ROTTERDAM'S TRANSFORMATION POTENTIAL

TRANSFORMING VACANT OFFICE SPACE INTO HOUSING

Graduation Research Proposal P2
R.A. de Ridder
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COLOPHON

P2 RESEARCH PROPOSAL

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Preface

This report presents the research proposal of my graduation thesis towards the transformation potential of Rotterdam's vacant office space into housing. This master thesis is the final assignment for the master-track Management in the Built Environment at the Delft University of Technology.

The choosing of the topic of this thesis can be traced back to an episode of "De slag om Nederland" (VPRO 2012). This documentary showed the problematic situation of the Dutch office market. However, solutions for this problem where hardly proposed. With this thesis I will go into more detail on the origin of the current Dutch office vacancy and how adaptive reuse can serve as a possible solution. By doing so, I want to expand my knowledge on adaptive reuse and its value in a social and economic way.

R.A. de Ridder

Rotterdam, 2017

Abstract

This research aims to uncover the transformation potential of the structural vacant office space in Rotterdam to residential. The office market in the Netherlands is a replacement market. Meaning that tenants have many options to go to, due to the oversupply. What happens is, is tenants choose to rent the highest quality offices at the best locations. Resulting in structural vacancy in the bottom end of the office market. The Rotterdam office market may offer possibilities to expand the transformation market. Hereby office vacancy is reduced and the housing market cooled down. The main question for this thesis is:

> *How can transformation potential be measured and what is the transformation potential of Rotterdam's structural vacant office space to residential?*

Many factors influence transformation potential. All these factors are modeled in the conversion meter 2017. This model is used to measure the transformation potential of Rotterdam. By doing so the model is further tested and developed and may add additional parameters due to market research, literature review, case study analysis and expert interviews. After measuring using the Conversion Meter 2017 the transformation potential is then mapped in a geographic information system (GIS) map. Showing Rotterdam's transformation potential and with the results from both the meter and the map more insight is given for building owners to initiate transformation of their structural vacant office space.

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Introduction

In the Netherlands many buildings are empty or have lost their function, among those are office buildings, schools, industrial sites, barracks, and other utility buildings. The highest vacancy rates however, are recorded in the office market (Cushman & Wakefield, 2017). The focus of this research is therefore only on this type of real estate. A large part of this office space is structurally vacant, meaning that these objects have been vacant for three years or longer and will not be taken up by a rising economy (Remoy, 2014). In other words, without some sort of intervention these buildings will remain vacant with all its associated financial and social negative consequences. This mismatch of demand and supply is not just an issue within the office market but also for the housing market. The difference between the two markets however is that the office market is coping with an oversupply and the housing market with a shortage, especially in the Randstad area where space is scarce. This increasing demand is caused by the migration to the city, smaller households, and insufficient building production in recent years. Office building owners have several strategies to cope with vacancy. Their options are selling, consolidation, renovation, demolish and build new, or transformation. However, by selling the object the problem is not solved. The same goes for consolidation, as mentioned before, waiting for better times is not an option. By renovating the building, the quality is improved of the original function, however this function is no longer desirable on the location since it has been structurally vacant. Function change is the most viable solution and can be obtained by either demolition and new build or transformation. Transformation into another function is the more sustainable way to cope with structural office vacancy. This strategy is not a new phenomenon however it is still not being used on a large scale (Remoy, 2010). To make transformation feasible, a number of factors are important. These include among others, the location and a market demand from another function, for example housing. At first sight the situation in Rotterdam, a city in the Randstad, may offer possibilities for expanding the transformation market, due to the above average office vacancy, the location of the (structural) vacant office space, and the high demand for housing (PorpertyNL, 2017). This thesis is about the transformation potential of Rotterdam's vacant office real estate into housing. The aim of this research is to uncover the drivers and barriers of transformation of vacant office buildings into housing and modeling these factors into a decision-making tool. The insight this tool will give can be used to aligning demand and supply in Rotterdam's office and housing market. Ultimately, showing how significantly office vacancy and housing shortage can be reduced in Rotterdam. By doing so this research follows up on previous research about measuring and modeling transformation potential (PBL, 2017; Brink, 2017; Remøy 2010, 2014, 2017; Geraerdts, 2017; Van der Voordt, 2017; Muller, 2008).

A deeper analysis of the problem and the relation between structural office vacancy, the overheating housing market, transformation and how Rotterdam fits within these domains is given in the next paragraph, the problem analysis. From this analysis a problem statement is formulated, the main research question. This main question is then dissected into sub questions. The combined answers of the sub questions will ultimately lead to answering the main research question of this thesis. How these questions will be answered is explained in the following paragraph, methodology. Next is the overall schedule of the research. After this more background information, based on a literature review, is given on the aforementioned topics. Lastly, the used literature is listed in the bibliography.

Social relevance

Vacant real estate affects its immediate environment. This influence can express itself in various ways. Vacancy affects the value of the object itself and on the value of surrounding buildings. In addition, vacant buildings have an influence on the social nature of the environment, often occupying valuable space within the built environment and causing the loss of income for owners. Transforming the vacant building not only reduces the environmental impact by reducing the amount of waste produced but also keeps the cultural heritage intact.

Scientific relevance

Buildings, like cities, change through new developments and technology. Buildings, infrastructure, and public areas become outdated technically and economically, but also due to spatial shifts and changes in function and in cultural values. Available space becomes increasingly scarce, the need for more surface is growing and therefore there are vacant buildings under increasing pressure to be addressed. This research follows up on previous research about measuring and modeling transformation potential (Remøy 2010, 2014, 2017; Geraerdts, 2017; Van der Voordt, 2017; Muller, 2008; Rodermond & Van Gool, 2011; Djajadiningrat, 2013; PBL, 2017; Brink, 2017).

Research aim

Using the Conversion Meter 2017 as a foundation and further test and develop this model which can be used to measure transformation potential in Rotterdam. With this model insight is given in an object's transformation potential on all aspects (market demand, financial, technical, legal, etc.) and ultimately with this knowledge more transformation projects may be initiated. By initiating more transformation projects office vacancy is reduced and at the same time supply is added to the overheating housing market within Rotterdam. Both are ambitions of the city of Rotterdam. (Sources: PropertyNL, 2017; Algemeen Dagblad, 2017; Municipality of Rotterdam, 2017)

Problem Analysis

A lot has been said about office vacancy in the Netherlands. The thing all parties agree on is the oversupply of office space that no longer fulfills the current users' requirements (JLL, 2015). The high vacancy rates in the Netherlands are causing various problems. Too much vacancy can lead to area degradability, poor investment imagery and loss of value. At year-end 2016 approximately 7.75 million m^2 office space was recorded for rent or sale, which is 15.9% of the total Dutch office stock (48.74 million m^2).

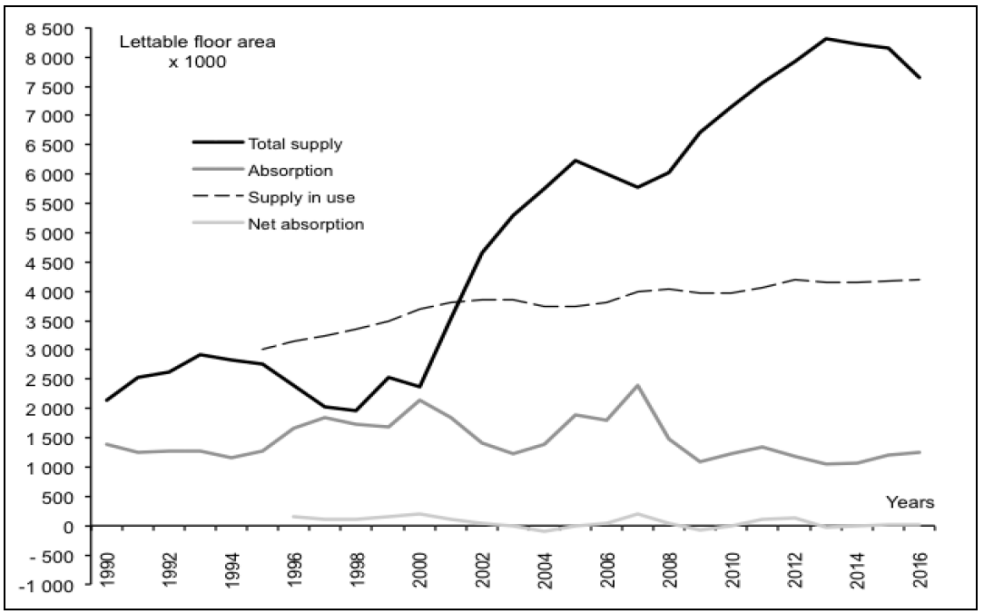


Figure 1, Vacancy levels in the Netherlands, 1995-2016 (Source: Geraedts, R.P., D.J.M. van der Voordt and H. Remøy, 2017)

The vacancy rate shows an especially strong increase around the turn of the century. The bulk delivery of new construction projects was the main reason for this increase. After a period of scarcity and reluctance from municipalities, investors and developers started to take on new developments on a large scale towards the end of the 1990s. These new office projects where being developed 'at own risk'. Meaning that up to 80% of the new offices were developed without having a user in place beforehand (Zuidema & Van Elp, 2010). These vacant new developments are almost entirely responsible for the increase in vacancy rates up until 2002. Only after 2002 does the number of new offices decrease again and the vacancy rate in the existing stock increases significantly. Office organizations move to these new buildings leaving their old offices behind, adding to the vacancy. Due to the shift from an expansion market to a replacement market, this vacancy will not be quickly eliminated due to a growing uptake because the survey is mainly at the top of the market where the structural vacancy is relatively low, with the result that the bottom end of the market will remain vacant. Hence, forecasts indicate that demand will fall in the future, due to economic, technical, and demographic changes, adding to the vacancy. As the years pass by the buildings become older and less attractive. Rental contracts end, and tenants move to newer high-quality locations leaving the old building behind. Slowly but surely the older office buildings are getting less attractive to move towards. Owners try to keep tenants using incentives. Eventually however the buildings become completely vacant. Eventually this frictional vacancy becomes structural vacancy after a period of three years. It is forecasted that of the total vacant stock 70% will not be used again, hence structurally vacant (Zuidema & Van Erp, 2010). Indicating that these buildings are completely redundant as office space as illustrated below in figure 2.

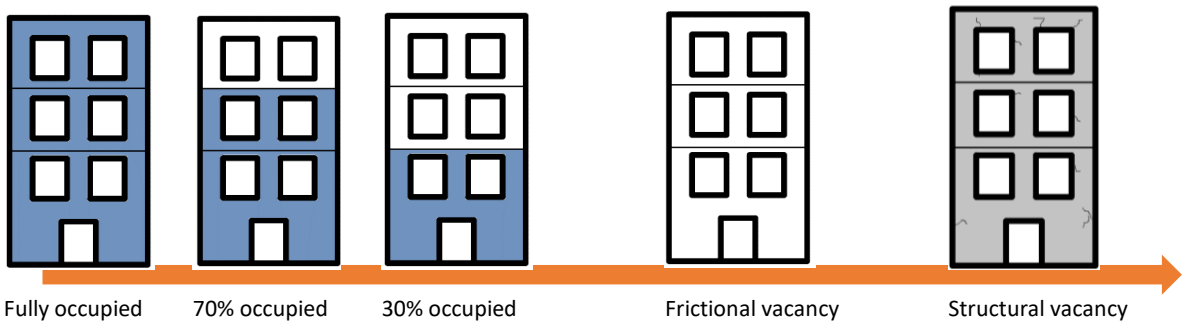


Figure 2, illustration of increasing vacancy due to replacement market (Source: Own Illustration)

The market currently shows that the amount of structural vacancy, the bottom end of the office market is growing. These buildings have poor quality and usually have an energy performance label which is lower than label C. Considering the upcoming threshold of Label C for office space to be used is a considered a driver for building owners of structural vacant office space to act. The problem of structural vacancy can be seen as an opportunity for building owners to initiate an intervention. Intervention methods as renovation, demolition / new construction and transformation are conceivable. However, considering that offices are no longer in demand at that location a function change is needed. A function change can either be obtained by demolition and new build or transformation. Transformation being the more sustainable method of the two. Sustainability is important because buildings account for 40% of the total energy consumption in the European Union, 35% of greenhouse gas emissions, 50% of all materials extracted and 40% of the waste generation. In case of transformation reusing the existing structure helps reduce minimizing waste. Also, as 80% of the real estate needed for the next 100 years is already built, new accommodation demand primarily should be accommodated in the current stock. Potentially, 50% of the existing real estate can be reused, but still adaptive reuse is not taking place on a large scale (Remoy 2017). By expanding the transformation market office vacancy may be greatly reduced in the most sustainable way.

