

The effects of foundation quality on residential housing value;  
a case study of the municipality of Rotterdam

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Daan Feldkamp

S3476448

d.feldkamp@student.rug.nl

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Version	1.1
Author	Daan Feldkamp
Supervisor	Em. Prof. Dr. Ed Nozeman
Assessor	Dr. Sarah Mawhorter
E-mail	d.feldkamp@student.rug.nl
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## ABSTRACT

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This paper employs a mixed methods analysis, co-combining hedonic pricing in the form of OLS regression and problem-centered expert interviews to infer the relationship between foundation quality and residential housing prices. A declining structural quality of a groundwork can have serious implications for the superstructure. This is hypothesized to be observed in transaction prices in the form of a discount. The municipality of Rotterdam, the Netherlands, forms the case study of focus for the research. Combining housing transaction data with foundation examination reports, property characteristics, and fixed effects by means of a hedonic pricing model serves the quantitative analysis. A sample of 921 microtransactions is used to reveal that a degradation of foundation quality of one on a scale of one to six is coupled with a -2.28% decrease in residential housing value. Further regression analysis illustrates that impairment to concrete foundations results in the most severe discount of -14.01% per level, relative to concrete foundations this price adjustment is -1.22% for non-piledriven groundworks. Supplementary expert interviews serve to corroborate these findings and situate them in a broader context. Additionally, consumer behavior, biases, and asymmetric information are explored in relation to the price-determining effects of foundations.

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## Keywords

foundations, housing value, structural quality, mixed methods, consumer behaviour

## **PREFACE**

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### **Disclaimer**

Master theses are preliminary materials to stimulate discussion and critical comment. The analysis and conclusions set forth are those of the author and do not indicate concurrence by the supervisor or research staff.

## CONTENTS

1. INTRODUCTION.....	5
1.1. Motivation.....	5
1.2 Literature review.....	6
1.3 Research problem statement.....	8
2. THEORY.....	11
2.1 Physical state of foundations .....	11
2.2 Foundation quality and residential price determination.....	13
2.3 Human behaviour, imperfect information, and home buying.....	13
2.4 Hypotheses .....	15
3. DATA & METHOD.....	16
3.1 Context .....	16
3.3 Descriptive analysis .....	18
3.4 Hedonic regression model .....	20
3.5 Qualitative expert interviews .....	23
3.6 Limitations.....	24
3.7 Ethical considerations .....	24
4. RESULTS .....	25
4.1 Regression models .....	25
4.2 Qualitative results.....	30
5. DISCUSSION.....	35
6. CONCLUSION .....	38
REFERENCES .....	40
APPENDIX A: COMPOSITION OF SEDIMENT LAYERS IN ROTTERDAM.....	46
APPENDIX B: CORRELATION MATRIX & VIF STATISTICS .....	48
APPENDIX C: RESIDUAL PLOTS .....	50
APPENDIX D: NOTATIONAL GLOSSARY .....	44
APPENDIX E: STATA DO-FILE.....	45
APPENDIX F: REGRESSION ASSUMPTION TESTS.....	49
APPENDIX G: INTERVIEW GUIDE.....	50
APPENDIX H: REGRESSION OUTPUT .....	52
APPENDIX I: INTERVIEW TRANSCRIPTIONS.....	53

## 1. INTRODUCTION

### 1.1. Motivation

Poor housing quality and associated restoration bills can bring homeowners into despair. This is particularly the case for structural foundation problems as these are synonym to substantial repair bills. A durable structure needs a solid foundation. The state of this groundwork can have serious impacts on the state of the construction above. Therefore, it can be expected that a poor foundation affects the quality of the residence and thus its valuation. Foundation problems are of specific concern to homeowners in the Netherlands. Due to the land's unique physical characteristics, it is exposed to high risks concerning foundation impediments (Schothorst, 1977). Specifically, subsidence is a high-risk factor (van den Born *et al.*, 2016; Willemsen, Kok & Kuik, 2020). Owing to the nature of its construction, a foundation lies hidden and its quality can be unknown. This deficiency of information can lead to a lack of transparency and price shocks when not addressed. Foundation problems are expected to culminate in substantial financial losses. The Kenniscentrum Aanpak Funderingsproblematiek (KCAF, 2021) determines that of the 7.7 million residential homes in the Netherlands, 1 million will currently, or in the future, experience foundation problems. The mitigation of these problems is estimated to cost between 40 and 60 billion euros. Therefore, to tackle the problem and improve the information provided to the market, various governmental and non-governmental institutions have addressed the situation. This culminated in the proposal of a foundation label similar to the one already in existence for efficient energy use. Such a label would provide clear and transparent insights into the quality of the groundwork as well as the eventual costs of mitigating the risks. Dialogs of implementing this measure have led to resistance from homeowners due to potential detrimental effects on the value of their assets (Paling, 2020). Moreover, the need for extensive foundation examinations poses a logistical and financial burden. Klaassen (2015), nevertheless, estimates that the consequences of doing nothing could be enormous with a new foundation costing around 10 – 30% of a home's value. Efficient markets rely on the free exchange of information (Hayek, 1945). This raises the following question: Does the quality of one's foundation relate to the value of its home? If so, does this imply that a downward price adjustment is expected when information regarding the state of foundations is considered during the purchase of a home? Answering these questions will provide insight into the way foundations are priced into home values and expose potential pricing mismatches. This research focuses on the impact of foundation quality on housing value in the Dutch context. Establishing the current magnitude of the pricing effect foundation quality exhibits will help further our understanding of the Dutch residential housing market. Besides this, it can function as a baseline measurement for future policy implementations.

## 1.2 Literature review

The academic investigation into the attributes that impact housing value has been extensive. Numerous factors that influence the price of housing have been empirically revealed. The most frequent method of quantitative analysis used within this body of literature is hedonic pricing. First used by Waugh (1928) to estimate the value of vegetables in Boston, this method looks at the attributes of an object which impacts its price. Looking at specific attributes of a house via this method has been done in an extensive body of real estate research. These hedonic models often include physical characteristics of the house as well as locational attributes. Prior quantitative research on the valuation of housing quality focuses on various dimensions.

Firstly, key influencers of the price that often emerge are the size and the age of a residence (Kagie & Wezel, 2007; Dale-Johnson & Philips, 1984). In a literature review, Sirmans, Macpherson & Zietz (2005) illustrate that the most common attributes included are: square feet, the number of stories, age, lot size, the number of bedrooms, fireplace, central air conditioning, basement, pool, deck, garage, brick exterior, time on the market, distance to CBD and time.

Secondly, research on the structural makeup of residences reveals factors that can impose premiums as well as discounts on the value of a residence. Papers that try to quantify structural depreciation by age have included more variables in the nature of structural makeup, quality, and maintenance (Francke & van de Minne, 2017). Correspondingly, Wilhelmsson (2008) estimates the effects of maintenance on housing value in Stockholm via a hedonic model. The results indicate that homes with consequent indoors & outdoors maintenance depreciate about 13% slower. This trend of maintenance improving the value might also be observed on the subject of foundations. Preceding literature suggests a clear link between the foundation quality, type, and damage to their superstructures. Peduto *et al.* (2017) exemplify this by analyzing settlement-induced housing damage using a neighborhood in Schiedam as a case study. They conclude that the damage recorded at 310 residential homes highlights structural inhibition due to subsurface movement. As a consequence, it can be argued that the quality of the groundwork and subsurface conditions of a residence are important determinants of its value. While the literature on the subject gets modest attention from the perspective of geotechnical engineering it presents a clear gap in real estate literature. Hitherto there is no academic publication on the economic effect of the state of foundations on structures. Waddell, Berry & Hoch (1993) do include the type of foundation as a control variable in their research on the implicit price of locations. They differentiate between Pier & Beam, Slab, and other foundations. The results indicate that Pier & Beam foundations have the highest price premium while the category other scores the poorest. Similarly, in a study looking into the justification of NIMBYism, Wassmer & Wahid (2019) apply a regression model that investigates the effects of new affordable housing on the existing housing stock. They include foundation type as a control variable. Consequently, they estimate that, in comparison with having no foundation, a foundation yields an

approximate house price premium of 30%. Furthermore, significant differences between types are observed with raised foundations experiencing the highest premium, and concrete slabs the lowest. Established literature hints at the existence of a relationship between the type of foundations and housing value. Still, these studies, like many others, do not control in any way for the quality and maintenance of the underpinnings of the structure. Furthermore, this topic remains unexplored in the Dutch context. Quantitative modeling with foundation quality labels and the type of foundation as a key independent variables would provide insight into these unexplored price-establishing forces.

Lastly, next to physical characteristics and maintenance levels, environmental influences are identified as determinants of a property's value. Sirmans, Macpherson & Zietz (2005), for instance, subsequently identify less common environmentally depending attributes like living in an earthquake zone, proximity to landfills, and hog farms. The risk of damage by environmental factors can negatively influence the demand for housing in an area. Nyce *et al.* (2015) describe this effect through a hedonic model utilizing the rise of insurance premiums due to environmental factors. They conclude that rising insurance premiums, due to environmental risks, can significantly decrease the value of properties. These assumptions are supported by Dumm, Sirmans & Smersh (2018) and Dumm *et al.* (2020) both studies focus on the risk of sinkholes finding that this environmental threat adversely affects housing prices in certain high-risk locations. In addition, Nicholls (2019) further illustrates the impacts of environmental disturbances on housing value including foundation condition. She signifies that the presence of invasive species, bacteria, and pests can damage structures and their foundations which leads to a decline in property value. The effects of these degrading factors differ between the composition of materials used and the age of a groundwork (Klaassen & Creemer, 2012). Overall, established literature hints at the existence of a relationship between foundations, the risk of damage, and housing value.

Furthermore, particularly within the Dutch physical landscape, the state of the foundation can lead to problems. Peat oxidation and the slow consolidation of clay particles due to the rigorous artificial draining of peat and clay soils cause the land to sink (Schothorst, 1977). Contrary to popular belief, the Netherlands was not always as low-lying as its name, and the contemporary landscape, suggests. This primarily materialized due to cultural influences like draining the land. Specifically, clay and peat soils are still subject to subsidence due to the settling of particles instigated by drainage and drought. The resulting impediment of foundation quality has been underrepresented in Dutch real estate literature. Per contra, prior academic literature on the effect of subsidence on housing value is present in the academic debate surrounding housing value, albeit minimal. Willemsen, Kok & Kuik, (2020) for example, estimate using a hedonic pricing method that the effects of subsidence on housing prices culminate in an average value loss of 6 percent in the cities of Rotterdam and Gouda. Likewise, Yoo & Perrings (2017) apply a hedonic model to residences in Phoenix, Arizona. They conclude that subsidence due to water depletion leads to a significant lowering of property values. Additionally, more general studies on



subsidence reveal its effects on foundations. For instance, van Hardeveld *et al.* (2018) state that real estate foundations are extra prone to damage due to the process of subsidence. Consequently, damage and financial costs due to subsidence can be extensive (Doornkamp, 1993). Future climate change and associated droughts are conjectured to increase the prevalence and magnitude of subsiding peat and clay (Brouns *et al.*, 2015; Harrison *et al.*, 2012). This will increase the extent of the problem and the costs of mitigation. Since preceding literature indicates that subsidence can lead to a decrease in property value, the quality of the foundation of a building might exhibit similar effects. Additionally, different types of foundations are expected to exhibit different characteristics and risks. Older wooden pile foundations, for instance, are found to be at a higher risk of degradation than their contemporary concrete counterparts (Klaassen & Creemer, 2012). Therefore, from these structural discrepancies, a potential housing value effect can be deduced. Nevertheless, analogously to foundation quality, no previous academic attention has been given to the potential price effects of foundation types in the Netherlands. The type and quality of foundation present a clear gap in the existing literature on housing value.

### **1.3 Research problem statement**

The research problem is to examine the association between foundation quality and residential housing value. Through analyzing preceding academic literature it can be inferred that there is an eventual effect to be discovered. The absence of academic research on the topic exemplifies the contribution this research can make to the broader academic debate. Specifically, it will elucidate the influences of foundations on consumer housing valuation. The following main research question will precede this endeavor:

- › *What is the effect of foundation quality on housing prices?*

This research will utilize and confine itself to the Dutch housing market as context. Residential owner-occupied housing units will form the sample. Transaction prices will form the proxy for the value of a residential property. This way we leave the rental market unaddressed since our interest goes out to residential housing valuation coming from demand for structures. Therefore, the focus will lie on owner-occupier demand which will aspire to set the right price for a residence and its attributes. The makeup of Dutch residential foundations differs across location and the age of structures. Several environmental, as well as anthropogenic factors, will ensure variation in foundation quality between cases. Other influential factors will be accounted for through the use of control variables. For these means, a cross-sectional dataset including sale prices and foundation quality measures will be attained. To achieve the desired empirical examination and further explore the subject, several sub-questions are answered to study the effect and provide context.

In figure 1 the research problem is visually represented via a conceptual model. Housing price, as the main proxy for value, is signified in white and will function as the dependent variable in the analysis. Factors that influence the value of a home, as elaborated upon by the literature review, are represented by the gray box in the top left. The structural makeup and quality of a residence are important determinants of its price (Sirmans *et al.*, 2005; Waddell, Berry & Hoch 1993). Furthermore, the level of maintenance is also observed to be important for the quality of structural components of a residence (Willhelmson, 2008; Francke & van de Minne 2017). Consequently, it can be conjectured that the same applies to foundations as an indispensable part of a structure. This phenomenon is explored using the following sub-question.

