way to know if a project actually will be built. The opposite of this, is to use the apartment register. But then we lack the rich flora of nuances present in the permits. These nuances are important, and they are the basic justification of why you need and architect in the first place. A big part of our job is to care for the qualities developed over centuries and make sure future generations also get to enjoy them. This is something that statistics from regular sources have a hard time describing.

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