However, transformation can only be successful under certain conditions. Three factors amongst others are described as the most important drivers in the conversion of office space into housing Remøy (2014). These three drivers are sustainability aims, redundant office buildings and a tight housing market. Conversion of structurally vacant offices into housing could increase and broaden the housing supply and at the same time create possible new use for obsolete office buildings (Geraedts, R.P., D.J.M. van der Voordt and H. Remøy, 2017; Brink, 2017; EIB, 2010).

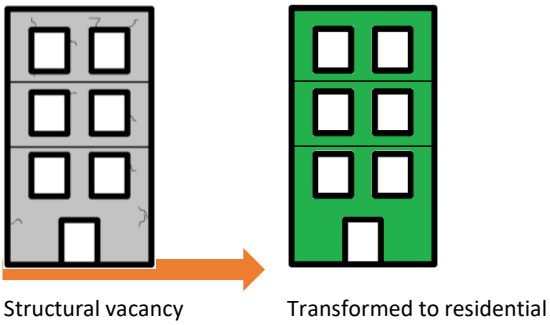


Figure 3, illustration of structurally vacant office transformed to residential building (Source: Own Illustration)

Amongst these drivers are also barriers these include technical, legal, and financial factors that can make a transformation infeasible. In the short term, impairments and withdrawals are hampered by institutional factors and regulations. On the institutional side, the price rigidity plays a role. The strong value depreciation of their real estate can cause problems for acquiring loan capital. The depreciation

is rather taken in steps and therefore the existing tenants are kept on board with all kinds of incentives. Eventually, the real estate should be appraised at true values and rental prices should be reduced to their (lower) current market value. This makes the refurbishment of the existing stock better possible. However, the valuation of the structural vacant office stock is not a straightforward task. Valuing the office stock might have specific characteristics, which will not have a market value, or only for similar enterprises and specific use. The value might also be influenced by industry trends or labor costs followed by shifts of the company's activities to other locations or even other countries (Jensen, A., & Van der Voordt, T., 2017). However, when transforming the structural vacant office space to residential it should not be valued as office space. Other valuation methods have been proposed better suited for valuing vacancy which could help overcome the financial barrier (Rodermond, W., & Van Gool, P.,2011 & 2016; Djajadiningrat, B., 2013; Barentsen, D., 2015; Kraag, A., 2015).

The location also plays a major part in the success or failure of a transformation project. Good locations that are well-connected to public transport and urban networks offer better feasibility then structural vacant offices located in peripheral areas. As mentioned before another factor that drives transformation projects is a high demand for housing. In the Randstad area in the Netherlands the housing market is overheating due to high demand and limited supply. When the number of households only increased, and more people moved to the cities in recent years, the number of new homes lacked behind. Supply of housing could not keep up with the high demand. While around 80,000 homes were needed, between 45,000 and 55,000 homes were added. Therefore, experts say the one true solution to keep up with demand is to scale up building production (NOS, 2017). According to NVM spokesman Roeland Kimman (2017) there are 200.000 homes necessary right now and 1 million new homes must be realized in 2040 to keep up with demand (PBL, 2017). However, within the Randstad there are limited building locations due to the fully developed VINEX locations. According to TU Delft Professor Peter Boelhouwer (2017) a significant amount of the much needed new supply to cool down the housing market can be created through transformation of obsolete buildings.

Rotterdam, a city in the Randstad seems to offer possibilities to expand the transformation market due to the above average office vacancy, the location of the (structural) vacant office space, and the high demand for housing (PorpertyNL, 2017). In Rotterdam 935.000 sqm of the total office supply is left vacant. This is mainly due to wrong location, bad energy performance or a poor external appearance (PropertyNL, June 2017, p.14). With 19,9%, vacancy rates are above average in office real estate (PropertyNL, June 2017, p.14). 18% of this supply can be considered really promising, 58% as promising and 24% as underprivileged. An advantage of the Rotterdam office market is that more than half of the vacancy is in and close to the city center, in other words suitable locations for redevelopment (Nederpelt, 17-12-2015).

The housing market in Rotterdam is coping with a shortage. Due to its increased popularity supply can not keep up with demand. In 2015, Rotterdam had 624,000 inhabitants and in 2016 another 629,000. Growth has been particularly rapid in recent years. The number of residents has increased by 33,500 since 2008. This strong increase will continue. Forecasts show that 2030 in Rotterdam is growing to 676,000 inhabitants. In addition to this population growth, an increase in the number of households can be expected. The City of Rotterdam claims it is building at least 30.000 homes within ten years. Meaning 3.000 new homes each year for the next 10 years. However due to increasing popularity this number will not be sufficient to keep up with the current high demand according to alderman Robert Simons. Therefore, the municipality is aiming to build a total of 50.000 residential units by 2040 (Algemeen Dagblad ,2017). This however comes down to only 2.500 new homes per year. Taking the median of 2.750 new homes per year it is still questionable where to build this amount of new homes. It is hard to find locations due to the city's limited land ownership. Most 'easy' VINEX-locations (Vierde

Nota Extra) are mostly developed. Therefore, it is to be expected that the density of certain inner-city locations will be raised (Simons, 2017).

The Municipality of Rotterdam actively pursues a policy against vacancy and helps in a facilitating way. The municipality helps to connect parties from the market, which would not normally come into contact with each other. But it also helps in connecting initiatives and ideas about buildings that are not directly picked up by the market themselves. The municipality is the partner in terms of rules, procedures, and permits and streamline the licensing process.

According to literature Rotterdam seem to be a prime location to expand the transformation market. To test this transformation potential empirically a tool must be developed incorporating all the parameters that affect a transformation project. The Conversion Meter (Geraedts, R.P., D.J.M. van der Voordt and H. Remøy, 2017) is a new tool that assess the conversion potential of vacant office buildings into housing based on these drivers and barriers in the best possible way. This can form the foundation for this research in modeling all drivers and barriers in transformation projects and testing Rotterdam's transformation potential. The insight this tool will give can be used to aligning demand and supply in Rotterdam's office and housing market. Ultimately, showing how significantly office vacancy and housing shortage can be reduced in Rotterdam.

Problem Statement

How much (structural) vacant office space should be taken up to get Rotterdam's vacancy rates down to healthy market levels?

How much of Rotterdam's (structural) vacant office space is suitable for transformation?

How many residential units does the transformation of potentially transformable (structurally) vacant office space yield?

Does this number cool down the housing market in Rotterdam significantly?

How much money does the transformation of vacant office space to residential potentially yield?

    Is this a significant percentage of Rotterdam's total budget?

Which buildings in which districts should be transformed?

Which district in Rotterdam offers the most significant drop in vacancy through transformation from office space to residential?

Which vacant or to be vacant buildings should be selected for transformation and why

    Use conversion meter for selection

Main question

From the problem analysis the following main research question is formulated:

> How can transformation potential be measured and what is the transformation potential of Rotterdam's structural vacant office space to residential?

Sub questions

- Which factors affect transformation projects and how do they affect them?

- What are the most important investment considerations for property owners of (structural) vacant commercial/office real estate when it comes to transformation projects?

- Which factors affect the costs and revenue of transformation projects, and with that the financial feasibility of these type of projects?

- How can de Conversion Meter 2017 be further improved for property owners and developers?

- In what way can insight in its future market value of the potential highest and best use(s) add to the acceleration e.g. increase of transformation projects in Rotterdam?

- To which extent will transformation contribute to balancing the office- and housing market in Rotterdam?

- Are there regional differences within the districts of Rotterdam that affect the transformation potential?

Methodology

To uncover how many and which buildings should be taken up in Rotterdam in order to reduce office vacancy to healthy market levels and cool down the housing market from the municipality's viewpoint.

AIM:

Reduce office vacancy in Rotterdam from current above national average of 19% to healthy 4 - 6%.

Cool down housing market through transformation of structural vacant office space to residential

Percentage of Municipality's yearly aim of 1600 – 3200 new homes per annum

Using Conversion Meter 2017 to select and grade Rotterdam's structural office vacancy.

Benchmarking / further testing the Conversion Meter 2017

The Case Studies (cross sectional studies: using interviews + documents + physical artefacts (p.100 - p. 109; Knight & Ruddock, 2008)) may provide information to improve model (for example practicality)

GIS-mapping: - Structural vacancy in Rotterdam

- Transformation potential (per district)

Interview involved actors with different occupations with the aim to obtain knowledge from all viewpoints. This may affect the weighing of certain factors of the Conversion Meter 2017.

To grade Rotterdam's transformation potential, a model will be made. This transformation potential model will test each structurally vacant office on criteria that are drivers and barriers within transformation projects. By uncovering the city's transformation potential will also show how significantly this impact the vacancy rate and the overheating market. With my research, I also want to discover the transformation potential of vacant office real estate in Rotterdam. By developing a feasibility model in which the structurally vacant offices are tested against the factors that influence the transformability. The input for the model comes from literature, already developed models, expert interviews and case studies of buildings that have already been transformed and cases in which the transformation ultimately did not take place. The cases will concern transformation projects that have been transformed from office to residential function. The residential function will be a permanent residential function, so all temporary housing projects will be left out of consideration. Ultimately, the literature research, case analysis and interviews will form the framework for the transformation model.

In this second part of the research, the Rotterdam housing market will be examined on the demand for housing and the price per m² per housing market segment. The data collection will be done by collecting figures from the municipality of Rotterdam and housing needs research. In addition, the structural vacancy per district will be investigated. In this second part, cards are also created using a Geographic Information System (GIS) application. This makes it clear which locations have a low to high potential for transformation of buildings and what influence transformation can have in Rotterdam. The model is then tested by applying it to the Rotterdam office stock, where the transformation potential is determined. Where possibly the transformation potential per district can be explained. This research will follow up on previous research on this topic. Where a model has already been constructed. This research will test this model on the selected “population” (vacant office space in Rotterdam) and add to it on the sustainability part. The described methodology is visualized on the next page.