- › SQ1: *To what extent does foundation quality influence residential housing value?*

Several environmental hazards are determined to pose a risk to the structural quality of groundworks. Subsidence, a shifting water level, soil type, and ecological pests like bacteria can all inhibit the structural quality of a foundation (Willemsen, Kok & Kuik, 2020; Nicholls, 2019; Klaassen, 2008). Furthermore, the age and maintenance level of a foundation play a role in the determination of its condition. The factors that determine a foundation's condition can be observed in figure 1 in red, signifying their potential inhibiting influence. Therewithal the physical characteristics of a groundwork can influence its structural quality, and therefore, the quality of its superstructure. Discrepancies between the material, building technique, and age are shown to exert different influences on the state of groundworks (Peduto *et al.*, 2016). For instance, a residence with a dated groundwork is extra prone to subsidence, ergo, at a higher risk of structural damage. Hence, one could argue that the type of foundation can affect its quality. Consequently, this might induce divergences between the valuation of properties between types. Interactions between structural types and their structural quality can reveal differences in foundation characteristics. Therefore both quality, type, and the interaction between these variables can hypothetically influence the price of residences. In accordance, the second sub-question is formulated as follows:

- › SQ2: *To what extent does foundation type influence foundation quality and residential housing value?*

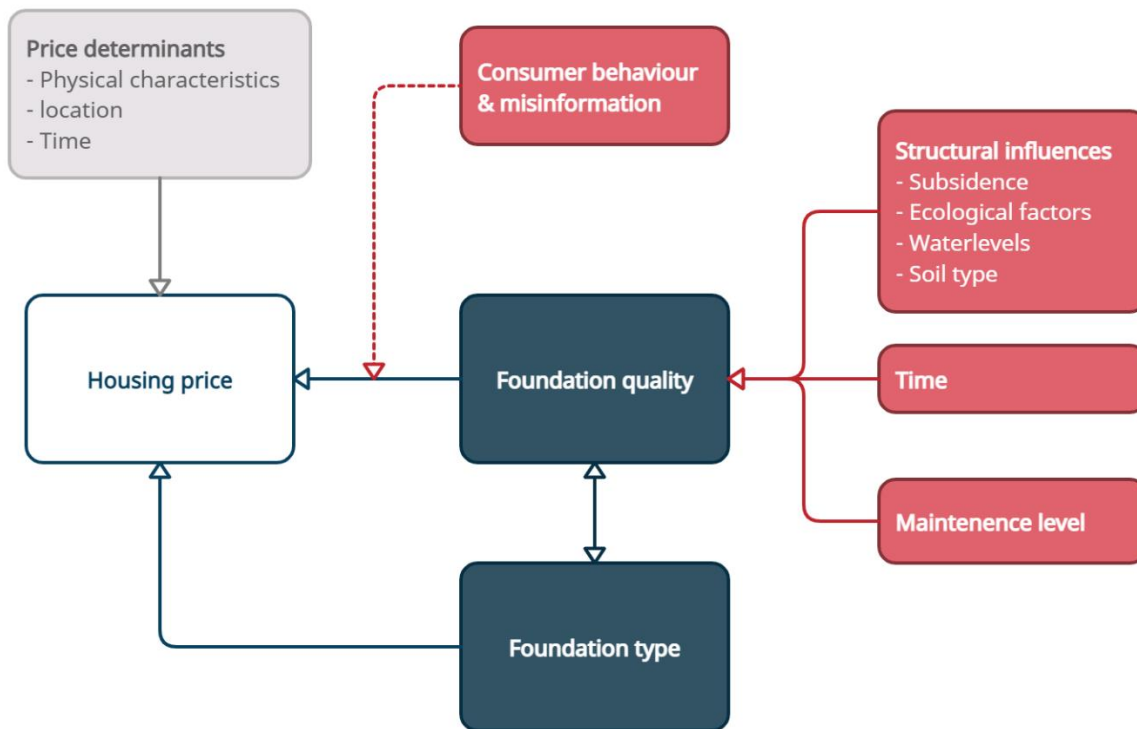
The method used to obtain the answer to SQ1 & SQ2 is a quantitative hedonic pricing model in the form of OLS. The data required is sourced from the municipality of Rotterdam, specifically the Funderingsloket, a municipal department specialized in foundations and providing information to homeowners. In addition, Dynamis, an overarching organization of real estate agents provides transaction data from the Nederlandse Vereniging van Makelaars (NVM). These institutions support the research by providing the required foundation-label data and detailed housing price data respectively in

the form of individual microtransactions. Creating a hedonic model that controls for supplementary price-determining factors will reveal whether foundation qualities impact the current pricing of residential properties and to what extent. Besides the available control variables, a fixed effects method will be applied to control for exogenous locational and temporal dimensions. The implied conceptual relation is denoted in figure 1 with the key independent variable, foundation quality, being situated to the right of housing price signifying its potential impact. Foundation type, as one of the main independent variables, is added to the model with an arrow towards foundation quality signifying the mutual relation. This potential interrelationship is empirically explored using interaction terms to form a complementary model. Residences are categorized in terms of their foundation type by individual foundation inspections combined and provided by the municipality of Rotterdam. The distribution of foundation examinations will be spatially displayed using GIS software (Esri inc, 2016).

Lastly, it can be expected that the behaviour of consumers impacts the specific valuation of foundations. Insights into consumer behaviour, biases, and eventual misinformation will provide context to the main research question. Answering sub-question 3 will serve this purpose.

› *SQ3: To what extent are foundation quality and type considered during a house sale?*

A qualitative method will be employed to explore this subject through the means of expert interviews. The target group for this analysis comprises real estate agents active in the region of Rotterdam. This way the price setting influences of consumers can be elaborated upon and linked up with previously established quantitative findings. The eventual information asymmetry and consumer biases that are present in the market are highlighted by the box misinformation & consumer behaviour in figure one. The dashed line denotes the eventual intermeddling impact these factors can have on the valuation of foundation quality



**Figure 1.** Conceptual model explaining the relation of Foundation quality on housing prices.

The remainder of this paper is structured as follows. Section 2 will provide an insight into previous theories and link them to the research. Section 3 elucidates the data and methods used to arrive at the results. These results will be illustrated in section 4. Section 5 will relate these findings to previous research in the form of the discussion segment. Finally, Section 6 will conclude.

## 2. THEORY

The central purpose of this thesis intends to quantify the relation between foundation quality, type, and housing price. This section illustrates the theoretical links between theories, concepts, and this endeavour.

### 2.1 Physical state of foundations

The real estate market is diverse and heterogeneous. Numerous factors contribute to the perceived quality of a structure and thus the determination of a home's price. As discussed in the literature review, preceding academic endeavours have identified several main determinants like physical characteristics, maintenance levels, and environmental hazards (Sirmans *et al.*, 2005; Francke & van de Minne 2017; Nyce *et al.*, 2015). The subject of focus in this research, foundations, can be considered as linked to all three aforementioned determinants. Firstly, the physical characteristics and the type of foundations influence their strength and resilience. Secondly, maintenance levels are of key importance due to the

long lifetime of most inhabited spaces and the concealed nature of their foundations. Thirdly, environmental hazards can deteriorate the quality of foundations in several ways. For instance, subsidence can induce structural damage through tilting structures (Reddish & Whittaker, 2012). Using a small Dutch sample from Zaanstad and Dordrecht Peduto *et al.* (2016) illustrate the existence of a clear link between foundation differential settling and damage to a structure. Furthermore, ecological factors like pests and bacteria can undermine the structural quality of a structure's groundwork (Nicholls, 2019). Theory suggests that the type of foundation significantly influences the capacity and structural quality of foundations. Throughout several phases of city building, different techniques and materials were utilized to create a groundwork to build upon. One of the first methods used to render the Dutch clay and peatlands buildable is the usage of wooden foundation piles. This method was applied throughout history until the end of world war II. Around 1950 concrete piles gradually replaced their wooden counterparts (Klaassen & Creemers, 2012). Generally, the buildings in Rotterdam have three main foundation types, within these categories, structures have their own varieties and possible combinations (Gemeente Rotterdam, 2022). The main foundation varieties are Wooden, concrete, and non-piledriven groundworks. Many historical wooden piles are still in service. Wooden piles are prone to degradation through bacteria, fungi and are sensitive to water level changes (Klaassen, 2015). Brolsma *et al.* (2012) analyse existing theory on this topic and conclude that pole-rotting, due to low water levels exposing the upper parts of wooden pole foundations, is the highest risk problem caused by the effects of drought on an urban landscape in terms of the total cost. This rot is a consequence of the wooden poles contacting oxygen triggering oxidation. Effective water level management can mitigate these problems to a certain extent (Willemse, 2018). This ecological degradation also differs between timber types, softwood, like spruce and pine species experience more damage than hardwood timber (Klaassen, 2008). Later constructed concrete piles and structures experience less underlying damage through the abovementioned causes (Peduto *et al.*, 2017). Firstly, concrete exhibits significantly lower risks of structural degradation. Eventual concrete degradation is often caused by chemical attrition instead of ecological pests (Wang, Nelsen & Nixon, 2006). Secondly, due to the improved building techniques and materials, the relatively younger concrete groundworks experience less damage from settling (Klaassen & Creemers, 2012). To finalize the main foundation archetypes some structures have a non-piledriven groundwork. This type does not use any piles to embed the structure in a deeper underlying sand layer, rather the structure is built directly upon the upper layer. Therefore, these assemblies are also called shallow foundations. Historically, an expert would determine whether the subterranean makeup was suitable for a non-piledriven foundation. Due to settling being a high-risk factor for this type of structure non-pile driven foundations are often built upon stable sand layers (Oosterhof, 2008). While this reduces the probability of its occurrence, settling and subsidence can expose these structures to a high risk of structural damage.

## 2.2 Foundation quality and residential price determination

Hitherto there has been no scientific exploration or theory on the subject of the economic impact of foundation on housing value. Nevertheless, previous authors have described various structural and qualitative aspects of a building that significantly impacted the valuation of property (Sirmans, Macpherson & Zietz, 2005). As discussed above, the structural solidity and quality of a foundation can be inhibited by several factors over time. Hence, it is expected that the groundwork, as a structural component, falls in line with the general theory of depreciation. Amongst the causes of the different types of depreciation described by Baum (1993), physical deterioration, the reduction in function because of weathering or poor maintenance, is the most applicable to foundations. Maintenance is an important determinant of depreciation. Francke & van de Minne (2017) use a hedonic model to test the physical deterioration of structures in the region of 's-Hertogenbosch. They find that for the first 20 years poorly maintained structures exhibit an annual physical deterioration of more than 1.5%. On a 50 year-horizon, this is determined to be almost 1%. While maintaining a home well can lead to little to no physical deterioration. Armengot, Williams & Padiál (2021) demonstrate that the link between depreciation and the need for maintenance is not linear. Buildings from different cohorts and eras of construction exhibit different needs. This is in accordance with different types of foundations being constructed in different eras and most likely exhibiting a qualitative discrepancy. Maintenance of a structure's groundwork can be difficult due to its inaccessible nature. Still, monitoring and renovating is possible. Peduto *et al.* (2016) illustrate in their article that the efficacy of foundation reparation is reliable. Using DinSAR-derived measurements on a sample of residences in the cities of Zaanstad and Dordrecht they demonstrate a clear countering of the displacement settling of a structure and its groundwork due to repairs. These restorations have the potential to reduce future costs. Billings (2015) rightly adds to this discussion by signaling that structural housing renovations can induce a bias in hedonic models that aim to explain the effect of an attribute on housing value. Adding detailed renovation data for the city of Charlotte in North Carolina resulted in the observation of this bias positively influencing and skewing the hedonic indexes. However, Billings notes that this omitted renovation bias only has a minimal impact on research outcome and identifies it as a second-order concern in terms of research design.

## 2.3 Human behaviour, imperfect information, and home buying

No real estate market is perfect. Clayton (1997) confirms this notion by showing that rational price expectations diverge from the ex-post results. On average, house price appreciation moves in the opposite direction of quarterly and annual forecasts. He theorizes that this is either due to the housing market being imperfect, with prices deviating from the actual value of an asset, or the assumption that the market is frictionless and participants are risk-neutral. Human behaviour is shown to cognitively bias the purchase of housing in several ways. Farlow (2004) describes over-optimism as the leading bias in regards to property purchase. His findings demonstrate that households believe that the purchase of a

house does not involve much risk since the average homebuyer estimates the yearly appreciation to be around 11%. Furthermore, over-confidence, the act of overestimating one's own level of control and thereby downplaying risk is also a contributing factor (Salzman & Zwinkels, 2017). In a study on the adoption of mortgage insurances in the Netherlands Cox & Zwinkels (2013) find that only 30% of households insure their loan. One of the main explanations of this phenomenon being over-confidence. With these concepts in mind, it seems natural that the overestimation of future returns coupled with the underestimation of risk could influence the rational evaluating of foundation quality and type during a sale process. The current market situation potentially magnifies this effect. The Dutch residential housing market has experienced a surge in prices over the last few years. Factors like low-interest levels, a lagging supply, and a growing demand spur prices to exceedingly higher levels. Especially central urban locations are in high demand (Öztürk *et al.*, 2019). Consequently, it can be argued that regret theory, as illustrated by Farlow, (2013) further adds to this demand rise. The theory implies that households anticipate the future regret of not entering the market. Perceiving others obtaining high returns due to a price jump leads one to fear the regret of not participating themselves. Overall it is expected that human cognitive behaviour might skew rationality in regards to weighing the risks, costs, and benefits of the foundation of a structure.

To further understand the role of consumer behaviour, the supply of information should be included as a price-determining influence. Preceding theory suggests that asymmetric information can distort the sale process. Several authors empirically tested these assumptions in the Dutch context. Using list-price reductions as signals of unobserved properties of a structure De Wit & van der Klaauw (2013) observe substantial effects. The lowering of a list price is shown to increase the selling rate by 84% while increasing the rate of withdrawal by 44%. In an asymmetric market, signals do not add information, these signals can therefore be considered as evidence for the existence of asymmetric information in the residential housing market. Correspondingly, Anenberg (2016) exemplifies that information friction significantly impacts short-run aggregate price appreciation. To bridge the information gap, real estate agents are often employed. These agents are better informed about the local market and the value of housing characteristics than their clients. However, real estate agents can also exploit this advantage in information. Partly due to the system of commissions these agents have an incentive to sell their client's homes quickly. Levitt & Syverson (2008) provide empirical evidence of this theory showing that real estate agents sell their own homes for 3,7% more than the properties of their clients. Similar results are found by Agarwal *et al.* (2019) in the context of Singapore. Here, agents purchased their own houses for 2.54% less than comparable homes. The evidence suggests that information asymmetries, especially information advantages and bargaining power are expected to affect the ability of home-buyers to effectively consider foundation quality and the eventual risks that go paired with it. The unobserved nature of foundations and the need for extensive and costly foundation examinations will potentially only magnify this phenomenon.