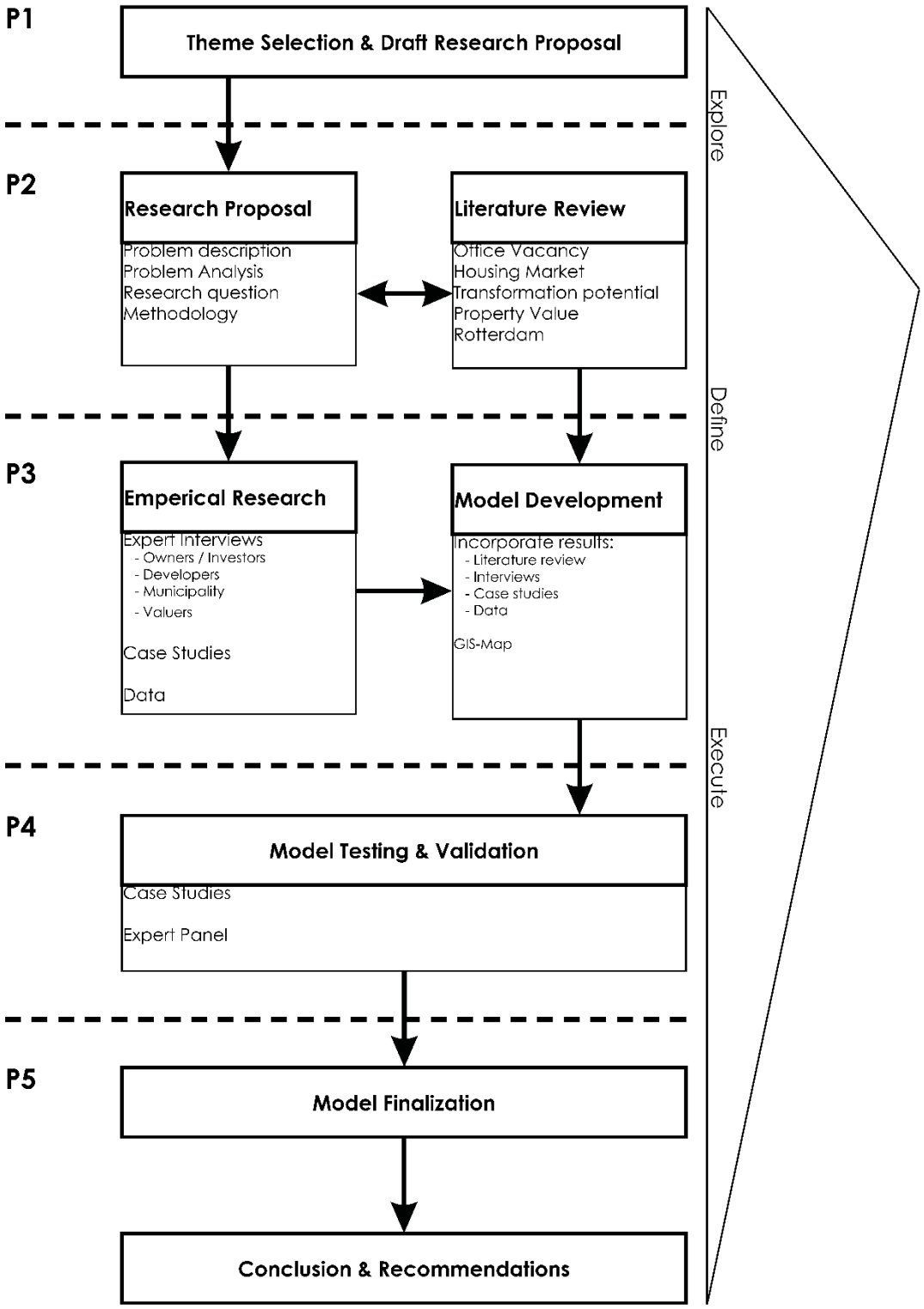


Figure 4, Research Design (Source: Own Illustration)

Research Output

The output of the research is the following:

- Final research report (developed iteratively P3 – P4 – P5)
- GIS Map of structural vacant offices in Rotterdam showing their transformation potential towards housing.
- A further developed and tested Conversion Meter 2017.

Personal study targets

With this research I have several personal study targets:

- Expand knowledge on adaptive reuse of vacant office space to housing.
- Expanding my valuation knowledge and skills. Determining the value of and object using the appropriate valuation method for each object.
- Learning how to model data and knowledge into decision-making model using the Conversion Meter 2017 as a foundation. Benchmarking this model and further improve if necessary during the research.
- Furthermore, I want to improve my research skills. The way I obtain and process the knowledge on the aforementioned topics. Through literature review, analyzing cases and interviewing professionals.
- Also, I want to improve my writing and reporting skills
- Lastly, my communication skills through consulting with my mentors, talking to professionals and presenting my research to any type of public.

Research planning

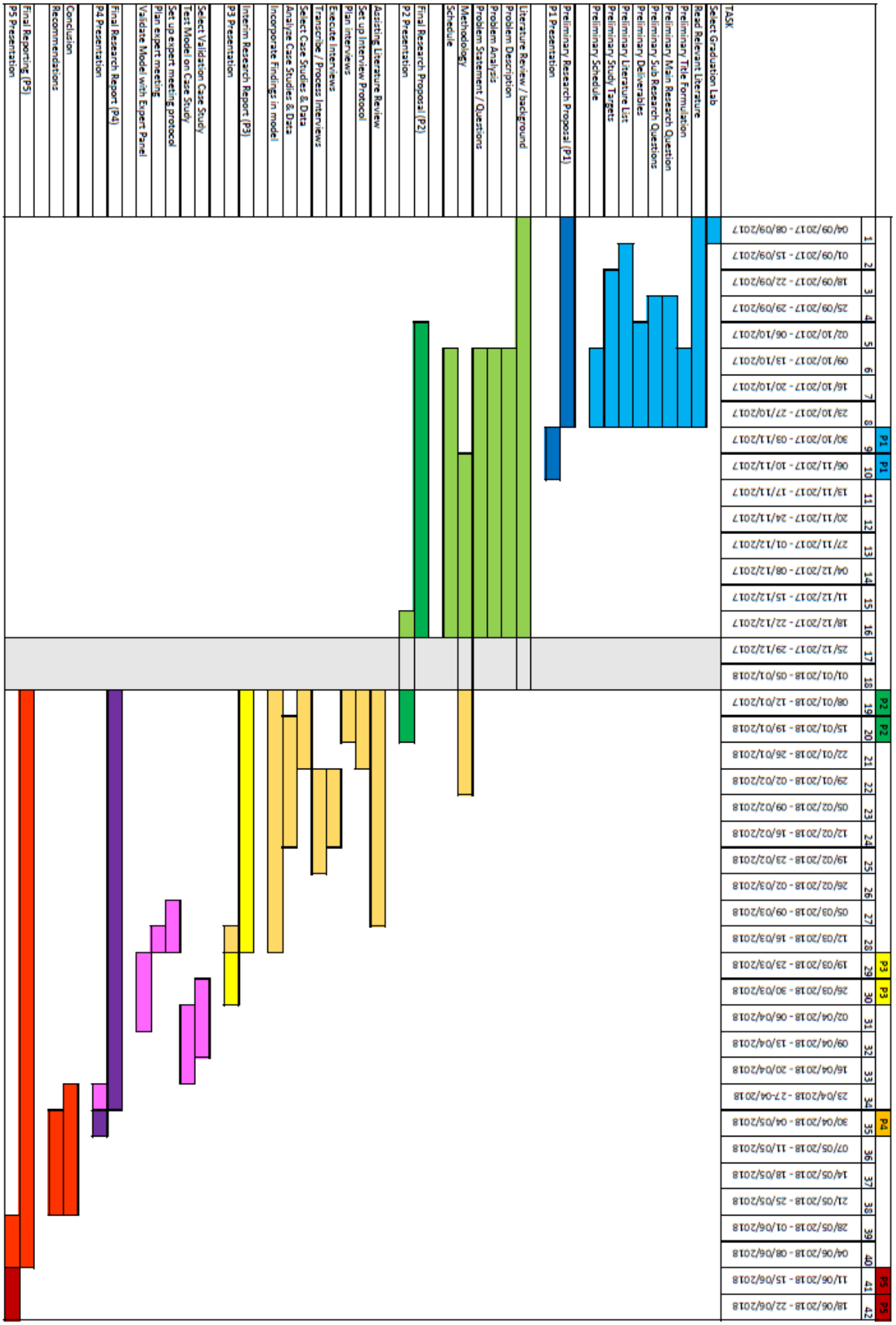


Figure 5, Gantt chart schedule of research plan (Source: Own illustration)

Background

Office vacancy

Facts and Figures

A lot has been said about office vacancy in the Netherlands. The thing all parties agree on is the oversupply of office space that no longer fulfills the current users' requirements (JLL, 2015). The high vacancy rates in the Netherlands are causing various problems. Too much vacancy can lead to area degradability, poor investment imagery and loss of value. At year-end 2016 approximately 7.75 million m^2 office space was recorded for rent or sale, which is 15.9% of the total Dutch office stock (48.74 million m^2). Looking at the global office space markets it is obvious that the Dutch office market has alarmingly high vacancy rates.

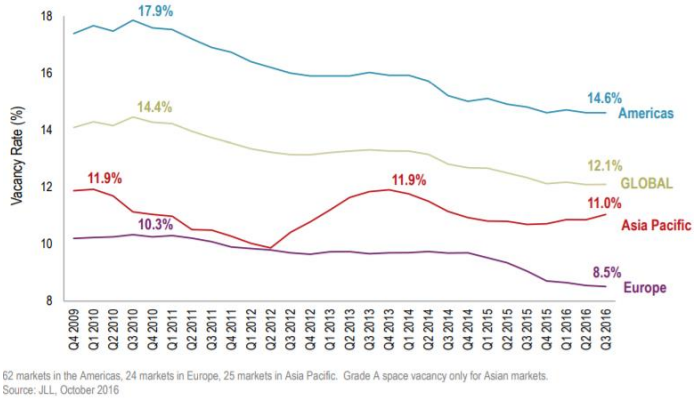


Figure 6, Global and regional office vacancy rates 2009 - 2016 (Source: JLL, 2016)

There is however a positive change noticeable. By looking at the numbers from 2015, the office market is moving in a positive direction. At the end of 2015 a vacancy rate of 17.1% was recorded which accumulates to approximately 8.47 million m^2 of vacant office space (NVM, 2017). Not only did total supply drop, but also the number of offices that have been available for a long time went down in 2016 (4.4 to 4.2 million m^2). Supply levels dropped as demand intensified but mainly because quite a significant number of buildings had been withdrawn from stock (approx. 1.08 million m^2). 224,000 m^2 where demolished and the remainder was transformed into homes. Especially in the Randstad, where the alarming lack of homes for rent or sale persisted last year, more residential space was provided in former office buildings (NVM, 2017). However, as shown in figure 7 there is still a significant mismatch between demand and supply. Which must be dealt with. However, the aim should not be to completely diminish vacancy. For the real estate market to function optimally only 4 to 6% of the total stock should remain vacant (Zuidema & Van Elp, 2010). Meaning that in the Netherlands approximately 12% of office space is unnecessarily vacant and should be dealt with.

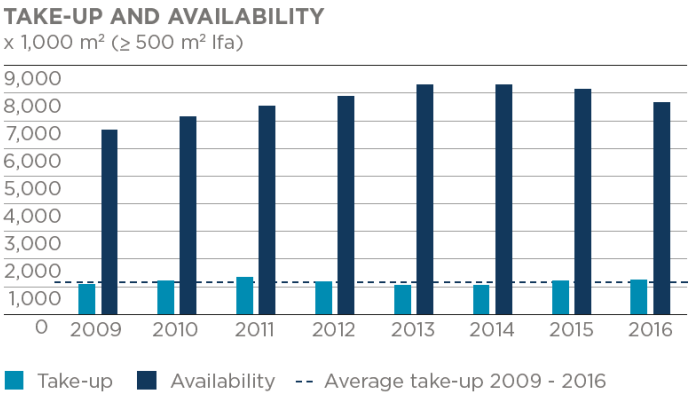


Figure 7, Office take up and availability in the Netherlands (Source: Cushman & Wakefield, 2016)

Cause

The Dutch economy grew to a greater or lesser extent in the 1980s and 90s, and ended the century with a peak recording growth rates of over 4 percent (JLL, 2015). This growth resulted in more employment, especially office jobs increased significantly. Consequently, a rising demand for office space resulted in many new offices being developed, and the office stock grew. Growth continued until the IT-hausse (boom) period. Economic growth, together with the rise of the IT sector, caused a huge demand for office space. With the prospected growth in mind, IT companies often rented twice as much office space than they needed. However, with the bursting of the IT bubble in 2000, this office space was not utilized. Therefore, the ratio between supply and demand ranged considerably, i.e. an expansion of the office market. Here the first signals were visible of the oversupply on the Dutch office market, as shown in figure 8.