## 2.4 Hypotheses

Reflecting on existing theory leads one to observe several factors that influence foundations and their relation with residential housing valuation. It stands to reason that expectations are formulated using these findings. Firstly, the qualitative state of a foundation can expose users to increased risk and extensive costs (Doornkamp, 1993). Additionally, a clear negative relationship is observed between the state of a groundwork and the structural quality of its superstructure (Peduto *et al.*, 2016; 2017). Therefore, it can be reasoned that this factor is considered to decrease the value of a structure. Ergo, the first hypothesis is formulated as follows:

- › H1: There is a negative relation between foundation degradation and residential housing prices.

Besides the effects of quality, different types of foundations are proven to exhibit varying characteristics. Older foundation types are more prone to structural damage and weathering (Klaassen, 2008). Especially wooden pile substructures are at a higher risk of deterioration. Instigators like water level fluctuation, subsidence, fungi, and bacteria are shown to affect wooden foundations to a greater extent than their concrete counterparts (Klaassen, 2015; Peduto *et al.*, 2017; Nicholls, 2019). Hence, it is expected that the type of groundwork might be related to foundation quality. The interaction between these variables could constitute a significant influence on price. Therefore the second hypothesis is constituted as follows:

- › H2: Wooden foundations are valued less than their concrete counterparts.

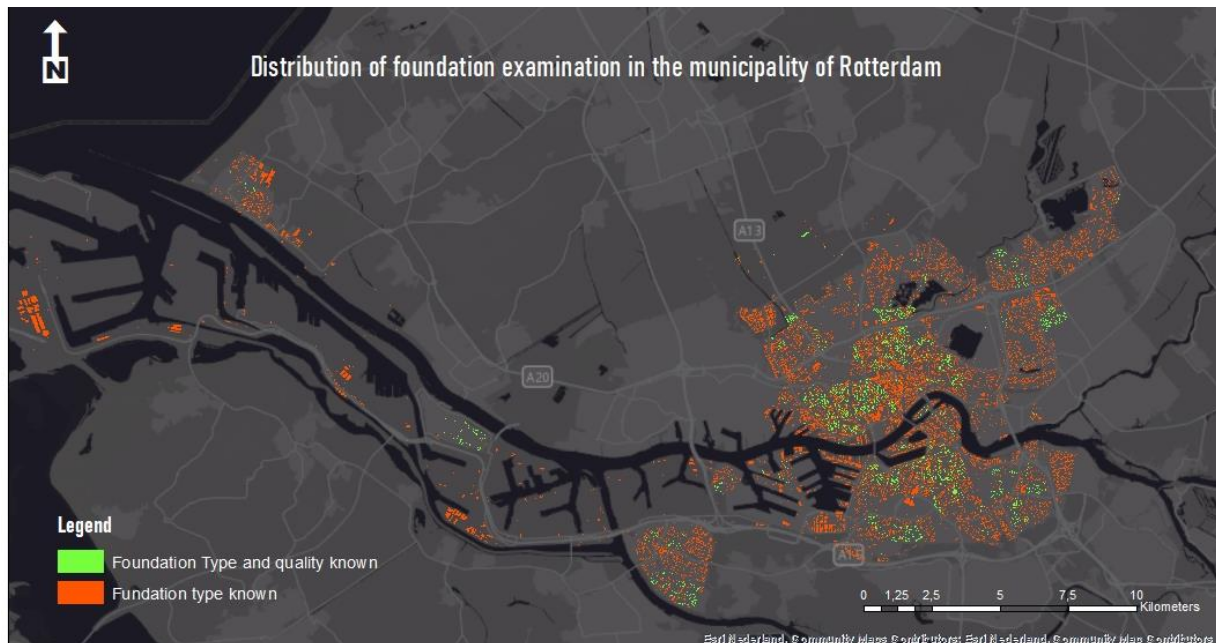
Moreover, besides the purely structural side of residential housing valuation, consumer influences can bias the valuation of a home and its substructure. The interaction between human behaviour and the explicit pricing of foundations is expected to distort valuation. Over-optimism and over-confidence, especially in a heated market, inhibit the risk assessment and expectations of home-buyers (Farlow, 2004; Salzman & Zwinkels, 2017; Cox & Zwinkels, 2013). In addition, the regret of not participating in a bull real estate market and the potential economic losses paired with this can further inhibit the rational decision-making in a sale process (Farlow, 2013). Information asymmetry also plays a determining factor in home sales distorting the market (De Wit & van der Klaauw, 2013). With the preceding theories on consumer behaviour in mind, it is to be expected that the potential risks alluding to the quality and makeup, of foundations can be overlooked or underestimated. Consequently, the final hypothesis is formulated as follows:

- › H3: Consumer behaviour, biases & information asymmetry lead to an underestimation of the risks and the potential price-determining properties of foundations.





In 2021 the housing stock of the city comprises around 318.000 dwellings (Gemeente Rotterdam, 2021). Of these homes, 44.492 have had a foundation examination of some sort according to data provided by the funderingsloket. Figure 3 illustrates the geographical extent to which foundation examinations are available throughout the municipality.



**Figure 3.** Distribution and extent of foundation examination in the municipality of Rotterdam

It is no coincidence that Rotterdam has founded a separate department concerning foundation problems. The subsoil of Rotterdam is built upon mainly consists of Holocene marine and fluvial sediments. The depositional makeup of several sediment layers in the subsoil under the municipality of Rotterdam is illustrated in Appendix A. Using GIS software and data provided by the province of Zuid-Holland (NGR, 2016) several maps are rendered displaying subsoil cross-sections. The maps demonstrate the sedimented layers in the following depth categories: 0 to 1 meter, 1 to 3 meter, 3 to 5 meter, and lower than 5 meters respectively. The dominantly clay and peat deposits are prone to subsidence due to the settling and oxidation of particles (Schothorst, 1977; van den Born *et al.*, 2016). These natural forces are integral to the problems faced and have, inter alia, urged the municipality to provide clear and transparent information regarding subsidies, foundation examinations, and repair options. The subsurface sediments of Rotterdam are typical for the western part of the Netherlands, mainly comprising the coastal regions of the provinces Zeeland, Zuid Holland & Noord Holland. Furthermore, similar clay & peat grounds can also be found in the northern coastal regions in the provinces of Friesland and Groningen.

### 3.3 Descriptive analysis

The complete statistical dataset utilized in the quantitative analysis is retrieved from two sources. First, the municipality of Rotterdam's funderingsloket provided GIS data on structures and their eventual foundation examination reports. The raw data consist of 44.492 structures with an examination report available. Secondly, Dynamis, an overarching service organization that provides market research for its partners in the realtor branch provides NVM transaction data containing individual properties in the municipality of Rotterdam. This dataset comprises all housing sale microtransactions from 2010 until 2020. The total amount of sales adds up to 70.519 transactions. Matching these two data sources is accomplished using GIS software. Initially, a structure's unique id (BAG pand id) is coupled to addresses in the municipality of Rotterdam. Afterwards, these addresses are matched to transactions using the corresponding data in the NVM sale database.

As developed further here, data management has led to several omissions in the sample. All observations with a foundation examination date before 2010 have been removed. This is due to the limited durability and difference in guidelines of foundation examination reports. Since the research design is cross-sectional, eventual repeat sales were left out, preserving the last registered transaction. Observations that have an examination date ahead of their transaction date are exempted to ensure that foundation information was available and potentially considered during the sale process. Moreover, eventual repairs conducted in the interval between a foundation examination and the sale date are taken into consideration. To structurally restore a foundation one needs a specific building permit. Using data on these permits supplied by the municipality of Rotterdam allows insight into foundation renovations. Subsequently, 14 observations with a bad foundation quality and a successive repair are discerned and consequently removed from the data. This way, omitted renovation bias is accounted for. The data are screened to remove outliers. Irrationally low sale prices that do not conform to the market price are removed. For example, several properties were sold for 1 euro. These observations are excluded from the sample. Lastly, all missing values are omitted leaving a final sample of 921 observations. To allow a better fit of the dependent variable, and further remove any outliers, the natural logarithm of the sale price is taken. The microtransaction data allows for the use of the core price-determining characteristics of a residential home identified in the literature review. The following variables are utilized in the analysis; the final sale price that is paid for the residence, the quality of its foundation derived from foundation examinations on a scale of six, the quality of its foundation derived from foundation examinations on a binary scale, the age of the structure on the date of sale, the surface area in square meters the number of rooms present, the type of groundwork that is present as determined by its foundation examination report, eventual parking facilities supplementary to the residence & the type of residence as determined by the real estate agent reporting on the housing transaction. In table 1 the descriptive statistics of the sample are exemplified.

**Table 1.** Descriptive statistics

<b>Variables</b>	<b>Definition</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
<b>Main variables</b>					
Sale price	Euros	198911.7	116439.7	61500	1150000
Ln Sale price	logarithmic	12.09	0.45	11.03	13.96
Quality	Scale 1-6 (good-bad)	1.90	1.47	1	6
Quality binary	Good or impaired (1-0)	0.74	0.44	0	1
<b>Ratio variables</b>					
Age when sold	Age	58.94	23.36	1	137
Surface area	Square meters	100.79	24.19	26	450
Rooms	Number of rooms	4.34	1.12	1	8
<b>Nominal variables</b>					
Type of foundation	1 = Concrete		497	53.96	53.96
	2 = high chance on wood or non-piledriven		8	0.87	54.83
	3 = Wood		159	17.26	72.10
	4 = Wood with upright extensions		92	9.99	82.08
	5 = Non-piledriven		165	17.92	100
Garage	1 = Building extension consisting of stone		10	0.98	0.98
	2 = Carport		3	0.33	1.41
	3 = none		846	91.86	93.27
	4 = Indoors		8	0.87	94.14
	5 = Parking cellar		1	0.11	94.25
	6 = Parking place		37	4.02	98.26
	7 = Detached consisting of stone		16	1.74	100
Type of residence	1 = Apartment		9	0.98	0.96
	2 = Ground floor apartment		62	6.73	7.71
	3 = Upstairs apartment		42	4.56	12.27
	4 = Double ground floor home		5	0.54	12.81
	5 = End house		15	1.63	14.44
	6 = Corner house		175	19	33.44
	7 = Maisonette		13	1.41	34.85
	8 = Tenement		10	1.09	35.94
	9 = Terraced house		513	55.70	91.64
	10 = Semi-detached house		20	2.17	93.81
	11 = Detached house		24	2.61	96.42
	12 = Flat		33	3.58	100
<b>Observations</b>	921				

Note: numbers are rounded to two decimals. The variable Quality consists of the categories good, decent, mediocre-good, mediocre, mediocre-bad & bad encoded into 1-6 respectively. Quality binary groups these gradations in good (good & decent) and impaired (mediocre-good, mediocre, mediocre-bad & bad) foundations.

The average sale price of the homes sold in Rotterdam between 2010 and 2020 is approximately 200.000 euros. The key independent variable will be treated as an interval one, therefore the six ordinal values good, decent, mediocre-good, mediocre, mediocre-bad, and bad are recoded into a scale from one to six. Since most of the homes in the sample have a good foundation quality the mean of the sample is 1.95, nearing a decent average groundwork state. Additionally, foundation quality is also categorized as a

binary variable indicating whether the foundation quality is good (1) or impaired (0). This variable shows a similar distribution with a mean of 0.74. The mean age of a building when sold is 58.94. Of the foundation types observed over half are made out of concrete, consisting of 53.1%. The other residences mainly have wooden or a non-piledriven subterranean composition. Most homes do not have a parking space or garage. The type of house that is most common is terraced homes. These observed characteristics are in line with the urban nature of the city of Rotterdam.

Correlation statistics of the variables are demonstrated in Appendix B. A correlation matrix illustrates the levels of correlation between two variables. Additionally, some dot plots are added to illustrate some of the relations that could influence the regression model. Of the correlations found some were to be expected. For instance, a high correlation between age when sold and quality of foundations. Deterioration of foundations over time is the logical clarification. As explained by the theory section, older properties were built with wooden pile foundations which are more susceptible than their contemporary concrete counterparts (Klaassen, 2015). The first dot plot exemplifies this, showing that foundations that are classified as good are often younger than the other quality gradations. Similarly, the type of foundation is also relatively correlated to age. The second dot plot shows the distribution of foundation types over age. This demonstrates the younger age of concrete foundations relative to wooden and non pile-driven groundworks. Potentially, this might affect the results of the model considering there is some overlap between the variables. Notably, the quality and type of foundations exhibit the highest correlation metric. This is potentially attributable to the previously noted structural qualities of different types of foundations. For instance, the third plot in appendix B clearly shows that the quality of concrete foundations is almost exclusively registered as good. Understandably, surface area and the number of rooms also display a sizable correlation. A further inquiry using VIF statistics shows that there is no critical multicollinearity problem. It is generally agreed that multicollinearity issues arise above the critical threshold of 5 (Hair *et al.*, 2010). None of the variable VIF's exceed this level. There is, however, one exception, after adding fixed effects the variable number of Rooms surpasses a VIF of 5. In the next model, this variable is transformed into a polynomial. The levels of VIF for each model are represented in Appendix B.

### **3.4 Hedonic regression model**

To ascertain the quantifiable effect of foundation characteristics on housing value a hedonic pricing method is used by means of an OLS regression model. Hedonic regression serves to explain a phenomenon through the changes and differences in characteristics. The first use of the method is by Waugh (1929) who estimates the influence of different factors on vegetable prices in Boston. Rosen (1974) further developed the method of hedonic pricing to explicitly value the utility of property characteristics through their economic price. Due to the heterogenic nature of housing, hedonic pricing is used widely throughout the field of real estate. Using this approach, the price of a house is determined

by a function of structural characteristics and environmental factors. Previous literature substantiates multiple variables of importance to add to this function. Similar studies, like the estimation of depreciation in 's-Hertogenbosch conducted by Francke & van de Minne (2017), use maintenance level, type of house, surface square meters, the number of rooms, the availability of parking facilities, and the age of the building. These factors are widely used as the core control variables and align well with the aspirations of this research.