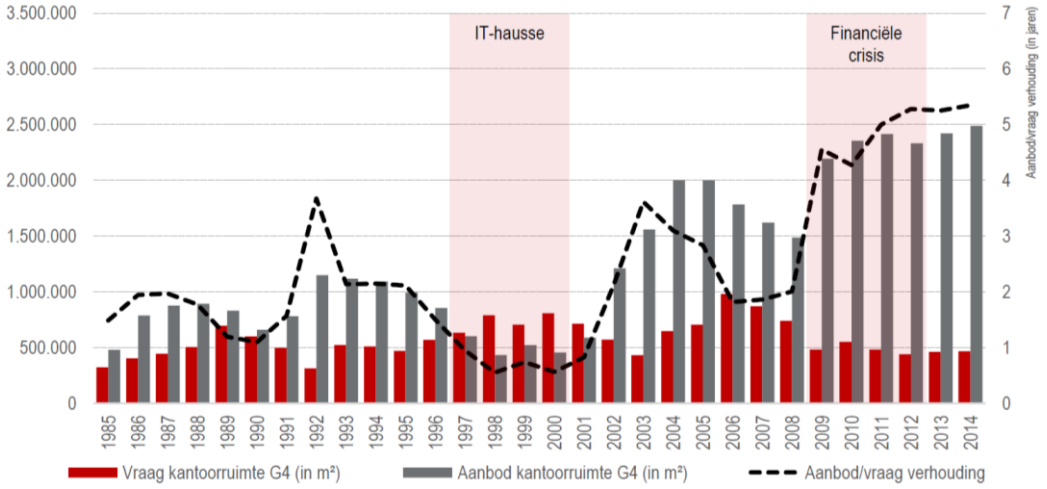


Figure 8, Historic development of office space demand and supply in sqm per annum (Source JLL, 2015)

The vacancy rate shows an especially strong increase around the turn of the century. The bulk delivery of new construction projects was the main reason for this increase. After a period of scarcity and reluctance from municipalities, investors and developers started to take on new developments on a large scale towards the end of the 1990s. These new office projects where being developed 'at own risk'. Meaning that up to 80% of the new offices were developed without having a user in place beforehand (Zuidema & Van Elp, 2010). These vacant new developments are almost entirely responsible for the increase in vacancy rates up until 2002. Only after 2002 does the number of new offices decrease again and the vacancy rate in the existing stock increases significantly. Office organizations move to these new buildings leaving their old offices behind, adding to the vacancy. As a result, the share of vacancy in new construction decreases, but does not fall below 10%. Partly, because (although limited), at that time there are still offices being built at own risk and simply no users are found for these recently delivered office buildings. This oversupply of new buildings is typical for the real estate market and know in economics as boom and bust cycles (Dutch: varkenscyclus). The opacity of the market, combined with the cyclical sensitivity of demand for offices and the long construction phase, led to observation of a clear cycle in the office market. In this boom and bust cycle periods of major scarcity and excess supply alternate each other. The demand for office space is driven by employment development, which in turn is driven by demographic and short-term in particular by economic growth. In times of prosperity the rent prices rise and in response to this rise, development of new office space starts. In the case of a boom and bust cycle this amount of new developments is too high. Resulting in an oversupply. The cycle is strengthened by the fact that the office market is a stockpile market, has a delay in demand (which is often only known after the limits of the existing stock is reached) and, offices have a long production time. Developers mostly build in an upward cycle, in

part, speculatively (at own risk), and that means that for the developed offices at the start of construction there is not, yet a tenant found. This speculative new office space is then delivered too late and is too big for the then current market where the business cycle is already reversed. In the first years after the turn of the century, economic growth has decreased, due to events such as the 9/11 terrorist attacks in the United States and the bursting of the IT bubble a major role. In 2003, the Dutch economy recovered slowly and in 2006 and 2007 grew again by more than 3 percent (JLL, 2015). During this period, demand for office space increased. The surplus declined slowly, and resulted in a less extreme mismatch between supply and demand. However, this recovering relationship between supply and demand in the office market was short-lived. Due to the financial crisis in 2008 demand for office space dropped again. Banks and insurance companies were mostly affected and heavily influenced office employment. The following years, the Dutch economy remained unstable and saw companies' turnover recede, resulting in many redundancies at large employers. To reduce expenses, cost-cutting measures were taken in several ways, including in their real estate. Emerging trends, such as automation and new ways of working, were accelerated. Through these trends, companies facilitated the same number of employees on less square meters of office space. The average 2 million m² demand in the period just before the financial crisis fell to just over 1 million m² in the years 2012 - 2014. At the same time, the supply of 4.7 million m² in 2007 increased to more than 7.1 million m² in 2010 and remained the same since then, hence the mismatch between supply and demand grew further apart. Even though the Dutch economy is now growing again, no increase in office-related employment is expected. The further automation of businesses is expected to continue to lower the demand for office space in the future.

In addition to this quantitative development, the demand of today's office user has also changed qualitatively. The location and quality of office property plays an important part here. The dynamics that still exist are mainly located in major cities within locations that are well-connected to public transport and urban networks. Furthermore, the quality requirements of office users have been tightened and sustainability is high on the agenda. Having a more sustainable building is pushed forward through new legislation. The new law says that office buildings must have a minimum energy performance label C in 2023 (Rijksoverheid, 2017). If this mandatory performance label is not met, the office building may not be used. The Dutch national government also gave notice that the energy performance label of in use office buildings must have label A in 2030. The obligation for a label C therefore amounts to 52% of the current stock. Respectively 66% and 75% of office space becomes affected by mandatory labeling B and A (EIB, 2017). In short, demand and supply in the office market shows a strong polarization in both quantitative and qualitative terms, which means that a large part of the current office (over) supply is unlikely to get a new tenant / user. For example, of the current supply (7.1 million m²) in the Netherlands over 3.5 million m² of office space has been on the market for more than 3 years and considered structurally vacant and needs some sort of intervention.

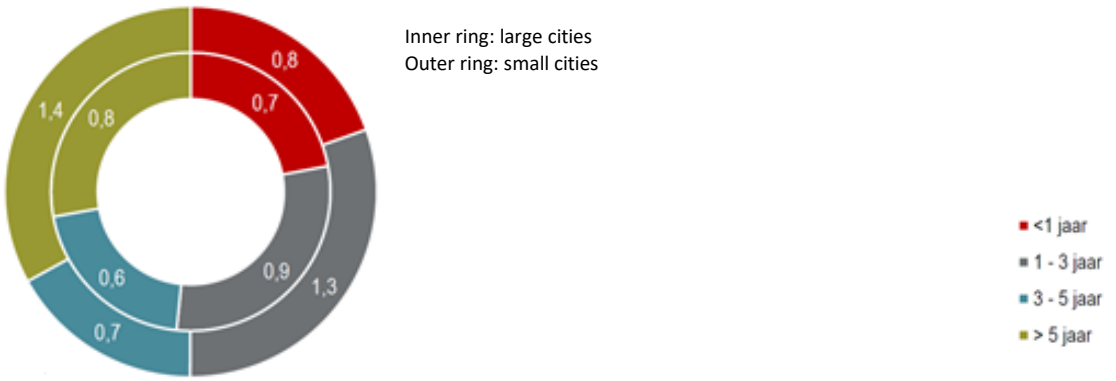


Figure 9, Office space supply availability in years in million m² (Source: JLL, 2015)

Building life cycles & intervention methods

How a building becomes obsolete has to do with its life cycles or life spans. The life cycle of a building can be divided into three types:

1. Technical lifespan

   The technical life span is the period that the building remains as is after realization. This depends on the use of materials and equipment. The technical lifespan of one building is generally longer than the functional and economic life. A building asks for technical adjustments only when used materials are worn. Sustainable materials thus increase the technical lifespan of a building.

2. Functional lifespan

   The functional lifespan is the period that the building meets the requirements to accommodate the function for which it has been developed for. The functional lifespan is very dependent on external developments affecting the building users' needs. Rapid developments ensure a short functional longevity, making new investment scenarios necessary. Building flexibility increases the possibility of realizing functional changes, flexibility is therefore important in functions with rapid developments.

3. Economical lifespan

   The economic lifespan is the duration of the period that the net present value of the future returns is higher than the net present value of the future required expenses. The economic lifespan ends when the net present value of the objects' exploitation proceeds is lower the net present value of the lands' proceeds after demolition of the building.

When a building has reached its acceptance limits of its functional, economic, and / or technical lifespan the building owner will have to choose between different accommodation strategies. These involve function renewal, function change or function termination. For a building owner to align its real estate to one of three aforementioned strategies he/she has the following intervention methods to choose from:

a. Consolidation; no change in function
b. Renovation; function renewal
c. Demolition & Build; function termination or change
d. Transformation; function change

In addition, it can be decided to sell the building, but the new owner will be faced with the same accommodation/intervention strategy decision.

Housing market

When we speak about the housing market, we are talking about all trade, buy, sell, and rent, with stock of Dutch homes. It is not therefore not to be confused with the number of houses in the Netherlands, this is the housing stock. The total Dutch housing stock consists of over 7.6 million units. The majority, 4.3 million, of which is owner occupied. 3.2 million units are rental homes which can be divided into two groups. Social housing corporations which hold 2.2 million units and the remaining 1 million are rented out by other companies, individuals, or institutional investors such as pension funds and insurance companies. The remaining 100.000 units it is unknown who the owner is and if it is for the owner occupied or rental market (NVM, 2017). The Dutch housing market is an important factor for the Dutch economy. The total Dutch mortgage debt is 650 billion euros, according to De Nederlandsche Bank (DNB). That is 175 billion more than Dutch national debt, and 84% of gross domestic product (GDP). It is therefore not surprising that housing transactions influence the growth (or shrinkage) of the Dutch economy.

The housing market in the Netherlands, according to the NVM, cannot be defined as a singular market. It can be divided into three regional levels. The first level is located in the Randstad and the cities Eindhoven and Groningen. In this area the market is “overheating” due to the limited supply and high demand. Prices here are already 10% higher than the highest point just before the 2008 credit crunch. The other two regional levels are considered more balanced markets. These are the larger cities such as Arnhem and Breda and the more rural areas in for example East-Groningen and North-Limburg. This research will therefor leave the latter two areas out of consideration.

To understand the current overheating of the housing market we must go back to 2008, just before the financial crisis hit. In August of 2008 the Dutch housing market peaked. Back then the average price of a house in the Netherlands was 261.900 Euro. With a mortgage rate of 5.3% people used to pay more for their house then nowadays. However, shortly after this peak the market collapsed due to the financial crisis as mentioned before. The average price of a home dropped to 206.100 Euro. From this low point in 2013 the housing market has been recovering ever since. Reaching a new peak in the third quarter of 2017. The average selling price reached a record high of 264,000 Euro. Also, the number of days a house is for sale has been decreasing for a while. In the third quarter last year it was 79 days, in the same period this year it was 54 days. The short for sale period is caused by the high demand of city living. Several factors cause this high demand. Firstly, the historically low mortgage rate of 1,65%. Due to this low mortgage rate buying a house now is particularly attractive. Because you need to pay less interest on your purchase amount, you can spend a higher amount of your home. In short, you get more value for money. Secondly, demographics. In recent years the Dutch population has grown significantly, even more than predicted by the Central Bureau of Statistics. People are becoming older, and even though the birthrate is going down, the number of immigrants is increasing with such a rate that the total population is growing. Especially in the Randstad area due to all the amenities in the close vicinity, adding to its popularity e.g. demand. Lastly, another factor that needs to be taken into account: the number of households. The average household size has been decreasing since 1995 (figure 10). Resulting in more households, meaning even more houses are needed.

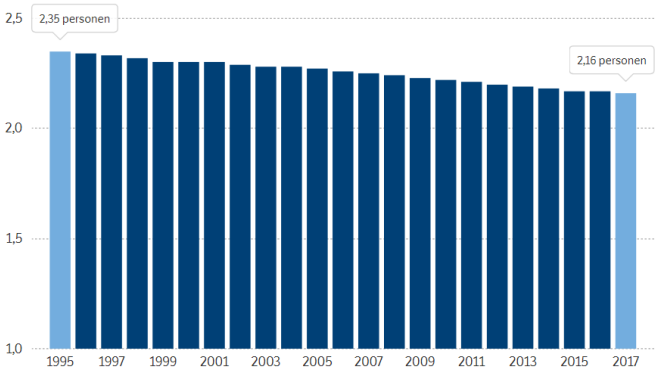


Figure 10, Average household size in the Netherlands (Source: CBS, 2017)

When the number of households only increased in recent years, the number of new homes lacked behind. While around 80,000 homes were needed, between 45,000 and 55,000 homes were added figure 11. Therefore, experts say the one true solution is to scale up building production (NOS, 2017). According to NVM spokesman Roeland Kimman (2017) there are 200.000 homes necessary right now and 1 million new homes must be realized in 2040 to keep up with demand (PBL, 2017). However, within the Randstad there are limited building locations due to the fully developed VINEX locations. According to TU Delft Professor Peter Boelhouwer a significant amount of the much needed new supply to cool down the housing market can be created through transformation of obsolete buildings.

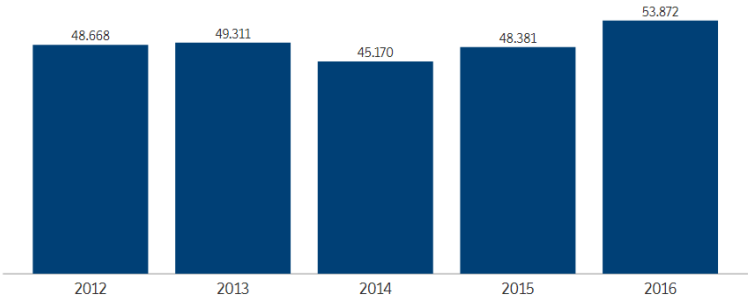


Figure 11, Residential building production in the Netherlands (Source: CBS, 2017)

Transformation

Part of the vacancy problem and the shortage of housing can be solved by transforming buildings into houses in a sustainable way. The transformation of buildings is nothing new and has been done since the existence of buildings. Transformation of real estate is the conversion of offices, shops, or business premises to another function, usually residential.

> *Transformation, "a complete change in the appearance or character of something or someone, especially so that that thing or person is improved" (Cambridge Dictionary, 2017).*

This definition fits in seamlessly with the transformation of vacant real estate. The changing of (structurally) vacant office buildings or buildings with a social function (education, care) transformed into living space or another function resulting in an improvement. This improvement lies in various social advantages. Primarily, vacancy is being combated and housing supply is being created. An empty office can eventually have a negative effect on the living environment; deterioration, vandalism, and feelings of insecurity around the building are lurking. When vacant offices get a function or a mix of functions, for example living, business and catering, this can improve the quality of life in the area. Moreover, with permanent transformation, savings can be made on the construction time and construction costs compared to new construction because the structure is already present. Which is good from a sustainability point of view. If it concerns an appealing building, in terms of architecture or cultural-historical value, this can also offer added value for residents. One reason for the fact that vacant offices are not yet being transformed on a large scale is that not every vacant office is suitable for transformation either temporary or permanent. This is due to technical, legal, and financial reasons. Transforming the vacant office property offers opportunities. For example, between 2010 and 2014 1.8 million square meters of office space were transformed, most of which were homes (1.1 million m²) and hotels (0.5 million m²) (JLL, 2015). There is too little space in the Netherlands to meet this housing question unlimited by means of new construction. The VINEX locations are full and the demand from the user is to live in the city. In addition, it would be irresponsible to demolish buildings that are no longer useful for the original function and replace it with new ones. This can lead to capital destruction in the cultural and economic spheres. We could lose many beautiful and distinctive buildings, and the environment is also heavily burdened.

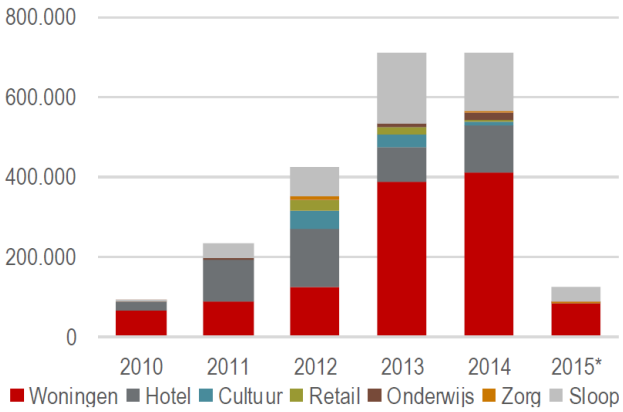


Figure 12, Take up dynamics per annum (Source: JLL, 2015)

These developments are occurring less in the smaller towns/cities. In these smaller cities only 330,000 m² have been transformed between 2010 and 2014 (JLL, 2015). On the one hand, this can be explained by the fact that within the small cities there is less demand from other segments, such as housing or hotel markets. On the other hand, the location or quality of office property is often insufficient. If office property has no alternative use, demolition seems to be the only viable solution. Due to the demolition of the office property, one can re-issue the land for development. Over the last five years, 470,000 m² of office space have been demolished, of which 165,000m² are in the small towns (JLL, 2015).

Influencing factors

In transformation projects of structural vacant office space to residential there are three interconnected factors that affect its success and failure. These are locational factors, market demand for housing and building properties.

Transformation feasibility tools

There are many tools that have incorporated the influencing factors in model in order to give a clear overview of what an actor should think of take care of. The tool that covers the most aspects is the Conversion Meter 2017 *(Geraedts, R.P., D.J.M. van der Voordt and H. Remøy, 2017).*

As shown in the figures below the conversion meter 2017 incorporates a lot of factors and parameters affecting transformation from offices to housing. This will be the tool used to measure the transformation potential of the city of Rotterdam. This follows op on the research and development of the tool which is described by its makers:

> *Further testing of the new Conversion Meter in current Dutch cases is relevant too. Additional case studies in the Netherlands and in other countries will provide a better insight in the impact of national and local legislation and the economic and cultural context. The same counts for the financial feasibility scan (Step 4) and financial ratios. The practical applicability of the Conversion Meter may be improved by digitizing the tool and by adding photos, sketches, and boxes with lessons from case studies to illustrate the criteria and risks checklist. Another topic is to explore the need for extra modules looking at particular issues such as sustainability. Finally, the criteria could be linked to tools for adaptable buildings in order to make future conversions functionally and technically simpler and less expensive. Buildings that support the possibilities of adaptive reuse are more ready to change and make it easier to cope with an ever-changing real estate market and as such will contribute to a more resilient built environment (Geraedts, R.P., D.J.M. van der Voordt and H. Remøy, 2017).*

The figures below show all the aspects that the conversion meter 2017 incorporates when measuring the transformation potential towards residential of a structural vacant office building. The parameters are divided in the three main aspects influencing transformation: location, building and market. With each step more sub parameters of each of the three main aspects are tested.

Location (housing environment)	Building (residential)	
1. Atmosphere a. Nature of built environment b. Social image c. Liveliness d. Available green space	1. Dwelling type 2. Access 3. Dwelling size a. Number of rooms b. Living room c. Kitchen d. Bedrooms e. Sanitary facilities f. Storage space	9. General conditions a. Accessibility b. Safety c. Flexibility d. Adequate management
2. Facilities a. Shops b. Restaurants, bars, etc. c. Schools d. Bank/Post office e. Medical facilities f. Recreative facilities	4. Arrangement of dwelling 5. Level of facilities 6. Outside space (garden, etc.) 7. View from dwelling, privacy 8. Environmental aspects a. Heating b. Ventilation c. Noise d. Exposure to sun/daylight e. Energy consumption f. Materials used	10. Costs a. Purchase price/rent b. Other costs
3. Accessibility public transport a. Distance to bus stop b. Frequency and times c. Distance to tram/underground		
4. Accessibility by car a. Distance to motorway b. Congestion level c. Parking facilities		

Figure 13, Conversion meter 2017 (Source: Geraedts, R.P., D.J.M. van der Voordt and H. Remøy, 2017)

Step	Action	Level	Outcome
Step 0	Inventory market supply of unoccupied offices	Stock	Location of unoccupied offices
Step 1	Quick Scan: initial appraisal of unoccupied offices using veto criteria	Location Building	Selection or rejection of offices for further study; Go / No Go decision
Step 2	Feasibility scan: further appraisal using gradual criteria	Location Building	Judgement about transformation potential of office building
Step 3	Determination of transformation class	Location Building	Indicates transformation potential on 5-point scale from excellent to not transformable
Further analysis (optional, and may be performed in reverse order if so desired):			
Step 4	Financial feasibility scan using design	Building	Indicates financial/economic feasibility Sketch and cost-benefit analysis; Go / No Go decision
Step 5	Risk assessment checklist	Location Building	Highlights areas of concern in transformation plan; Go / No Go decision

STEP 1 QUICK SCAN: initial appraisal of unoccupied offices using veto criteria

Common target group independent criteria.
*Answer '**Yes**' (score = 1) is positive for conversion into homes. Answer '**No**' (score = 0) is negative for conversion into homes*
The user of this checklist could reconsider if these criteria actually lead to a veto decision.
If one of the veto criteria concerned lead to the assessment 'No', the conversion into housing is cancelled.
In that case the next step 2 (Feasibility scan: further appraisal using gradual criteria) is no longer applicable.

ASPECT	VETO CRITERION	DATA SOURCE	Assessment Yes	No
VETO CRITERIA MARKET				
1 Demand for housing	1 There is a demand for housing of local target groups	Estate agent or municipality	☐	☐
VETO CRITERIA STAKEHOLDERS				
2 Initiator (advisor)	2 Presence of enthusiastic influential instigator	Local investigation	☐	☐
3 Developer	3 Does meet criteria for region, location, accessibility	Property developer	☐	☐
	4 Does meet criteria on size and character of building	Property developer	☐	☐
4 Owner	5 Willingness to sell the building	Owner	☐	☐
5 Investor	6 Willingness to buy and transform the building	Investor	☐	☐
6 Municipality	7 Positive attitude of the municipality	Municipality	☐	☐
VETO CRITERIA LOCATION				
7 Urban location	8 Zoning plan permits modification	Zoning plan, policy of municipality	☐	☐
	9 No serious public health risk (pollution, noise, odour)	Estate agent or on site inspection	☐	☐
VETO CRITERIA BUILDING				
8 Dimensions of skeleton	10 Free ceiling height > 2.60	Estate agent or on site inspection	☐	☐
		RESULT QUICK SCAN:	**0**	**0**

STEP 2 FEASIBILITY SCAN: further appraisal using gradual criteria

*Answer '**Yes**' (score = 1) is positive for conversion to homes. Answer '**No**' (score = 0) is negative for conversion into homes*
The user of this checklist could reconsider if on of these these criteria actually has to be a veto criterion.
If so, then this criterion switches to Step 1 and the other way around.