Several variable transformations help to achieve a better model fit. For instance, non-linear relationships are included where required. Appendix C demonstrates the residual plots of the continuous variables. The variable *amount of rooms* shows a clear non-linear relationship. In addition, previous research shows that the age of a building can have a non-linear effect as well. After a certain threshold, older homes are shown to sell for a premium (Rolheiser, van Dijk & van de Minne, 2020). Resulting in the addition of the variables *number of rooms* and the *age when sold* converted into a squared polynomial. Besides controlling for the above-described characteristics, capturing broader quality aspects of location and time is of key importance. In his paper on controlling for quality in hedonic models, Zabel (1999) explicitly recommends the use of fixed-effect methods. Adding fixed effects on a low spatial scale will help control for specific spatial and temporal differences between cases, cleaning up the indexes in the process. To further explore the explaining power of these fixed effects, an interaction term between them will be added to one of the models. This will include the overtime change in locational aspects. The analysis will progressively use several models to achieve the intended results<sup>1</sup>. The null hypothesis for the models is expressed as follows:

- › *H0: In the population, there is no linear relation between the key independent variable and the natural logarithm of housing prices.*

The first models will provide context, indicating the relations present without control variables. Later models will include all variables of use. The following comprehensive formula will facilitate this endeavor:

*Baseline specification (model 4):*

$$\ln P_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{3i}^2 + \beta_5 X_{4i}^2 + \sum_{c=1}^C \varphi_c X_i + \sum_{z=1}^{64} \gamma_z Z_i + \sum_{z=1}^{130} \gamma_z Z_i + \varepsilon_i$$

where  $P$  is the transaction price of the home. The natural logarithm of the transaction price is used indicated by  $\ln$ . The subscript  $i$  stands for an individual observation.  $\beta_0$  represents the constant and is added to ensure a conditional mean of zero in the error term. The key independent variable foundation

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<sup>1</sup> The analysis is facilitated through Stata software (StataCorp, 2019). For the Stata do-file please consult Appendix E



quality, expressed as an interval variable, is represented by  $\beta_1 X1_i$ . The other ratio variables, building year, surface area, and amount of rooms are accounted for by the expressions  $\beta_2 X2_i$ ,  $\beta_3 X3_i$  &  $\beta_4 X4_i$  respectively. To allow for a non-linear relationship of the variables age and number of rooms polynomials are taken and added to the equation illustrated by  $\beta_5 X3_i^2$  &  $\beta_5 X4_i^2$  respectively. The dummy variables type of residence, and garage are signified by the following expression  $\sum_{c=1}^C \varphi_c X_i$ . To achieve a more robust analysis and minimize the potential omitted variable bias both time and location fixed effects are added to the model being denoted as follows  $\sum_{z=1}^{64} \gamma_z Z_i$  &  $\sum_{z=1}^{130} \gamma_z Z_i$ . The location fixed effects use four-digit ZIP codes as a proxy to encode 64 categories. Time is controlled for using the month and year of the transaction resulting in 130 classifications. Finally,  $\varepsilon$  symbolizes the error term. A detailed description of components can be found in the notational glossary (Appendix D). subsequently, model five uses an identical formula replacing the foundation quality proxy for a binary variable indicating whether the structural foundation of an observation is good or impaired. This will control for the possibility that the model is not linear as assumed using the six-grade scale as a continuous variable.

To facilitate further analysis, the baseline model is expanded to include an interaction term between foundation quality and foundation type<sup>2</sup>.

*Model 7:*

$$\ln P_i = \beta_0 + \beta_1 X1_i + \beta_2 X2_i + \beta_3 X3_i + \beta_4 X4_i + \beta_5 X3_i^2 + \beta_5 X4_i^2 + \sum_{c=1}^C \varphi_c X_i + (\beta_5 X1_i \sum_{c=1}^3 X_i) + \sum_{z=1}^{64} \gamma_z Z_i + \sum_{z=1}^{130} \gamma_z Z_{it} + \varepsilon$$

First, the variable foundation type is added, signified by  $\sum_{c=1}^C \varphi_c X_i$ . Subsequently, the expression  $(\beta_5 X1_i \sum_{c=1}^3 X_i)$  allows for the interaction to be tested using the interval gradations of quality as a continuous variable in combination with the categorical types of foundation.

Due to the logarithmic nature of the dependent variable, the following function is used to transform the coefficients to percentages:

$$(\exp^{(\beta)} - 1) \times 100$$

To test whether the OLS regression analysis meets the assumptions formulated by earlier research several parametric tests are conducted. Multicollinearity statistics are reported in Appendix B.

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<sup>2</sup> Model 6 is bypassed due to model 7 being the more comprehensive version.

For the results of further parametric tests please consult Appendix F<sup>3</sup>. As the table illustrates, several assumptions are violated by the regression analysis. Problems arise with regards to heteroscedasticity, the normality of the residuals, and multicollinearity. Suitable solutions to these problems have been applied to ensure the validity of the model<sup>4</sup>.

### 3.5 Qualitative expert interviews

To explore the findings and place them in their wider context, qualitative problem-centered expert interviews will be conducted. This method aims to merge theory-generating expert interviews with problem-centered interviews. This approach, combines the expert's view, knowledge, and societal relevance with dialogic and discursive interviews examining personal experiences surrounding a certain problem (Döringer, 2021). The target population for this research comprises experienced real estate agents employed in the municipality of Rotterdam. These individuals are qualified to give their professional perception on the process of evaluating foundations as a price-determining factor. Real estate agents can shed their light on both the taxation process, as well as consumer transactions. The number of interviews will partially depend on the saturation of the information. This is reached when the data gathering does no longer gives new theoretical insights (Charmaz, 2006). However, time constraints might limit the extent of the analysis. The problem-centered expert interviews follow a predetermined interview schedule comprising of questions based on the theory section and results from the quantitative analysis. These questions are listed in Appendix G. The interviews are transcribed and coded using Atlas.ti software (Atlas.ti, 2021). Subsequently, patterns and interesting findings will be summarized in the results section.

Building from the idea that the qualitative part links to the previously established quantitative results a purposive sampling method is used to obtain a suitable sample. To this end, various real estate agencies were contacted. All firms approached have facilitated several real estate transactions that are represented in the data used for the quantitative analysis. Ultimately, four experts are selected and willing to partake in the research. The interviews are conducted via online communication software. The length of the discourses varies between 20 and 30 minutes. Table 2 illustrates some key characteristics of the experts.

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<sup>3</sup> Heteroscedasticity issues are revealed through the Breusch-Pagan test (Breusch & Pagan, 1979). The normal distribution of residuals is tested using the Shapiro-Wilkinson normality test (Shapiro & Wilkinson, 1965). The appropriate functional form is estimated using the link test (Pregibon, 1980). The correctness of the functional form is evaluated using the RESET test (Ramsey, 1969). Finally, the existence of influential observations is assessed through the Cook's distance test (Cook, 1977).

<sup>4</sup> Heteroscedasticity complications are treated by using robust standard errors in all models. Consequently, the differences in the variance of the error terms will be accounted for (Hayes & Cai, 2007). Eventual existing normality issues regarding the residuals will be invalidated because of the central limit theorem. Having an adequate amount of observations leads one to assume normality for the distribution (Rosenblatt, 1995). Multicollinearity issues that arose during the modelling have been managed through the transformation of the variable foundation type, a reclassification into the three broader categories concrete, wood and non-piledriven have mitigated the problem.



Individuals have been anonymized using letters to guarantee their privacy. The main occupation of all participants is sales agent, still, all agents are also active as appraiser and purchase broker.

*Table 2. Characteristics of interviewees*

<b>Respondent</b>	<b>Years of experience</b>	<b>Main operating area</b>	<b>Main occupation</b>	<b>Gender</b>
A	17	Kleiwegkwartier	Sales agent	male
B	25	Groot-Rotterdam	Sales agent	female
C	6	Rotterdam-noord	Sales agent	male
D	23	Rotterdam-noord	Sales agent	male

### **3.6 Limitations**

Due to the nature of the data and methods used eventual biases might be present. Foundation examinations are often conducted for a collective of buildings. To this end, a sampling method is applied to evaluate all foundations of a particular area. This might induce misclassification bias since not all individual cases were subjected to an examination. Subsequently, measurement errors might be present due to the usage of secondary data. Additionally, the NVM data provided allows the models to control for certain key determinants of housing value. Subsequently, applying a fixed-effects approach aims to control for further unobserved variables that influence housing value. Nevertheless, exogenous variables might cause omitted variable bias which impedes the accuracy of the findings. The qualitative expert interviews use real estate agents as a selected sample. The results of the analysis are therefore limited to the perception of these professionals.

### **3.7 Ethical considerations**

This research has been conducted fully independently and objectively. To ensure complete privacy single data cases or individuals will be anonymized. The data is handled confidentially and individuals will be anonymized. Finally, the positionality of the author concerning the topic is important to remark upon. The author does not own any property himself and writes this thesis from the perspective of a Dutch master student at the Rijksuniversiteit Groningen.

## 4. RESULTS

### 4.1 Regression models

**Table 3.** OLS estimates of hedonic models including quality of foundations

Model	1	2	3	4	5
VARIABLES	Log sale price	Log sale price	Log sale price	Log sale price	Log sale price
Impaired foundation <sup>[1]</sup>	X	X	X	X	-0.0794**
	X	X	X	X	(0.0394)
Age when sold squared	X	X	X	0.00004*	0.00004
	X	X	X	(0.00002)	(0.00002)
Age when sold	X	0.0040***	-0.0005	-0.0047*	-0.0045*
	X	(0.0009)	(0.0010)	(0.0025)	(0.0024)
Surface area	X	0.0039***	0.0025***	0.0025***	0.0025***
	X	(0.0011)	(0.0005)	(0.0008)	(0.0008)
Foundation quality	0.0057	-0.0294**	-0.0196*	-0.0231**	X
	(0.0103)	(0.0118)	(0.0104)	(0.0117)	X
Constant	12.0763***	11.6377***	12.2455***	11.9943***	11.8750***
	(0.0236)	(4.8603)	(0.2598)	(0.2991)	(0.3007)
Polynomial's	no	no	no	yes	yes
Fixed effects (Month of sale)	no	no	yes	yes	yes
Fixed effects (ZIP)	no	no	yes	yes	yes
Property characteristics	no	yes	yes	yes	yes
Observations	921	921	921	921	921
Adjusted R-squared	-0.0007	0.1454	0.5070	0.5118	0.5122

Robust standard errors in parentheses. \*\*\*, \*\*, \* indicating significant at 1%, 5% and 10%, respectively. Property characteristics include the variables surface area, age when sold, amount of rooms, type of residence & garage. Polynomial's include rooms squared & age when sold squared. <sup>[1]</sup> Reference category includes good foundation category.

Table 3 displays the regression results for the first four models. The estimates for the fixed effects have been omitted due to their large scope of dummies. For the complete OLS estimate table including property characteristics please consult Appendix H. Starting at model one, each consecutive model adds more control variables. The first regression comprises solely of the logarithm of sale price as the dependent and quality of foundations as the independent variable. This rudimentary model illustrates a positive relationship between the logarithm of transaction price and foundation quality albeit not statistically significant. Remarkably, the adjusted R-squared is negative, indicating that at this stage the independent variable does not explain the variation in any meaningful way. Model two introduces property characteristics as dependent variables. In line with earlier findings, several property attributes exhibit a significant relation with transaction prices. Model three adds location and time fixed effects in the form of ZIP codes and the month and year of the transaction respectively. Factoring in the locational and temporal dimensions results in a substantial increase of the adjusted R-squared to 50.7%. Due to the non-linear nature of some variables, two polynomials are added in model four, namely, age squared and

the number of rooms squared. Age squared will allow the regression to adjust for depreciation as well as eventual price premiums. Older housing, especially from certain building periods, can present a clear price premium which slows down depreciation (Syed & de Haan, 2017). Besides this, an increasing amount of rooms will only induce a higher transaction price to a certain threshold. This non-linear relation is exemplified by the residual plots illustrated in Appendix C. In an attempt to increase the explaining power of the models an interaction term containing both time and location fixed effects has been added. This measure increases the adjusted R-squared to 57.7%. The addition, however, leads to high levels of multicollinearity in all variables. Transforming variables did not alter the high collinearity statistics, hence, this model is excluded from the analysis.

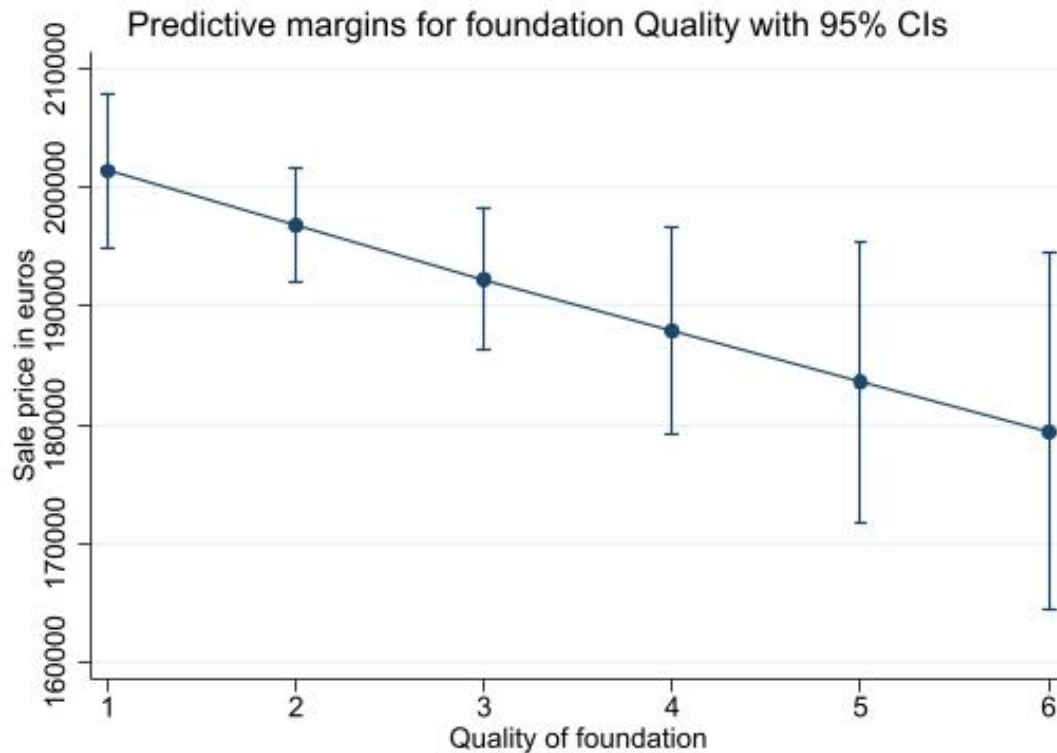
The adjusted R-squared highlights that model four and five are the most comprehensive. The first treats foundation quality as a continuous variable made up of six foundation quality gradations. The latter is identical but uses an indicator variable for whether the gradation of quality is good (including the categories good & decent) or impaired (including the categories mediocre-good, mediocre, mediocre-bad & bad). In both models the generated statistically significant estimates for the property characteristics are in line with expectations and previous literature. Only slight changes in the coefficients of the independent variables are perceived between the two variants. The main estimates for housing characteristics in model four are set out subsequently. An increase of one square meter of surface area results in an increase of the transaction price by 0.39%<sup>5</sup>. The coefficients for the age variables show a slightly increasing slope. This hints towards the existence of a vintage effect, albeit modest. Conversely, the rooms variable shows a decreasing slope indicating the lesser importance additional rooms have in properties with numerous chambers. In addition, the residence types semi-detached and detached houses are statistically significant under the 1% and 5% threshold respectively. With a rowhouse as reference, they face premiums of 62.25% for semi-detached and 39.64% for detached homes. The garage and parking types demonstrate only one significant relation within a 10% level. Having a carport will increase the value of a home by 44.73% relative to having parking.