LOCATION

ASPECT	GRADUAL CRITERION	DATA SOURCE	Assessment Yes	No
FUNCTIONAL				
1 Urban location	1 Building in suitable area (not remote industrial or offices area)	Town map / Google Maps	☐	☐
	2 Good daylight/sunlight possibilities	On-site inspection	☐	☐
	3 Good view from building, > 75% floor space	On-site inspection	☐	☐
2 Distance and quality of facilities	4 Shop for daily necessities < 500 m.	Local investigation / Google Maps	☐	☐
Remark:	5 Neighbourhood meeting-places (square, park) < 500 m.	Local investigation / Google Maps	☐	☐
The quality of facilities can be described in terms	6 Food service industry (bar, café, restaurant) < 500 m.	Local investigation / Google Maps	☐	☐
of quality, a wide variety and the number of	7 Bank / post office < 5 km.	Local investigation / Google Maps	☐	☐
different facilities	8 Basic medical facilities (practice, health centre) < 2 km.	Local investigation / Google Maps	☐	☐
	9 Sports facilities (fitness, swimming pool, sports park) < 2 km.	Local investigation / Google Maps	☐	☐
	10 Educational facilities (from kindergarten to university) < 2 km.	Local investigation / Google Maps	☐	☐
3 Accessibility by public transport	11 Distance to railway station < 2 km.	Town map / Google Maps	☐	☐
	12 Distance to bus, tram, underground < 1 km.	Town map / Transport services	☐	☐
4 Accessibility by car and parking facilities	13 Good flow, normal street quality	Local investigation / Google Maps	☐	☐
Obstacles: bottlenecks or thresholds in roads, bridges	14 Distance to parking sites < 250 m.	Local investigation / Re-design	☐	☐
Flow: 1-way traffic, no parking, traffic jam	15 > 1 parking lot/100 m2 office space	Local investigation / Re-design	☐	☐
CULTURAL				
5 Representative impression	16 Situated centrally (not near highway locations)	Town map / Google Maps	☐	☐
Remark:	17 Other buildings present in direct neighbourhood	Town map / Google Maps	☐	☐
Assessment of location dependent of target group	18 Lively neighbourhood	On-site inspection / local press	☐	☐
E.g. Youngsters not in mono-functional area	19 Direct availability of green environment	Local investigation / Google Maps	☐	☐
E.g. 55+ not outside city centre	20 Area has a good reputation/image; no vandalism	On-site inspection / local press	☐	☐
Related to impression of building	21 Area has good air quality and low pollution and noise hindrance	On-site inspection / local press	☐	☐
LEGAL				
6 Urban location	22 Noise load on façade < 50 dB (e.g. max. for office building is 60 dB)	Municipal authorities	☐	☐
7 Ownership of location	23 Land in property or with short lease	Estate agent / municipality	☐	☐

Total Location (=number Yes):	0	x
Default weighting:	5	=
Maximum Score Location:	115	
FEASIBILITY SCAN LOCATION:	**0**	**A**

Maximum score for Location (with default weighting 5) = 23 x 5 = 115

Figure 14, Conversion meter 2017 (Source: Geraedts, R.P., D.J.M. van der Voordt and H. Remøy, 2017)

STEP 2 FEASIBILITY SCAN: further appraisal using gradual criteria

*Answer **'Yes'** (score = 1) is positive for conversion to homes. Answer **'No'** (score = 0) is negative for conversion into homes*
The user of this checklist could reconsider if on of these these criteria actually has to be a veto criterion.
If so, then this criterion switches to Step 1 and the other way around.

BUILDING

ASPECT		GRADUAL CRITERION		DATA SOURCE	Assessment Yes	Assessment No
FUNCTIONAL						
1	Year of construction or renovation	1	Building > 3 years	Year of construction		
		2	Building renovated > 3 years	Year of last renovation		
2	Vacancy	3	Complete building is vacant	Estate agent		
		4	Building vacant > 3 years	Estate agent		
3	New housing	5	Capacity building > 20 1p-units / 50 m2	≥ 1000 m2 floor space		
		6	Lay-outs adaptable for local target groups	Sketch design		
4	Extendibility	7	Horizontal extension building possible (neighbouring buildings)	On-site inspection / Google Maps		
		8	Vertical extension building possible (no inclined roof/light construction)	On-site inspection / estate agent		
		9	Possibilities for constructing basement	On-site inspection / estate agent		
CULTURAL						
5	Representative impression	10	Identifiable compared to surrounding buildings	On-site inspection		
	Related to impression of location	11	Own identity realisable	On-site inspection / re-design		
6	Cultural heritage	12	Being not a cultural heritage: simplifies transformation	Municipality / Authorities		
7	Access (entrance, elevators, stairs)	13	Clear, safe and clarifying building entrance	On-site inspection / re-design		
TECHNICAL						
8	Condition of maintenance	14	Well maintained; maintenace up-to-date	On-site inspection / facades		
9	Dimensions of support structure	15	Depth of building < 10 m.	On-site inspection / estate agent		
	E.g. Facade grid size determines location inner walls	16	Grid support structure > 3.60 m	On-site inspection / estate agent		
		17	Height dimension between floors < 6.00 m	On-site inspection / estate agent		
10	Support structure (walls, columns, floors)	18	Condition support structure is good / not hazardous	On-site inspection / estate agent		
11	Facade	19	Possible connection inner walls on grid < 5.40 m.	On-site inspection / estate agent		
	External living space dependant of target group	20	Facade/openings well adaptable	On-site inspection		
	Cultural heritage: limited / no adaptability	21	Facade windows can be reused / opened	On-site inspection / re-design		
12	Installations	22	Sufficient service ducts can be constructed	On-site inspection / re-design		
LEGAL						
13	Environment	23	Absence of large amount of hazardous materials in building	On-site inspection / municipality		
	Exposure to sunlight, air, noise pollution, hazardous materials	24	Acoustic insulation of floors > 5 dB	On-site inspection / re-design		
		25	Good thermal insulation of facades and roof	On-site inspection / municipality		
		26	Sufficient daylight factor > 90% floor surface new units	On-site inspection		
14	National Building Decree, escape and access routes	27	Elevators available / easy realisable in building (> 4 stories)	On-site inspection / estate agent		
		28	(Emergency) stairways available / realisable	On-site inspection / re-design		
		29	Distance of new units to stairs/elevators < 50 m.	On-site inspection / re-design		

Maximum score for Building (with default weighting 3) = 29 x 3 = 87

Total Building (=number Yes):	0	x
Default weighting:	3	=
Maximum Score Building:	87	
FEASIBILITY SCAN BUILDING	0	B

STEP 3: DETERMINATION CONVERSION POTENTIAL CLASS OF OFFICE BUILDING

CONVERSION SCORE	CONVERSION CLASS
Conversion Score Location + Building = 0 - 40	Class 1: No transformation potential
Conversion Score Location + Building = 41 - 80	Class 2: Hardly any transformation potential
Conversion Score Location + Building = 81 - 120	Class 3: Limited transformation potential
Conversion Score Location + Building = 121 - 160	Class 4: High transformation potential
Conversion Score Location + Building = 161 - 202	Class 5: Excellent transformation potential

Total Score Feasibility Scan A + B:	0
Maximum Score Location + Building = 115 + 87 =	202
CONVERSION CLASS	1

Dwelling types and Residents	Low level of interventions		High level of interventions	
	Construction costs	Purchase costs	Construction costs	Purchase costs
Student room	460 - 620	230 - 310	550 - 740	140 - 190
Studio	620 - 930	310 - 460	740 - 1110	190 - 270
2/3-room apartment, young couples	770 - 1030	380 - 520	930 - 1230	190 - 260
4-room apartment, young couples	770 - 1150	380 - 570	930 - 1380	270 - 400
3-room apartment, senior citizens	370 - 560	180 - 270	450 - 660	110 - 170
4/5-room apartment, senior citizens	500 - 1150	250 - 570	600 - 1380	140 - 340

Figure 15, Conversion meter 2017 (Source: Geraedts, R.P., D.J.M. van der Voordt and H. Remøy, 2017)

Dwelling types and Residents	Rent/month of dwellings	Feasible investment per unit	Feasible investment per m2/RFA	Feasible investment per m2/GFA
Student room	176 - 242	35.580 - 53.370	1.100 - 1.460	770 - 1.010
Studio	242 - 352	53.370 - 77.090	1.460 - 2.170	1.010 - 1.540
2/3-room apartment, young couples	605 - 825	130.460 - 177.900	1.920 - 2.300	1.300 - 1.720
4-room apartment, young couples	825 - 1100	177.900 - 237.200	1.920 - 2.5.50	1.300 - 1.900
3-room apartment, senior citizens	440	88.950	940 - 1.200	590 - 950
4/5-room apartment, senior citizens	605 - 1210	130.460 - 260.920	1.300 - 2.550	830 - 1.900

MARKET & LOCATION		RISC	POSSIBLE SOLUTION
1. Functional	1	Insufficient parking places	Dependant of target group; consultation about parking rules; consider parking basement
	2	Lack of facilities	Low scale facilities in building; collaboration with other stakeholders
	3	Absence public transport	Consulting public transport companies; collaboration with other stakeholders
	4	Unclear routing to building	Analysis neighbourhood; replacement main entrance or adding extra entrance
2. Cultural	5	Bad reputation or unsafe neighbourhood	Improvement neighbourhood in collaboration with other stakeholders; choice for specific target group
3. Technical	6	Annoyance of odour	Specific insulation of facades concerning
	7	Annoyance of noice	Possibilities for dispensation; extra noise insulation facades; extra membrane façade
4. Legal	8	Zoning plan change/procedure	Consulting local authorities; assessment of local policy and regulations
	9	Ground posession/lease	Unfavourable for development ground value; trying to reimburse ground lease
	10	Ground pollution	Clear ground declaration by owner; negotiating lower ground selling price due to cleaning ground costs
	11	Restriction maximum building height	Research for possibilities horizontal extension possibilities
5. Financial	12	Purchasing price dwellings to high	Extra benefits trough combination with commercial functions; redesign plot; other target group
	13	Bad lettability of dwellings	Improvement price/quality ratio; choice for other target groups
	14	Necessity of other, new facilities	Enhance financial feasibility by adding commercial functions
STAKEHOLDERS			
1. Initiator	15	Absence of enthusiastic influential initiator	Search for experienced instigator at other successfull locations, realised projects
2. Developer	16	Does not meet criteria for region, location, accessibility	Consulting and convincing property developer; search for other property developer
	17	Does not meet criteria on size and character of building	Consulting and convincing property developer; search for other property developer
3. Owner/investor	18	Not willing to sell the building	Consulting and convincing owner on realistic costs and benefits of building staying vacant

Figure 16, Conversion meter 2017 (Source: Geraedts, R.P., D.J.M. van der Voordt and H. Remøy, 2017)

BUILDING		RISC	POSSIBLE SOLUTION
1. Functional	1	False presuppostion with possibilities building	Analysis form factors, key rations, data; gross/nett floor area; extension possibilities (horizontal/vertical)
	2	Building depth to small	Adaptation layouts; enlanrgement depth by new foundation/facades; adding external gallery
	3	Building depth to large	Adaptation layouts; adding new open inner space (daylight) centralise entrances
	4	No basement available (f.i. for parking places, storage space)	Adding basement (dependant of foundation and access possibilities)
	5	Floor height to large	Use of lightweight mezzanines, combined with lightweight interior walls
	6	Windows can not be opened	Replacement windows; façade renovation
	7	Less connection possibilities for inner walls at facades	Connectable inner walls till complete façade renovation
	8	Lack of outdoor space	Target group dependant; French balconies; recessed parts façade; inner garden
	9	Insufficient elevators/stair cases (access and escape routes)	New elevators/stair cases within or extern building
	10	Insufficient access possibilities	Analysis different access possibilities (portico, gallery, inner corridor, central)
	11	Qualititive/quantitative insufficient existing inner walls	Adapt existing walls; adding new walls (future adaptability)
	12	Insufficient waterproofness for bathrooms	Waterproof finishing floors; use of prefab (plastic) bathrooms
2. Cultural	13	Limitations by monumental status	Early consulting with monumental agency and local government
	14	Insufficient distinguishability of building	Adding new façade (parts), balconies, dwelling entrances
	15	Insufficient distinguishability of building entrance	Emphasise by louver or something likewise; replacement to other location
3. Technical	16	False presuppostion with (quality of) construction status	Analysis construction status on site (design, condition, finishing, maintenance)
	17	Insufficient air climat facilities	Replacement/renewal adjusted to dwellings; individual md op woningen; individueel operated
	18	Insufficient piping, tubes and shafts	Extension (fire resistant walls between dwellings; holes in existing floors)
	19	Insufficient water supply facilities (f.i. need dwellings > offices)	Extension facilities (individual controlable and measurable)
	20	Insufficient electricity facilities	Extension facilities (individual controlable, measurable)
	21	Insufficient noise insulation of floors	Enhance floor insulation by double floors and/or double ceilings
	22	Insufficient thermal insulation of facades	Extra insulation outside or inside façade (monumental status); mind adapting windows
	23	Insufficient thermal insulation of windows	Replacement by double glazing; extra secundairy frame; extra membrane façade Inside or outside)
	24	Insufficient thermal insulation of facades of roof	Insulation existing roof (inside/outside); replacement by new roof; combine with vertical extension
	25	Presence of moisure, humidity	Analysis causes; humidity, leakage, condensation
	26	Bad flushing in facades	Cleaning façade; new flushing (partly of total)
	27	Insufficient daylight and sunlight (< 10% floor surface)	Implement inner corridors, extra holes in floors, bay windows, new large windows; ask for dispensation
	28	Bad/dangerous support structure	Reconstruction; extra reinforcement, steel, gunned concrete, assistant construction; fire resistance
	29	Limited carrying capacity or bad foundation	Reconstruction (extra piles, foundation)
	30	Insufficient carrying capacity for vertical building extensions	Implementation of lightweight construction (steel or timber frame) for new floor levels
4. Legal	31	Presence of asbestos; costly removal by requirements	Negociation lower selling price, demanding asbestos free declaration by seller of building
	32	Restrictions possibilities by (local) regulations	Dispensations: outer space, ceiling height, entrance/access, daylight, insulation
	33	Uncertainty/vagueness about building permittance	Early local communication about demands and information to be delivered
	34	Insufficent imbedding fire safety requirements	Early local communication about (access, fire escape routes, etc.)
5. Financial	35	Building difficult to buy/acquire	Step by step purchase; at first ground lease, in a later stage poseesion; collective purchase with other stakeholders
	36	Large investment in initial phase (advisors,feasibility study)	Financial feasibility study
	37	Difficult feasibility (f.i. building is too small)	Analysis of extension possibilities; combinations with other (commercial) stakeholders; search for subidies
	38	Risk of vacancy; impoverishment (f.i. long lasting development)	Limitation of vacancy period through temporary let of (parts of) building

Figure 17, Conversion meter 2017 (Source: Geraedts, R.P., D.J.M. van der Voordt and H. Remøy, 2017)

Rotterdam

Rotterdam is a port city located in the province Zuid Holland in the western part of the Netherlands. Just as the Netherlands has regional differences in the real estate market so does Rotterdam. In figure 18 the various districts are highlighted. Each district has its own characteristics and identity, resulting in different building typologies.

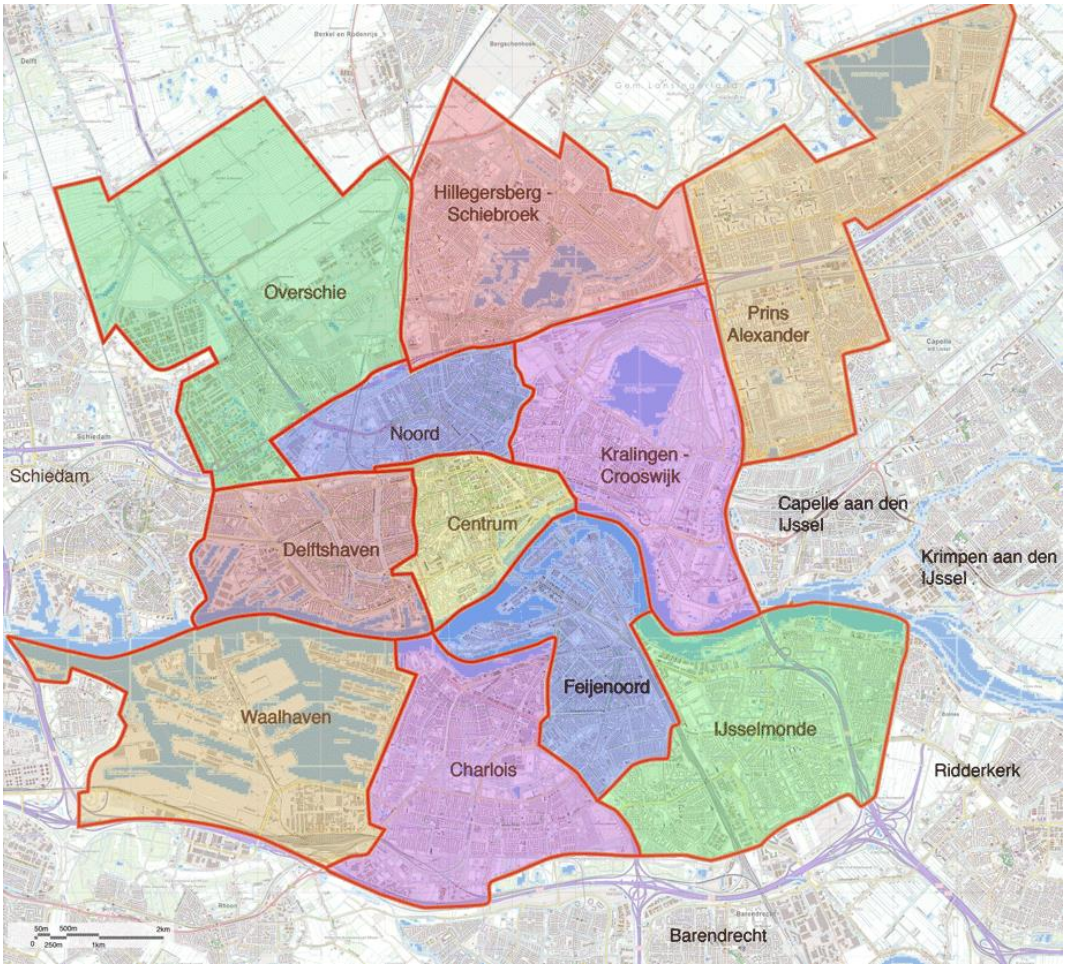


Figure 18, map of districts in Rotterdam (Source: http://zerotenexpat.nl/2015/11/neighborhoods-rotterdam-live/)

Centrum (City Center)

The Centrum district is literally the center of the city and therefore sits right in the middle. It is surrounded by the districts Delfshaven on the west, Noord in the north, Kralingen-Crooswijk on the east, and the river De Maas on its south side. Centrum is where you will find the highest density of shopping, hotels, restaurants.

Kralingen-Crooswijk

Not very long ago Kralingen was the place where the upper class lived and recreated, resulting in it having very nice and spacious houses and a lot of greens and gardens. Some of the most prestigious and expensive real estate in the country is located in (the east of) Kralingen. Nowadays, most of the houses have been converted to student homes which are conveniently located close to the Erasmus University. Crooswijk however has a lot more social housing and is much more culturally diverse and dynamic.

Noord
Noord is a very popular place for students, and also has its share of social housing. It has a vibrant cultural life especially closer to the Central district.

Delfshaven
Delfshaven is one of most cultural areas of Rotterdam. Since it was 'missed' by the Luftwaffe in the war, it still has the typical landmarks that you will find in most other Dutch cities.

Prins Alexander
Prins Alexander is a typical residential area with fine schools, a lot of shopping malls and good connections to the city.

Hillegersberg-Schiebroek
This part outside of the city is a mix of larges estates in Hillegersberg and affordable housing in Schiebroek.

Overschie
Overschie is almost a village in that it is sparsely populated and almost quaint. It does suffer somewhat from the A13 highway and airport Zestienhoven.

Feyenoord, Charlois & IJsselmonde
Home to the biggest football club in the city, these three folksy port worker neighborhoods are vibrant and culturally diverse neighborhoods. Their safety records have not been too good historically speaking, but the last few years things are moving in the right direction after a number of programs.

Waalhaven
A part of Rotterdam's enormous harbor. Not a lot of other things going on here apart from a few temporary events like pop up restaurants and concerts. Still more port then city.

Office Vacancy in Rotterdam
In Rotterdam 926.000 sqm of the total office supply is left vacant. This is mainly due to wrong location, bad energy performance or a poor external appearance (PropertyNL, June 2017, p.14). With 19%, vacancy rates are above average in office real estate (PropertyNL, June 2017, p.14). The national average being around 14% (CBRE Research, 2017).

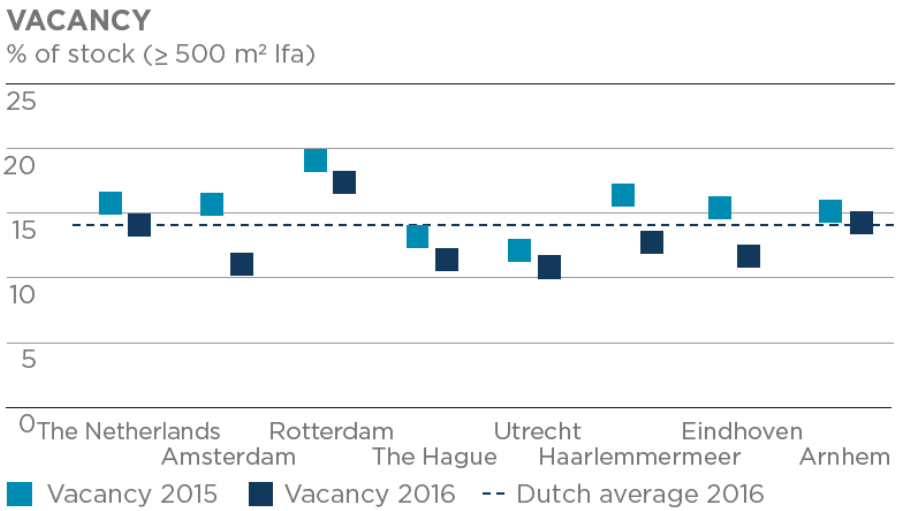


Figure 19, Vacancy rates per Dutch city (Source: Cushman & Wakefield, 2017)

As shown in figure 20, An advantage of the Rotterdam office market is that more than half of the vacancy is in and close to the city center, in other words suitable locations for redevelopment (Nederpelt, 17-12-2015).

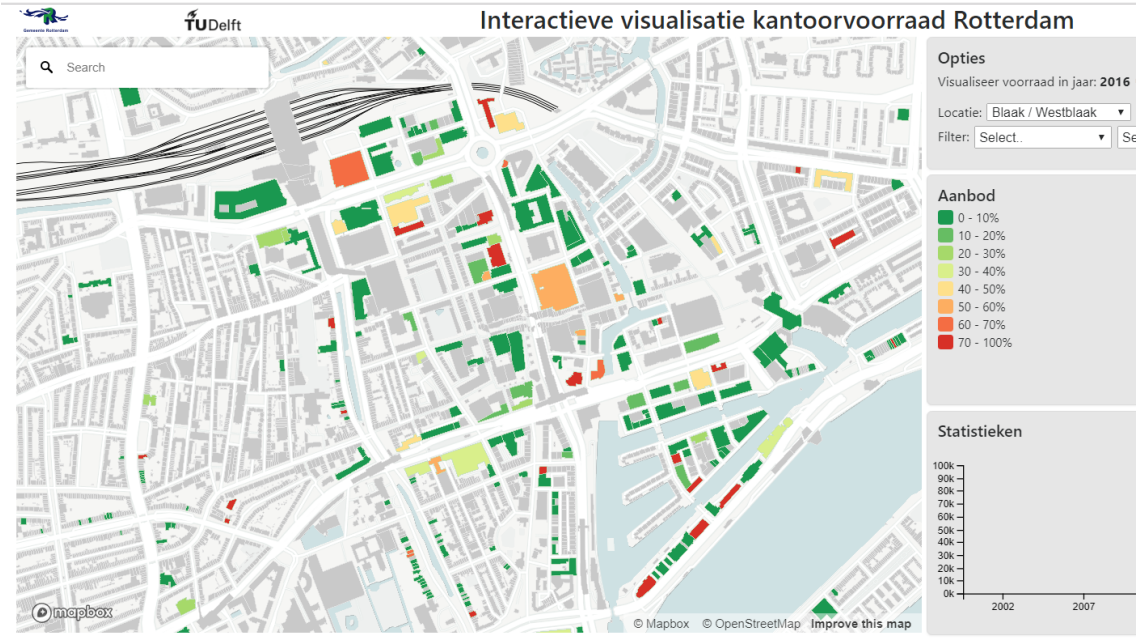
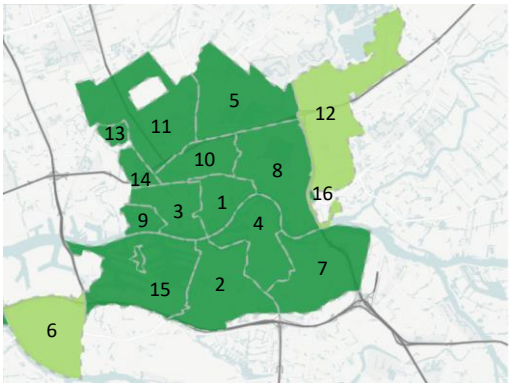


Figure 20, Interactive map of vacancy in Rotterdam (Source: TU Delft, 2017)

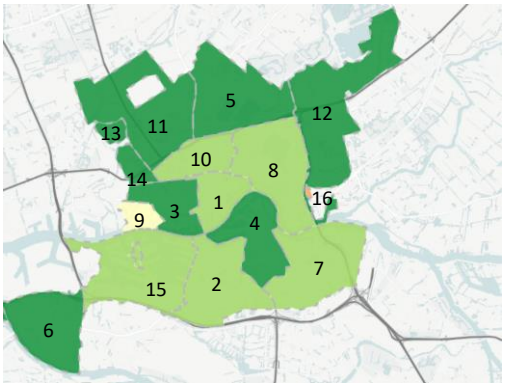
The table below shows the office stock supply and vacancy rates per district in Rotterdam. This table confirms that the highest vacancy rates are in and around the city center, good locations for transforming these objects from office space to residential.