Model 4 reveals a clear relationship regarding foundation quality and housing transaction prices. In all models, this relation is significant to a certain degree, except for the first. Model four suggests that per increased level of foundation degradation a 2.28% decrease in transaction price is to be expected. The variable quality consists of six categories with one being a proxy for a good state of the groundwork and six being the most defective. In figure 4 this estimation is graphically represented using predictive margins<sup>6</sup>.

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<sup>5</sup> For the sake of interpretation, in the discussion of the results the coefficients have been transformed into percentages using the following formula:  $(exp^{\beta} - 1) \times 100$

<sup>6</sup> To retransform the logarithm of price variable in the interest of the interpretation of graphics the smearing estimate method is used as described by Duan (1983)



Note: 1 = good, 2 = decent, 3 = mediocre-good, 4 = mediocre, 5 = mediocre-bad 6 = bad

**Figure 5.** Predictive margins of the types of foundation (model 4)

When the degradation of a foundation increases, the price decreases. The p-value for this relation is below the 5% threshold, consequently, we can reject the null hypothesis of no relation and assume that the relationship is statistically significant. Consecutively, model five reduces the six gradations to two categories, good and impaired foundations. The results are comparable to the previous model. Whenever a foundation falls within the impaired quality category this translates to a price discount of 8.26% compared to the good category. The results from these OLS regression models are in line with the expectations formulated in H1. A statistically significant negative relationship between foundation degradation and housing value is observed in the data.

Table 4 reports on the successive regression models which serve to estimate the effects of the type of foundation.

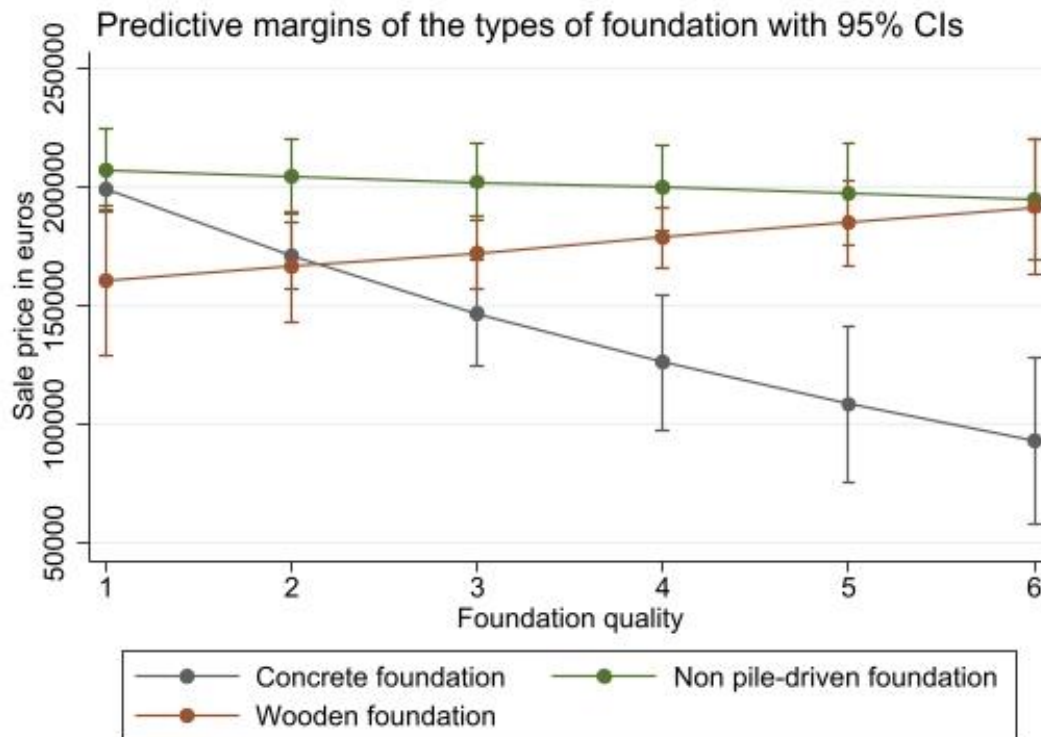
**Table 4.** OLS estimates of hedonic models including quality & type of foundation

Model	6	7
VARIABLES	Log sale price	Log sale price
Quality*Wooden foundation <sup>[1]</sup>	X	0.1393*** (0.0454)
Quality*non-piledriven foundation <sup>[1]</sup>	X	0.1870*** (0.0570)
Non-piledriven foundation <sup>[1]</sup>	-0.0741 (0.0538)	-0.4010** (0.1615)
Wooden foundation <sup>[1]</sup>	0.0437 (0.0618)	-0.0985 (0.0809)
Surface area	0.0024*** (0.0008)	0.0023*** (0.0008)
Quality	-0.0095 (0.0146)	-0.1516*** (0.0435)
Constant	11.9163*** (0.2993)	11.6377*** (0.3114)
Type*Quality of foundation	no	yes
Polynomials	yes	yes
Fixed effects (Month of sale)	yes	yes
Fixed effects (ZIP)	yes	yes
Property characteristics	yes	yes
Observations	921	921
Adjusted R-squared	0.5125	0.5127

Robust standard errors in parentheses. \*\*\*, \*\*, \* indicating significant at 1%, 5% and 10%, respectively. Property characteristics include the variables surface area, age when sold, amount of rooms, type of residence, & garage. Polynomial's include rooms squared & age when sold squared.<sup>[1]</sup> The reference category includes Concrete foundation.

As established in the descriptive statistics, the correlation matrix and VIF statistics indicate a high level of correlation between quality and type of foundations (see Appendix B). Consequently, incorporating the type of foundations in the model introduces sizable levels of multicollinearity in the model. The commonly established VIF threshold of 5 is not surpassed (Hair *et al.*, 2010). Still, the VIF of Quality is high with a 4,53. This causes the coefficient of quality to deviate from the previous models. The addition of foundation types increases the adjusted R-squared by 0,08%. Both the variables quality and type exhibit no significant relationship in model five. Nevertheless, the coefficient sign of the wooden foundation types is positive. Counterintuitively, prior literature indicates that wooden foundations are more prone to damage compared to concrete variants. A non-piledriven foundation is estimated to decrease the value of a property in contrast with a concrete variant. These estimates are not fit for inference due to their statistically insignificant nature. Model six serves to illustrate the difference in quality coefficients between foundation types. For this purpose interaction between quality types, an interaction term is added. This causes a minimal increase in the adjusted R-squared. From the interaction term, it can be derived that there is a significant difference between foundations. Firstly, if a home has

a concrete foundation, the model estimates that prices will decrease by -14.06% per gradation of quality. If a structure has a non-piledriven foundation, in reference to a concrete foundation, the slope of the effect is -1.22%. This leads us to conclude that when the quality of a non-piledriven foundation diminishes by one category the effect on housing price will be -1.22% in relation to a concrete foundation. For wooden foundations this effect is positive, with concrete foundations as a reference, the coefficient for the quality of wooden foundations is 3.6%. Figure 5 illustrates the predictive margins of the interaction term discussed above.



Note: 1 = good, 2 = decent, 3 = mediocre-good, 4 = mediocre, 5 = mediocre-bad 6 = bad

Figure 5. Predictive margins of the types of foundation (model 7)

The graphic representation exemplifies the counterintuitive coefficient estimates for wooden foundations yielded by model 7. Although the model controls for age and location, it could be hypothesized that the model does not adequately separate the eventual price-increasing characteristics from estimates observed. The results illustrate that there is a difference between the foundation types in regards to the valuation of their quality. It can, however, not be inferred that wooden foundations are valued less than the concrete version due to the opposite sign being observed and the statistical insignificance. Therefore there is not sufficient evidence to support H2 on the grounds of the examined quantitative results. Owing to the contrasting outcome with respect to hypothesis two this result is presented to the experts to infer their perspective on the issue and identify eventual explaining factors. Subsequently, the quantitative results listed above are employed and developed further by the qualitative section.

### 4.2 Qualitative results

The problem-centered expert interviews yield various insights and provide further context to the established quantitative analysis. Detailed transcriptions of the original discourse and a translation can be found in Appendix I. All answers are from the in-field perspective of residential real estate agents from the region of Rotterdam. The discourse is analyzed through the application of codes in Atlas.ti. The resulting analysis yields several main, and sub-codes. These are represented in Figure 4.

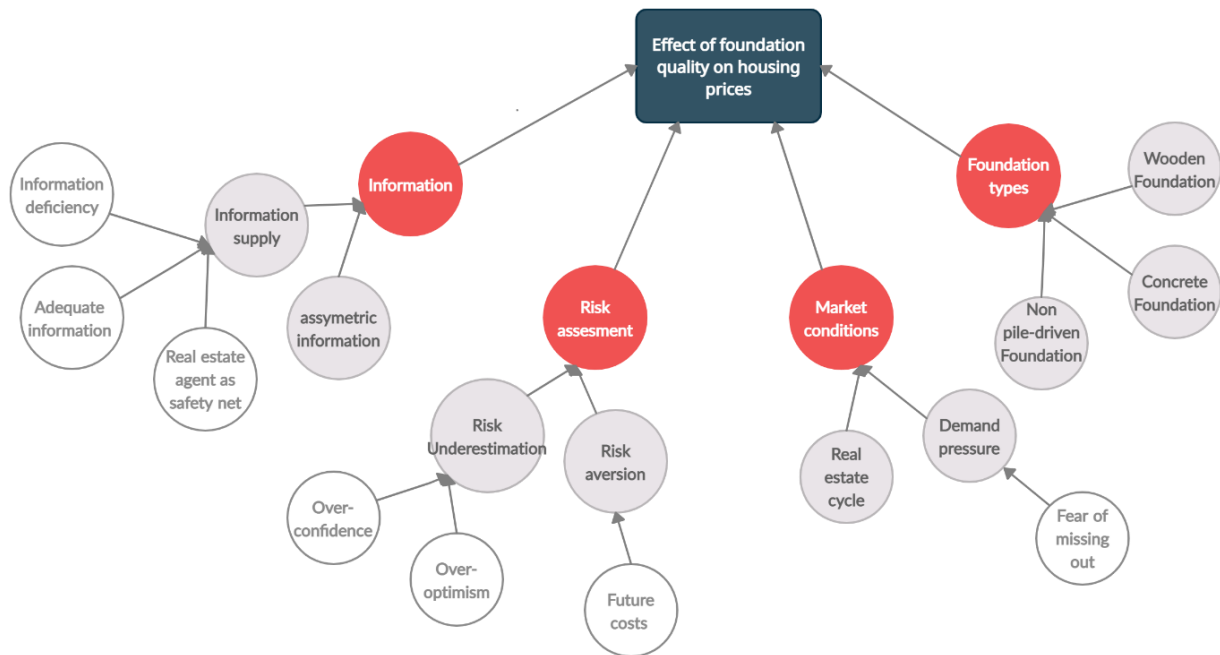


Figure 6. Coding tree

The four main codes that are identified are described below in table 5.

Table 5. Description of main codes

Code	Description
Information	Effects of information regarding foundation status
Risk assesment	The way buyers and real estate agents handle risks surrounding foundations through consumer behavior
Market conditions	The effects of market conditions on foundation problems
Foundation types	Different foundation types exhibit different characteristics

The findings from the expert interviews corroborate the earlier established negative relationship between the impairment of foundation quality and residential housing prices revealed by the quantitative analysis. In their perspective, a defective foundation has a clear negative effect on housing prices. Accordingly, the perspectives of the real estate agents fall in line with hypothesis one. Several factors, however, surfaced that considerably influence this relationship. For instance, all experts named the maintenance term as a determinant of the strength of this relationship. When a foundation examination is conducted,

the resulting report contains a maintenance term that estimates the durability of a groundwork in years. A structurally bad foundation can have a maintenance term of 0 to 5 years, a good one of 25+. Therefore, these terms are synonymous with the quality of foundations. The established price effects differ substantially between these terms. As expert B formulates it:

*“It depends, of course, on when it<sup>7</sup> has to happen. Look, if there is urgency, then it will have a 1 on 1 influence on the value. However, when it has to be done in the future, and people have to save up for it, it will lessen the influence.”*

Among the experts, there is consensus that short-term foundation problems are causing considerable devaluation while in the mid-long term these problems do not play a big part. If there is uncertainty, this can cause devaluation as well, especially when the residence of interest is located in a high-risk zone. The main reason for the devaluation is cost. The costs paired with foundation repair are high. Expert C estimates that for a standard dwelling in Rotterdam with a surface area of 66 meters a foundation repair costs between 80.000 to 100.000 euro. Expert A mentions similar costs, 1500 euro per square meter that needs repairs. These costs, however, can decrease when they are shared between apartments. Nevertheless, this surfaces the additional problem of getting everyone to pull together. Moreover, as stated in the quote above, potential home buyers sometimes have a buffer or the possibility to save up for future repairs. This is specified as an impeding effect on the adequate pricing of foundation quality. Remarkably, two of the experts remark that a renovation can also offer an opportunity for expanding the property with a basement.