	District	Number of buildings	Stock	Supply	Vacancy %
1	Centrum	309	1.465.085	323.910	22,1
2	Charlois	26	58.180	21.335	36,7
3	Delfshaven	69	99.630	9.695	9,7
4	Feijenoord	30	386.665	43.395	11,2
5	Hillegersberg-Schiebroek	12	16.970	2.305	13,6
6	Hoogvliet	23	43.135	7.340	17,0
7	Ijsselmonde	18	39.935	11.125	27,9
8	Kralingen-Crooswijk	77	228.425	42.225	18,5
9	Nieuw Mathenesse	5	78.120	49.680	63,6
10	Noord	26	92.600	14.640	15,8
11	Overschie	14	46.590	6.905	14,8
12	Prins Alexander	76	254.480	63.605	25,0
13	Rotterdam Noord-West	20	35.725	10.305	28,8
14	Spaanse Polder	13	44.465	8.065	18,1
15	Waalhaven-Eemhaven	42	129.570	17.880	13,8
16	Rivium	8	44.835	9.345	20,8

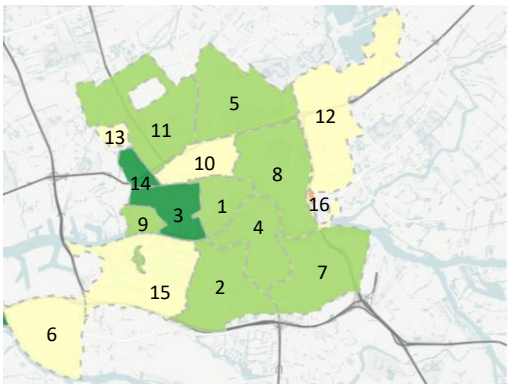
Table 1, Vacancy per district in 2016 (Source: TU Delft, 2017)



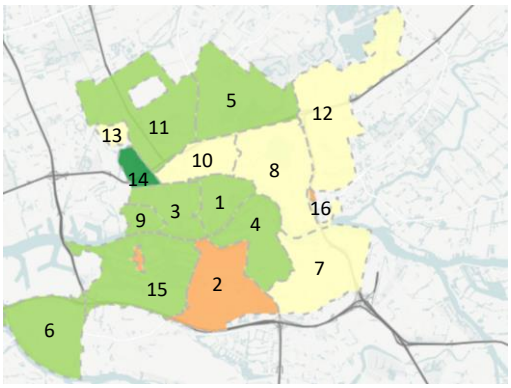
2002



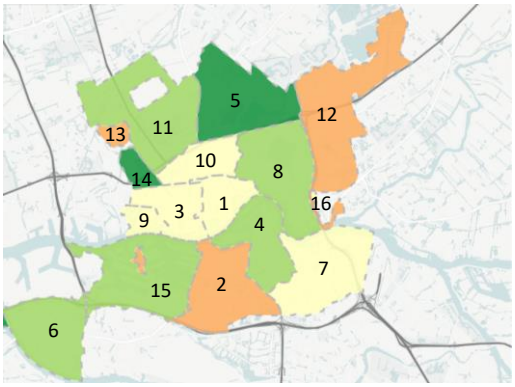
2007



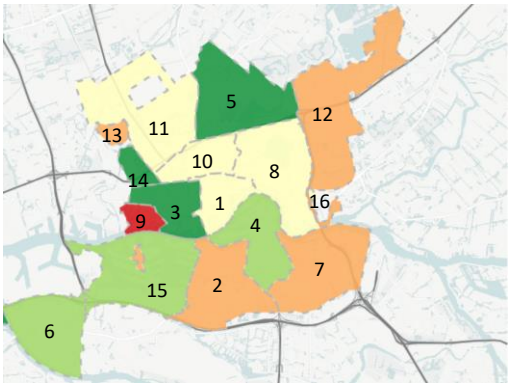
2012



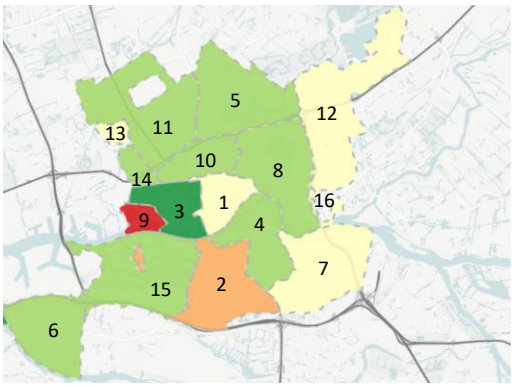
2013



2014



2015



2016

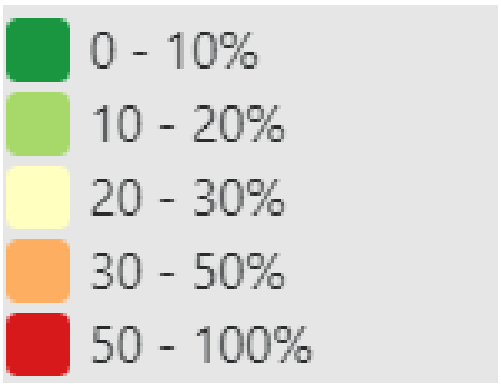


Figure 21, Maps of office vacancy per district in Rotterdam 2002 – 2016 (Source: TU Delft, 2017)

Rotterdam's housing market

The trends previously described on the housing market are also occurring in Rotterdam. Prices are rising stronger in the big cities compared to the rest of the Netherlands. On top of that houses are being sold quicker and often above asking price. Sometimes even without reservation of funding or a building report. These are all signs of an overheating market (Paul Wessels, PropertyNL August 2017 p.60). Due to its increased popularity supply can not keep up with demand. In 2015, Rotterdam had 624,000 inhabitants and in 2016 another 629,000. Growth has been particularly rapid in recent years. The number of residents has increased by 33,500 since 2008. This strong increase will continue. Forecasts show that 2030 in Rotterdam is growing to 676,000 inhabitants. In addition to this population growth, an increase in the number of households can be expected.

The City of Rotterdam claims it is building at least 30.000 homes within ten years. Meaning 3.000 new homes each year for the next 10 years. However due to increasing popularity this number will not be sufficient to keep up with the current high demand according to alderman Robert Simons. Therefore, the municipality is aiming to build a total of 50.000 residential units by 2040 (Algemeen Dagblad ,2017). This however comes down to only 2.500 new homes per year. Taking the median of 2.750 new homes per year it is still questionable where to build this amount of new homes. It is hard to find locations due to the city's limited land ownership. Most 'easy' VINEX-locations (Vierde Nota Extra) are mostly developed. Therefore, it is to be expected that the density of certain inner-city locations will be raised (Simons, 2017). The municipality of Rotterdam is aiming to build at least 30.000 new homes in the middle and high segment between now and 2030 (Woonvisie Rotterdam, 2016). This takes shape via:

- new construction at mooring locations, old port sites and restructuring locations;
- transformation of existing real estate, such as offices, schools, retail spaces / plinths and care homes spread throughout the city;
- more market-based rents, if the (potential) value allows this already or through quality improvement and merging.

In the new construction and transformation program, we give priority to projects aimed at owner-occupied homes starting at € 180,000 (not only middle-sized, but also high-end sales) and rental properties with a price from € 711 to € 1000 per month. Supply remains far behind the demand in these segments.

Transformation market

As a result of the "Convenant Aanpak Kantorenleegstand", the municipality of Rotterdam, together with market parties, transformed or upgraded and reused approximately 300,000 m² of empty office in the past 5 years. A list of the transformation projects can be found in table XXX. In the next 5 years, 150,000 m² of vacant offices are expected to be transformed. Plans are already being made by market parties. An additional 90,000 m² will follow soon after.

The Municipality of Rotterdam actively pursues a policy against vacancy. The municipality helps to connect parties from the market, which would not normally come into contact with each other. But it also helps in connecting initiatives and ideas about buildings that are not directly picked up by the market themselves. The municipality is the partner in terms of rules, procedures, and permits and streamline the licensing process.

Developer	Project	Location	Contact
HD ontwikkeling			Jan Leentvaarlaan 30 Rotterdam 0104148667 info@hdgroep.nl
EGM Architecten		Hang 5 -6	EGM Architecten
Amvest	Glashaventoren	Glashaven 8	Amvest en Klunder Architecten
ABB Ontwikkeling B.V	De Nieuwe Admiraliteit		Molendijk 160 Sliedrecht 0184 - 495 495 info@abbbouwgroep.nl
Citypads	Marconitorens Lee Towers		Kleine Berg 41 Eindhoven +31 40 84 82 009 info@frvastgoed.nl info@citypads.nl
Kikx Development			Jan Leentvaarlaan 63 Rotterdam 0104755574 infor@kikxdevelopment.nl
Van Omme & de Groot	Erasmushuis African Inn Willem Ruyslaan	Coolsingel Christiaan de Wetstraat 5-19 Willem Ruyslaan 223-225	Heemraadssingel 223 Rotterdam 0104775811 info@vanomme-degroot.nl
Being Development	West 399	Westzeedijk 399	Ridderspoorweg 115 Amsterdam 0208202181
Accresco Vastgoed	Weena Living Prinsenpoort Parkhavenstad	Schaatsbaan / Weena ‘s Gravenweg Westzeedijk 387	Westzeedijk 395 Q Rotterdam 0108928410 Klantenservice@accrresco.nl
Bestran Vastgoed / Classic Appartments	Caland Estate	Calandstraat 25 Mauritsweg (boksman bv)	Westzeedijk 98A Rotterdam 0102850485
Maarsen Groep	Westerlaantoren	Westerlaan 10-65	Buitenveldertselaan 106 Amsterdam 020 540 7400 info@maarsengroep.nl

Table XXX, Transformation projects in Rotterdam. Office to residential.

Reflection

At the start when I was gathering sources on my topic of office transformation I was overwhelmed with the amount of information and research that was already there. I found it quite hard to find a research gap within this topic. However, after a lot of reading, going to the Rotterdam transformation congress and speaking to professionals and consulting my mentors I started to see where my research should go. The major thing was I had a lot of ideas, but these ideas did not quite get on paper the way I intended. I really had to force myself to sit down and write, rewrite, and reshuffle the wording some more. With the help of my two mentors and with just writing the research proposal and literature review got better bit by bit. Through this iterative process I have learned a lot about transformation with all its influencing factors, office vacancy and the housing market.

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