As stated previously, the heterogenic foundations in Rotterdam all have their own characteristics and price effects. Especially the wooden pile foundations are perceived to be prone to damage and repairs. To this day, not a single expert has experienced an inhibited concrete foundation. Expert B describes it as follows:

*“You have wood or concrete, with wooden foundations its has influence, with concrete it does not, then one is sure there is nothing wrong.”*

Overall, the perspective of the experts does align with H2: wooden foundations are valued less than their concrete counterparts. This is mostly attributable to the increased risk due to structural impairment. In addition, non-piledriven foundations are also mentioned. These groundworks are mostly made up of steel beams or in some rare cases animal skins. Due to the lack of piles anchoring the structures in the ground, these residences are free to move in accordance with their subsoil. Most of these houses are built upon sand layers and experience little movement or a slight tilt. However, an alternative perspective is also given by expert C, illustrating increased risk:

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<sup>7</sup> Foundation repair



*‘‘Foundation on steel is different, that requires even more customization. Because it is built on steel there is rarely an examination of the foundations and it displays different problems. When a house is non-piledriven and has a slight tilt then you can sell it for a good price. But do you own a home and the tilt is such that the residence lies under the ground level and water freely enters, then the value will decrease steeply. Sometimes demolition and new development is the best solution.’’*

With these results and the earlier established quantitative findings, SQ1 and SQ2 have been answered in a sufficient way.

Another phenomenon that is mentioned frequently in relation to foundation problems is the current market conditions. There is a clear discrepancy in the effect of foundation quality on residential housing value between market cycles. Expert A illustrates this in the following segment:

*‘‘It is different now than in 2015/2016. In those times a home in a neighbourhood with known foundation problems became a thing. These days people are stepping over it too easily. This has to do with the moment of the market wherein people are buying.’’*

Due to the high demand, adding conditions or request for a foundation examination during a sale process will inhibit your chance of buying the property. Therefore, as a side-effect, the heated market diminishes the number of foundation examinations that are conducted. Or in the words of Expert D:

*‘‘Sure, before that<sup>8</sup> there was way more research. Yet, due to the scarcity and the potential buyers you see people stepping over that.’’*

In terms of information on the subject, the real estate agents prefer more foundation examinations to be conducted. Nevertheless, the information supply regarding foundations can be categorized as good, all experts note that Rotterdam has an extensive and transparent policy on the subject. The Funderingsloket<sup>9</sup> supplies a map illustrating risk levels, foundation types, monitoring wells, and available foundation examination reports. The information supplied by the municipality is considerably above the national coverage, where only a risk map exists. This gives appraisers, real estate agents, owners, and consumers adequate access to the available inside knowledge. The way this knowledge is spread, and whether asymmetric information exists between owners and buyers is also remarked upon. All interviewees agree that this is not a big problem in Rotterdam. The experts mention the duty to disclosure of the seller and the occupational risks for real estate agents as the major deterrents. The real estate agents perceive themselves as a safety net against malicious withholding of information regarding foundation status. Still, unintentional asymmetric information can arise when real estate agents do not know where to get information surrounding the topic. Firms from areas outside Rotterdam where there are no foundation

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<sup>8</sup> The current housing boom

<sup>9</sup> A municipal policy desk devoted to foundation problems

problems could overlook eventual information concerning foundation quality. Nevertheless, this information is freely accessible and obtainable.

To further understand the role of risk assessment of potential home-buyers, several questions were asked. These give insights into consumer behaviour and biases in relation to the valuation of foundation quality. From their perspective, real estate agents describe home searchers as certainly aware of the problems foundation damage can generate. During sightings, one of the first questions people ask is ‘‘how are the foundations?’’. This is mostly attributed to the high awareness concerning the issue and the information provided by the municipality. Correspondingly, all experts emphasize that they provide this information to their clients. Nevertheless, the processing of this information by potential buyers is not always considered adequate. Two scenarios are highlighted. Either there is a foundation report available, or there is uncertainty surrounding the state of the groundwork. Both reveal a different dynamic. When there is no examination report the eventual risks can be downplayed or overlooked. Expert C formulates it as follows:

*‘‘It is a good thing that potential buyers ask "how is the foundation?" Then the answer is often "it is a high-risk area and there have never been any investigations into the foundation". That they thereafter decide to just take the risk is a different thing. But I understand where they come from, you just have to take it into account.’’*

This exemplifies that when information on the subject of foundations and the paired risks is incomplete consumers often just step over it. This is enhanced by the fact that in the current market sellers are often not willing to allow an examination to happen. Other factors inhibiting foundation inspections are the costs of such a measure, which are approximately 3000 euro, and the time the process takes, 6 to 8 weeks. With the demand pressure of the current market proposing stipulations or requests for an investigation will place a consumer at the back of the row of potential buyers. Contrastingly, structural building inspections still take place, especially when transacting older structures. Nevertheless, this is only a visual inspection and does not include any information about the quality of the foundation apart from eventual visual elements hinting in that direction. In the second scenario, there is a foundation report available. In these cases, the maintenance term of the groundwork plays a significant role. The need for short-term foundation repairs through a maintenance term of 0-5 years will induce a 1 on 1 price effect and discourage potential buyers. Problems that will arise in the longer term, per contra, are often overlooked. Expert A remarks;

*‘‘Everyone thinks 10 to 15 years, don't cross the bridges before you come to them. That's how people work.’’*

Similarly, expert B remarks:

*“Sometimes we say “in about 15 years it really needs to happen”. So then it plays a little part but in this overheated market people often think: “it will last my time”<sup>10</sup>”*

The heated market conditions are a recurring theme that leads the consumer to downplay future risk to be able to get access to the housing market. This sentiment is described by expert B as "ostrich politics", a synonym for consumers sticking their heads in the sand, and downplaying the risks to be able to buy a property. This laissez-faire attitude exemplifies a degree of overconfidence and through looking the other way. It has to be noted that continued appreciation of the property and saving or a capital buffer will allow home buyers to execute the needed repairs in the future. A future market downturn, however, combined with foundation problems can expose these buyers to excessive risks. Expert A illustrates this with the following anecdote:

*“It has become greed. And I get it, because if you have been living at home with your parents for 2.5 years longer than planned, or you have received a huge amount of money from the sale of your own house, then yes, it is easier to spend. But then again, there may come a time when you have to sell, and then the outcome may be different.”*

Overall, these findings provide a nuanced answer to H3. The hypothesis was formulated as follows: consumer behaviour, biases & information asymmetry lead to an underestimation of the risks and potential price-determining properties of foundations. This statement can partially be accepted. In the perspective of real estate agents that are active in the current real estate market in Rotterdam, consumer behaviour does insinuate an underestimation of mid to long-term risks. Short-term risks seem adequately represented in both prices and the risk aversion of consumers. Moreover, uncertainty about the state of foundations can also give rise to risk underestimation. Both these dynamics are accelerated by market conditions. According to the experts, there is no substantiated reason to expect that information asymmetry plays a large role regarding the structural damage of groundworks. The supply of available information is mostly adequate and transparent. On the other hand, inexperience and ignorance are noted to potentially effectuate an uneven distribution of information between seller and buyer.

The qualitative insights listed above provide a suiting answer to SQ3.

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<sup>10</sup> A Dutch proverb referring to a lack of concern about an undertaking with consequences on the longer term

## 5. DISCUSSION

In this section, the quantitative and qualitative results will be compared, discussed, and contrasted with preceding academic endeavors. A moderate body of literature identifies the linkage between impaired foundations and physical damage to structures (Reddish & Wittaker, 2012). Using a comparable sample to this thesis consisting of residences in the cities of Dordrecht and Zaanstad Peduto *et al.* (2016) illustrate the aforementioned relation through the matching of DInSAR (Differential Interferometry Synthetic Aperture Radar) and damage surveys. The results presented in this thesis add a thus far unexplored economic dimension to these structural problems. Utilizing a sample of residential homes in Rotterdam quantitative analysis estimates a 2.28% transaction price discount whenever the quality of foundations degrades with one unit on a scale of six. Qualitative analysis verifies this negative relation. Nevertheless, the results indicate that local real estate agents perceive this relation in a non-linear way. The worst structurally damaged category is identified to exhibit a greater impact on housing value relative to the superior categories. Additionally, The experts emphasize that it is hard to generalize individual cases, owing to the heterogeneous character of the real estate market. Nevertheless, the observed negative relation falls in line with the notion that structural quality and the maintenance thereof is an important factor in the valuation of housing prices (Sirmans, 2005). In a comparable hedonic analysis using NVM data, Francke & van de Minne (2017) conclude that after 50 years of negligence of the maintenance of residential housing in 's Hertogenbosch a depreciation of 48% is observed. Due to the nature of the groundwork of a structure, maintenance is a strenuous and expensive process. The negative relation between the gradation of quality and prices can therefore be seen as an illustration of these costs. As previously established, the inhibition of foundations is mainly caused by environmental factors like differential settling, water level changes, and ecological pests (Peduto *et al.*, 2016; Klaassen 2015; Nicholls; 2019). Ergo, the effect of foundation quality on housing value can be viewed in a similar light as other environmental factors identified to cause structural impairment. For instance, Koster & van Ommeren (2015) estimate that exposure to earthquakes in the province of Groningen decreases housing value by 1.9% per tremor with a peak ground velocity of over half a centimeter per second. Yoo & Perrings (2017) estimate that in Maricopa County, Arizona, homes in subsiding areas exhibit a value decrease of 9.9%. In a study noticeably analogous to this thesis, Willemsen, Kok & Kuik (2020) explore the effects of subsidence on housing prices. Subsequently the cities Rotterdam, Arnhem, and Gouda are selected as a sample. Combining subsidence and NVM data reveals a discount in housing value of 7% for subsiding buildings in Rotterdam. This discount is to a certain extent comparable to the 2.28% price drop per gradation of quality impairment found in the quantitative analysis. Moreover, the use of an indicator variable for structurally good or impaired foundations in model 5 exhibits a discount of 8.26% for structurally impaired foundations. This is compatible with the findings of Willemsen, Kok & Kuik (2020). It has to be alluded that these results are an indication, due to data limitations, a relatively low amount of the variance is explained by the model, leaving it vulnerable to omitted variable bias.

Additionally, other factors might introduce bias to the statistical models. The experts mention that the prospect of saving up or having a buffer for future foundation damages can reduce the price effects that foundation quality has on housing value. Similarly, this can influence the pricing of foundation types in an adverse way. Furthermore, as a consequence of using secondary data measurement errors could be present in both the NVM as well as the foundation examination data.

Exploring the effect of foundation type on housing value does not yield statistically significant results. Contrastingly, examining the effects of foundation quality on different types of groundworks does reveal significant price discounts. Impaired concrete foundations present a major price decline as opposed to the non-piledriven and wooden counterparts. A potential explanation lies in the fact that damage to concrete groundworks is a rarity. All experts profess that they have never seen such a situation in their careers. Additionally, repairing and replacing concrete piles results in a relatively large-scale operation. The fact that wooden piles are shown to exhibit a price premium relative to concrete foundations, albeit insignificant, might be attributed to two characteristics working against each other. The high levels of multicollinearity in the last two models form a limitation to this part of the analysis. It is plausible that the overlap between foundation types and the age of the building, as plotted in Appendix B, obstruct an independent estimation of the value impact of these factors. Klaassen (2015) states that older wooden foundations are more susceptible to structural damage. The examination of the structural capacities of different types conducted by Peduto *et al.* (2016) substantiates these perceptions. Overall theory accepts that wooden foundations are more vulnerable than their concrete counterparts. Accordingly, the interviewed real estate agents perceive an economic discount for this type compared to a concrete groundwork. As discussed before, knowing that wooden foundations will experience structural problems might entice buyers to take this into consideration prior to the sale by saving a buffer. This anticipation could reduce the importance of the relative quality, which might partially explain the counterintuitive results produced by the interaction between the wooden pile foundation type and its quality. Overall, the qualitative findings demonstrate a validation of the characteristics found by prior literature. Nonetheless, the executed quantitative analysis does not find any statistically significant evidence that substantiates this notion.

In light of the findings, the earlier discussion on the relationship between foundations and consumer behavior can be developed further. Real estate literature defines several behavioral biases subject to potential home buyers. Consumer behavior is known to influence the price-setting workings of a real estate market (Salzman & Zwinkels, 2017). From the expert interviews, it can be deduced that over-optimism, the act of overestimating future appreciation, can be noticed in the current real estate market in Rotterdam. Farlow (2004) remarks that the average homebuyer overestimates appreciation to be 11% per year. This bias is often paired with over-confidence, the notion that consumers overestimate one's level of control of the situation (Salzman & Zwinkels, 2017). This behavior results in the downplaying

of potential risks (Cox & Zwinkels, 2013). The frequent *laissez-faire* purchase of structures with a mid to long-term maintenance term mentioned by the experts forms a good example of this conduct. Additionally, from the insights provided it can be derived that consumers overestimate their level of control. This leads potential home buyers to underestimate the risks corresponding with the lack of information surrounding the state of foundations. The main driver of this process perceived by the local market experts is the market cycle. Scarcity and high demand induced by the contemporary market boom interfere with the rational risk-assessing capabilities of potential home-buyers. This substantiates the earlier theories of Farlow (2013). Specifically, regret theory, the fear of not participating in a heated real estate market and anticipating eventual future regret when not buying the property is observed by real estate agents in Rotterdam. The fear of missing out leads consumers to downplay eventual risks regarding foundation problems. Another phenomenon hypothesized to bias real estate transactions is asymmetric information (Annenberg, 2016). Kurlat & Stroebel (2014) find evidence for these information asymmetries, exemplifying that homeowners often have more information about important characteristics, these sellers often yield a premium on the value of their asset. More informed buyers, however, have the opposite effect. Generating information on the quality of foundations is an expensive and demanding process. The results of such a structural investigation can be detrimental to housing value. This can induce incentives to withhold information during a transaction. Nevertheless, all real estate agents note that in their perception, asymmetric information does not significantly influence transactions and the pricing of foundation problems in Rotterdam. Public information supply by the municipality and the duty to disclosure for sellers are referred to as the main reasons countering heterogeneous information between parties. In this regard, the real estate brokers similarly identify themselves as a safety net against insufficient information. This corroborates earlier notions that real estate agents act as an admirable source of local information during housing transactions (Houston & Sudman, 1977). This is aided by the progressive public information supply organized by the municipality. Due to the transparent distribution of all available information, potential home-buyers and brokers can make an informed decision. This often leads consumers to adequately assess the risks posed by foundations in the short term, provided that a structural examination is available. Eventual uninformed decision-making is attributed to ignorance and inexperienced, often locally unaware, real estate agents.

Altogether the results fit into the wider body of previous academic literature that tries to quantify the effects of a housing component to its total value. While various governmental and non-governmental organizations emphasize the financial and geographical scope and severity of the foundation problem, the subject has received little to no academic attention. Enquiring local real estate agents about the problem illustrates that foundations exert significant influences on housing sales and the sale price. This corroborates the importance of the empirical estimations of the effect conducted in this research. Subsequently, inquiry into the subject allows for strong scientific contributions to be made now and in

the future. The problems addressed in this paper are mostly Dutch in nature. Therefore, the results can to a certain extent be generalized to other areas in the Netherlands. Specifically, historical cities and urban landscapes build upon clay and peat soil suffer from impaired foundation quality and damages through dated foundation techniques, subsidence, and water level changes (Schothorst, 1977; Klaassen & Creemer, 2012). Additionally, climate change is conjectured to increase the geographical scope and severity of subsidence and foundation degradation through droughts (Brouns *et al.*, 2015; Harrison *et al.*, 2012). Due to similar geological and anthropogenic factors particularly urban areas in the western and northern coastal provinces of Zeeland, Zuid-Holland, Noord-Holland, Utrecht, Flevoland, Friesland & Groningen might experience problems similar to Rotterdam.

## 6. CONCLUSION

This research explores the degree to which foundation quality is represented in residential housing transaction prices in the municipality of Rotterdam. A mixed-methods approach co-combining hedonic pricing modeling and problem-centered expert interviews provide insights into the economic impact of foundation impairment. This endeavor is the first to look at the impacts of foundation status on housing value, illuminating a clear gap in academic real estate literature. The key findings bring the following conclusions to light.

Firstly, a significant negative price-effect is revealed between foundation impairment and housing value. Hedonic pricing estimates that a decline in structural foundation quality of one on a scale of six results in a price discount of 2.28%. Additional transformation of the variable foundation quality exemplifies an 8.26% decrease in residential housing value whenever the structure has an impaired foundation relative to a structurally good groundwork. The analysis of local expert knowledge reveals that real estate brokers perceive a similarly negative effect. Nevertheless, they indicate that this relation is not linear, but stronger for structures with a short maintenance term. These results confirm that damage to a structure's groundwork does indeed instigate a negative impact on the transaction prices of residential real estate in Rotterdam.

Secondly, the discrepancy of this effect between different foundation types is projected. A damaged concrete foundation exhibits the strongest price discount in relation to a drop in quality of one gradation. The effects are -14% and -1.22% for concrete and non-piledriven foundations respectively. The effect of the wooden variant is found positive yet statistically insignificant. The supplementary qualitative analysis brings to light that local real estate agents perceive the biggest transaction price discount for wooden groundworks, in comparison to their concrete counterparts. Nonetheless, this paper finds no statistical evidence to support this notion. Additionally, real estate agents emphasize that housing is a heterogeneous market and every transaction is unique.



Finally, inquiring local market experts on the subject of consumer behavior exemplifies the presence of previously identified biases present in the Rotterdam real estate market. In their perception, over-confidence, over-optimism, and regret theory can cause impetuous decision-making. Especially the rational assessment of risks paired with foundations that are conjectured to structurally expire in the mid to long-term is impeded by these dynamics. The contemporary market upswing is identified as an accelerator of these phenomena. Similarly, the heated market deteriorates the information provision due to it hampering the supply of foundation examinations. Nevertheless, the provision of available information to real estate agents, appraisers, owners, and potential home buyers is competently organized by the municipality of Rotterdam. This enables informed decision making leading to a sufficient awareness and valuation of short-term risks. Moreover, asymmetric information is not judged to be a big problem in Rotterdam. This can mostly be attributed to the previously noted transparent information provision. Eventual existing information discrepancies can be credited to inexperience and ignorance towards the problem. The local real estate agents consider themselves to be safety nets in this regard.

Generally, all findings fall in line with the preceding literature. This study can be compared with earlier endeavors exploring the effects of environmental hazards and compromised structural components on residential housing value. As expected, different types of foundations showcase different characteristics. Additionally, consumer behavior and contemporary market conditions play a significant role in the price-setting workings of foundations. Nevertheless, certain Limitations restrict the explanatory usefulness of the methods employed in this analysis. The main limitation restricting the accuracy and generalizability of the paper is the plausible presence of exogenous variables unidentified by the statistical models. Additionally, the qualitative results might be biased since it is made up of the sole perspective of real estate agents. The views of potential home buyers themselves are not included.

The abovementioned results are the first on a hitherto academically unexplored aspect of housing value. The new insights allow for several policy implications. Estimating the impact foundation quality exhibits on transaction prices can enhance approximations of the economic costs of the contemporary foundation problems in the Netherlands. Additionally, the findings illustrate the importance and value of transparent municipal policy and information supply on the subject of foundations. Especially in the Dutch context, more research into the concern would be beneficial. This thesis specifically focuses on the impact of structures with a known foundation status. Uncertainty with respect to the structural quality of a groundwork can have a comparable impact on housing value. This provides a clear opportunity for future research endeavors. Comparing residential microtransactions between structures with available and undisclosed information regarding the groundwork of a structure can reveal the impact of uncertainty on transaction prices.



**REFERENCES**

- Agarwal, S., He, J., Sing, T. F., & Song, C., 2019, Do real estate agents have information advantages in housing markets? *Journal of Financial Economics*. 134(3): 715-735.
- Armengot, J., Williams, B., & Padiá, J.F., 2019, Spatial and temporal impacts on building depreciation. *Journal of Property Research*. 36(2): 206-225.
- Atlas.ti, 2021, *Qualitative Data Analysis*. Version 22.0.5.0. Berlin: ATLAS.ti Scientific Software Development GmbH.
- Anenberg, E., 2016, Information Frictions and Housing Market Dynamics, *International Economic Review*. 57(4): 1449–1479.
- Baum, A., 1993, Quality, depreciation, and property performance. *The Journal of Real Estate Research*. 8: 541–565.
- Brouns, K., Eikelboom, T., Jansen, P. C., Janssen, R., Kwakernaak, C., van den Akker, J. J., & Verhoeven, J. T., 2015, Spatial analysis of soil subsidence in peat meadow areas in Friesland in relation to land and water management, climate change, and adaptation. *Environmental management*. 55(2): 360-372.
- Brolsma, R. J., Buma, J., van Meerten, H., Dionisio, M., & Elbers, J. A., 2012, Effect van droogte op stedelijk gebied, Kennisinventarisatie.
- Breusch, T. S., & Pagan, A. R., 1979, A simple test for heteroscedasticity and random coefficient variation. *Econometrica: Journal of the econometric society*. 1287-1294.
- Billings, S.B., 2015, Hedonic Amenity Valuation and Housing Renovations. *Real Estate Economics*. 43(3): 652-682.
- Charmaz, K., 2006, *Constructing grounded theory: A practical guide through qualitative analysis*. London: Sage Publications.
- Cook, R. D., 1977, Detection of influential observation in linear regression. *Technometrics*. 19(1): 15-18.
- Cox, R., & Zwinkels, R. C., 2013, Overconfidence and Demand for Mortgage Insurance. *Real Estate Economics*, Forthcoming.
- Clayton, J., 1997, Are housing price cycles driven by irrational expectations? *The Journal of Real Estate Finance and Economics*. 14(3): 341-363.
- Duan, N., 1983, Smearing estimate: A nonparametric retransformation method. *Journal of the American Statistical Association*. 78: 605-610.

- Dale-Johnson, D., & Phillips, G. M., 1984, Housing Attributes Associated with Capital Gain. *Real Estate Economics*. 12(2): 162–175.
- de Wit, E. R., & van der Klaauw, B., 2013, Asymmetric Information and List-Price Reductions in the Housing Market. *Regional Science and Urban Economics*. 43(3): 507–520. doi: 10.1016/j.regsciurbeco.2013.03.001.
- Doornkamp, J. C., 1993, Clay shrinkage induced subsidence. *Geographical Journal*. 196-202.
- Döringer, S., 2021, The problem-centred expert interview. Combining qualitative interviewing approaches for investigating implicit expert knowledge, *International Journal of Social Research Methodology*. 24(3): 265-278, DOI: 10.1080/13645579.2020.1766777
- Dumm, R. E., Nyce, C., Sirmans, G. S., & Smersh, G. T., 2020, Pricing Moral Hazard in Residential Properties: The Impact of Sinkhole Claims on House Prices. *The Journal of Real Estate Finance and Economics*. 1-41.
- Dumm, R. E., Sirmans, G. S., & Smersh, G. T., 2018, Sinkholes and residential property prices: Presence, proximity, and density. *Journal of Real Estate Research*. 40(1): 41-68.
- Esri Inc, 2016, *ArcMap*. Software (version 10.5. 1).. Redlands, CA: Esri Inc.
- Farlow, A., 2004, The U.K. Housing Market: Bubbles and Buyers. *Paper presented at the Credit Suisse First Boston Housing Market Conference*.
- Farlow, A., 2013, *Crash and beyond: Causes and consequences of the global financial crisis*. Oxford University Press.
- Francke, M. K., & van de Minne, A. M., 2017, Land, structure and depreciation. *Real Estate Economics*. 45(2): 415-451.
- Gemeente Rotterdam, 2022, Funderingskaart. Retrieved at 2-12-2021. Available from: <https://www.duikinjefundering.nl/funderingskaart>
- Gemeente Rotterdam, 2021, Onderzoek 010, Bevolking per 1 januari. Retrieved at 2-11-2021. Available from: <https://onderzoek010.nl/dashboard/onderzoek010/bevolking/>
- Gemeente Rotterdam, 2021, Onderzoek 010, Woningvoorraad naar bezit 2021. Retrieved at 2-11-2021. Available from: <https://onderzoek010.nl/dashboard/onderzoek010/>
- Hair, J.F., Black, W.C., Babin, B.J. & Anderson, R.E., 2010, *Multivariate Data Analysis*. 7th Edition, Pearson, New York.
- Harrison, A. M., Plim, J. F. M., Harrison, M., Jones, L. D., & Culshaw, M. G., 2012, The relationship between shrink–swell occurrence and climate in south-east England. *Proceedings of the Geologists' Association*. 123(4): 556-575.
- Hayek, F. A., 1945, The use of knowledge in society. *The American economic review*. 35(4): 519-530.

- Hayes, A., & Cai, 2007, Using heteroskedasticity-consistent standard error estimators in OLS regression: An introduction and software implementation. *Behavior Research Methods* 2007. 39 (4): 709-722.
- Houston, M. J., & Sudman, S., 1977, Real estate agents as a source of information for home buyers. *Journal of Consumer Affairs*. 11(1): 110-121.
- Kagie, M., & Wezel, M. V., 2007, Hedonic price models and indices based on boosting applied to the Dutch housing market. *Intelligent Systems in Accounting, Finance & Management: International Journal*. 15(3-4): 85-106.
- KCAF., 2021, Wat doet het KCAF? Retrieved on 10-2-2021, Available from <https://www.kcaf.nl/wat-doet-het-kcaf/>.
- Klaassen, R. K., 2008, Bacterial decay in wooden foundation piles—Patterns and causes: A study of historical pile foundations in the Netherlands. *International biodeterioration & biodegradation*. 61(1): 45-60.
- Klaassen, R. K., & Creemers, J. G., 2012, Wooden foundation piles and its underestimated relevance for cultural heritage. *Journal of cultural heritage*. 13(3): S123-S128.
- Klaassen, R. K., 2015, Life Expectation of Wooden Foundations – a Non-Destructive Approach. *In Proc. of International Symposium Non-Destructive Testing in Civil Engineering (NDT-CE)*. Berlin, Germany, 775-779.
- Koster, H. R., & Van Ommeren, J., 2015, A shaky business: Natural gas extraction, earthquakes and house prices. *European Economic Review*. 80: 120-139.
- Levitt, S., D. & Syverson, C., 2008, Market Distortions When Agents Are Better Informed: The Value of Information in Real Estate Transactions. *The Review of Economics and Statistics*. 90(4): 599–611.
- NGR, 2016, Cultuurhistorische Hoofdstructuur: Archeologie, afzettingen. Retrieved at 15-11-2021 available from: <https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/6F9E4854-31E8-415A-B413-2CC8B0EFD4EF?tab=relations>
- Nicholls, S., 2019, Impacts of environmental disturbances on housing prices: A review of the hedonic pricing literature. *Journal of environmental management*. 246: 1-10.
- Nyce, C., Dumm, R., Sirmans, S., & Smersh, G., 2015, The capitalization of homeowners' insurance premiums in house prices. *Journal of Risk and Insurance*. 82: 891–919.
- Oosterhoff, J., 2008, *Kracht + vorm*. Bouwen Met Staal, Zoetermeer.
- Hair, J.F., Black, W.C., Babin, B.J. & Anderson, R.E., 2010, *Multivariate Data Analysis*. 7th Edition, Pearson, New York.

- Öztürk, B., van Dijk, D., van Hoenselaar, F., & Burgers, S., 2019, The relationship between supply constraints and house price dynamics in the Netherlands. *Hot Property*. 141-152.
- Paling, R., 2020, Funderingslabel bezorgt eigenaar woning nieuwe kopzorgen. *Vastgoedmarkt*. retrieved at 10-2-2021. Available from <https://www.vastgoedmarkt.nl/woningen/nieuws/2020/10/funderingslabel-bezorgt-eigenaar-woning-nieuwe-kopzorgen-101157845>
- Peduto, D., Nicodemo, G., Maccabiani, J., & Ferlisi, S., 2017, Multi-scale analysis of settlement-induced building damage using damage surveys and DInSAR data: A case study in The Netherlands. *Engineering geology*. 218: 117-133.
- Peduto, D., Nicodemo, G., Maccabiani, J., Ferlisi, S., D'Angelo, R., & Marchese, A., 2016, Investigating the behaviour of buildings with different foundation types on soft soils: two case studies in The Netherlands. *Procedia Engineering*. 158: 529-534.
- Pregibon, D., 1980, Goodness of link tests for generalized linear models. *Journal of the Royal Statistical Society: Series C (Applied Statistics)*. 29(1): 15-24.
- Ramsey, J. B., 1969, Tests for specification errors in classical linear least-squares regression analysis. *Journal of the Royal Statistical Society: Series B (Methodological)*. 31(2): 350-371.
- Reddish, D.J., & Whittaker, B.N. 2012, *Subsidence: Occurrence, Prediction and Control*. Elsevier.
- Rolheiser, L., van Dijk, D., & van de Minne, A., 2020, Housing vintage and price dynamics. *Regional Science and Urban Economics*. 84, 103569.
- Rosenblatt, M., 1956, A central limit theorem and a strong mixing condition. *Proceedings of the National Academy of Sciences of the United States of America*. 42(1): 43.
- Rosen, S., 1974, Hedonic prices and implicit markets: product differentiation in pure competition. *Journal of political economy*. 82(1): 34-55.
- Salzman, D., & Zwinkels, R. C. J., 2017, Behavioral Real Estate. *Journal of Real Estate Literature*. 25(1): 77–106.
- Schothorst, C. J., 1977, Subsidence of low moor peat soils in the western Netherlands. *Geoderma*. 17: 265–291.
- Shapiro, S., & Wilcoxon, M., 1965, An analysis of variance test for normality. *Biometrika*, 52(3): 591-611.
- Sirmans, S., Macpherson, D., & Zietz, E., 2005, The composition of hedonic pricing models. *Journal of real estate literature*. 13(1): 1-44.
- StataCorp, 2019, *Stata Statistical Software: Release 16*. College Station, TX: StataCorp LLC.

- Syed, I. A., & De Haan, J., 2017, Age, time, vintage, and price indexes: measuring the depreciation pattern of houses. *Economic Inquiry*. 55(1): 580-600.
- Van den Born, G., Kragt, F., Henkens, D., Rijken, B., Van Bommel, B., & Van der Sluis, S., 2016, *Dalende bodems, stijgende kosten*. Planbureau voor de leefomgeving, the Hague, the Netherlands.
- Van Hardeveld, H. A., Driessen, P. P., Schot, P. P., & Wassen, M. J., 2018, Supporting collaborative policy processes with a multi-criteria discussion of costs and benefits: The case of soil subsidence in Dutch peatlands. *Land use policy*. 77: 425-436.
- Waddell, P., Berry, B. J., & Hoch, I., 1993, Residential property values in a multinodal urban area: New evidence on the implicit price of location. *The Journal of Real Estate Finance and Economics*. 7(2): 117-141.
- Waugh, F. V., 1928, Quality factors influencing vegetable prices. *Journal of farm economics*. 10: 185-196.
- Wassmer, R. W., & Wahid, I., 2019, Does the likely demographics of affordable housing justify NIMBYism? *Housing Policy Debate*. 29(2): 343-358.
- Willemsen, W., Kok, S., & Kuik, O. 2020, The effect of land subsidence on real estate values. Paper presented at the *Proceedings of the International Association of Hydrological Sciences*. 382: 703-707. doi:10.5194/piahs-382-703-2020
- Willemse, N. W., 2018, *Stedelijke ontwikkeling en bodemdaling in en rondom Gouda. Een synthese van drie onderzoeken naar de relatie tussen (stedelijke) ontwikkelingen en bodemdaling*. Publication commissioned by the Coalitie Sterke Stad op Slappe Bodem and the Cultural Heritage Agency of the Netherlands, Gouda.
- Wilhelmsson, M., 2008, House price depreciation rates and level of maintenance. *Journal of Housing Economics*. 17(1): 88-101.
- Yoo, J., & Perrings, C., 2017, An externality of groundwater depletion: land subsidence and residential property prices in Phoenix, Arizona. *Journal of Environmental Economics and Policy*. 6:2: 121-133, DOI: 10.1080/21606544.2016.1226198
- Zabel, J. E., 1999, Controlling for quality in house price indices. *The Journal of Real Estate Finance and Economics*. 19(3): 223-241.

## **APPENDICES**

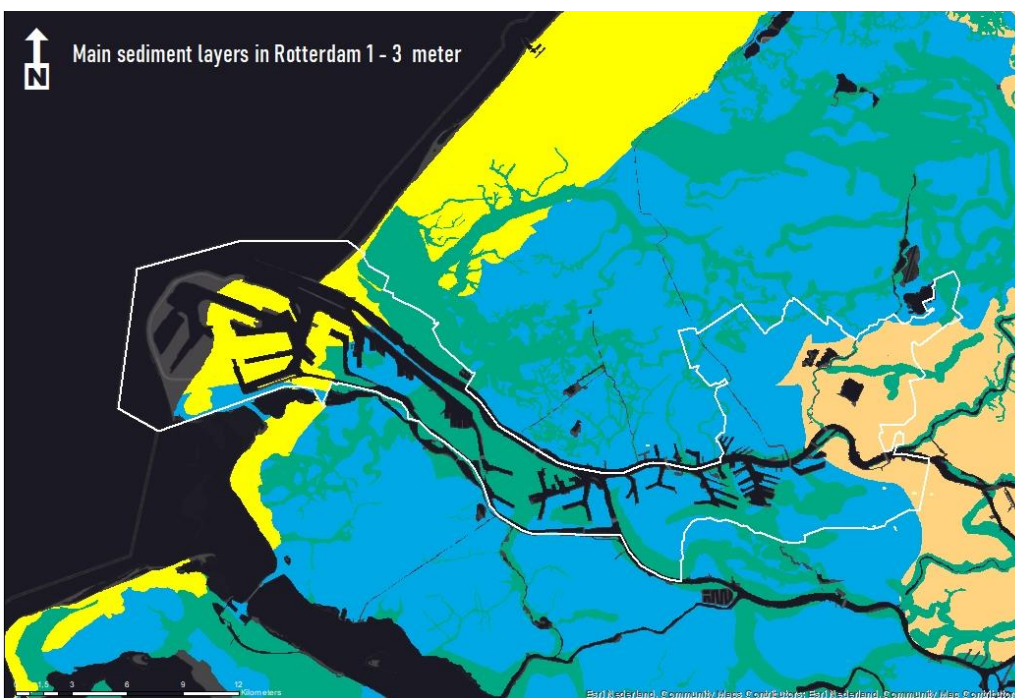
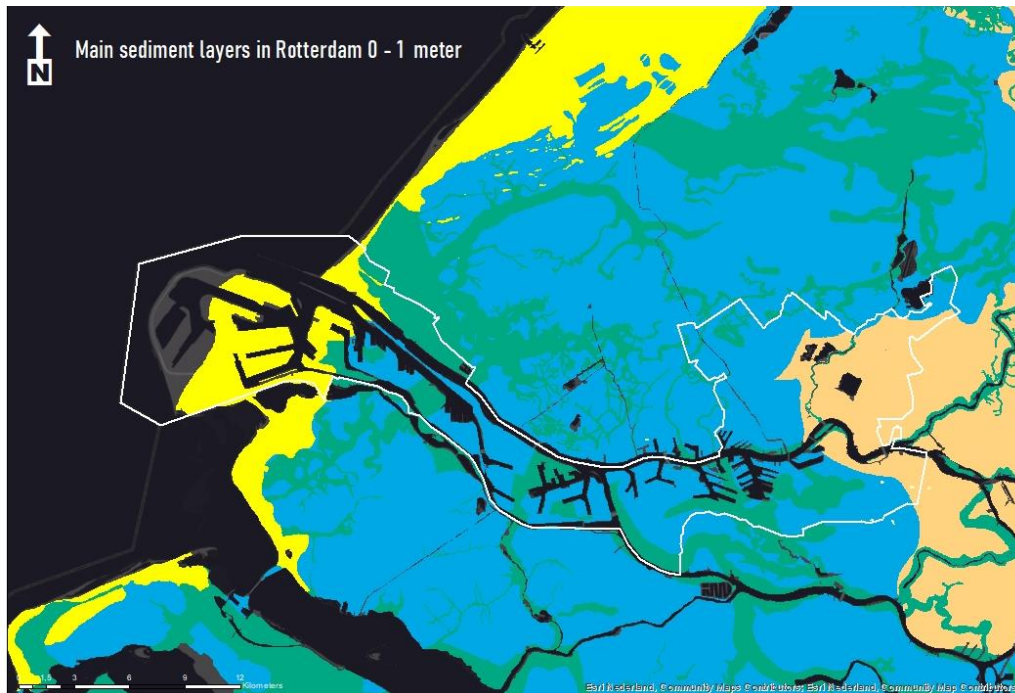
- A. Composition of sediment layers in Rotterdam
- B. Correlation matrix & VIF statistics
- C. Residual plots
- D. Notational glossary
- E. Stata do-file
- F. Regression assumption tests
- G. Interview guide
- H. Regression output
- I. Interview transcriptions

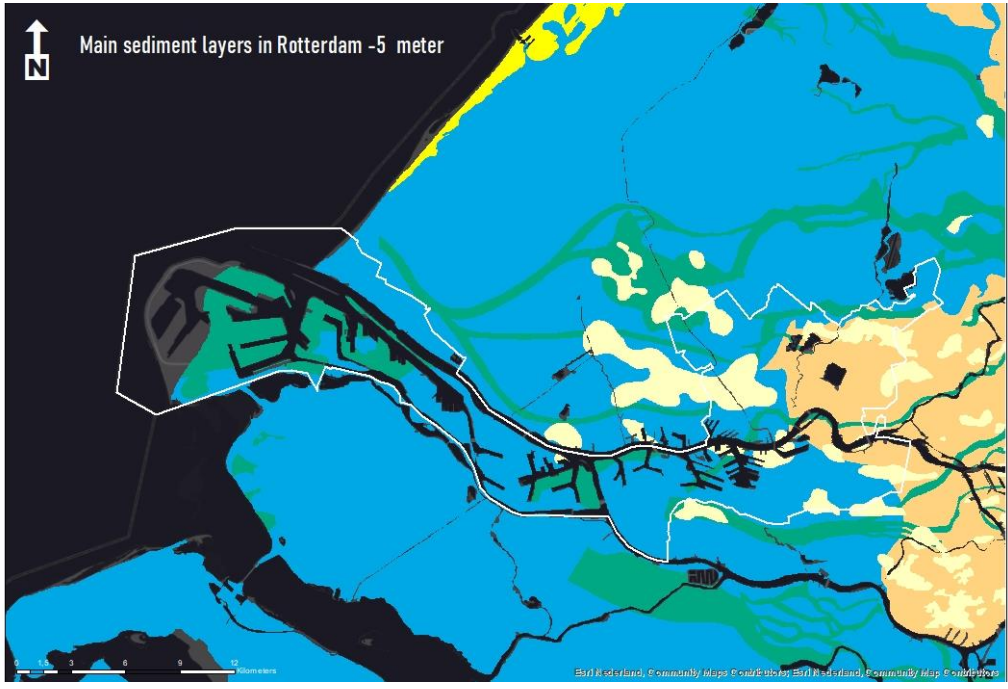
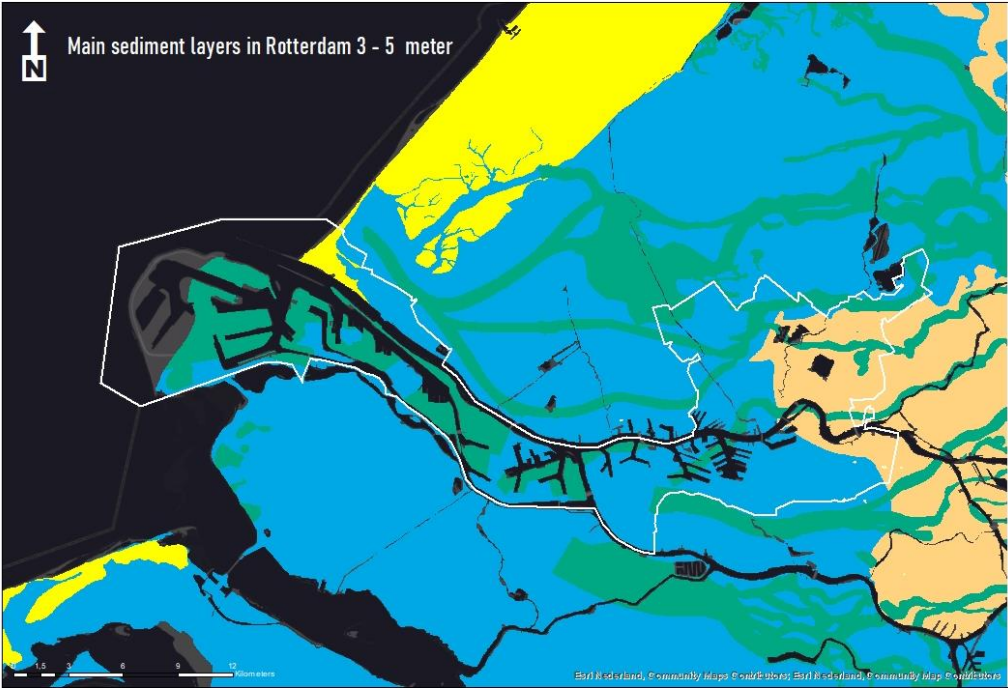


### APPENDIX A: COMPOSITION OF SEDIMENT LAYERS IN ROTTERDAM

#### Legend

- Dunes and beach sands
- River dunes and cover sands
- Marine sediments (mainly clay, in marshy conditions covered with peat)
- Inland lacustrine deposits (sand)
- Stream gullies (sandy ridges & clay)
- Fluvial sediments (clay often covered with peat)







**APPENDIX B: CORRELATION DESCRIPTIVES**

Correlation matrix:

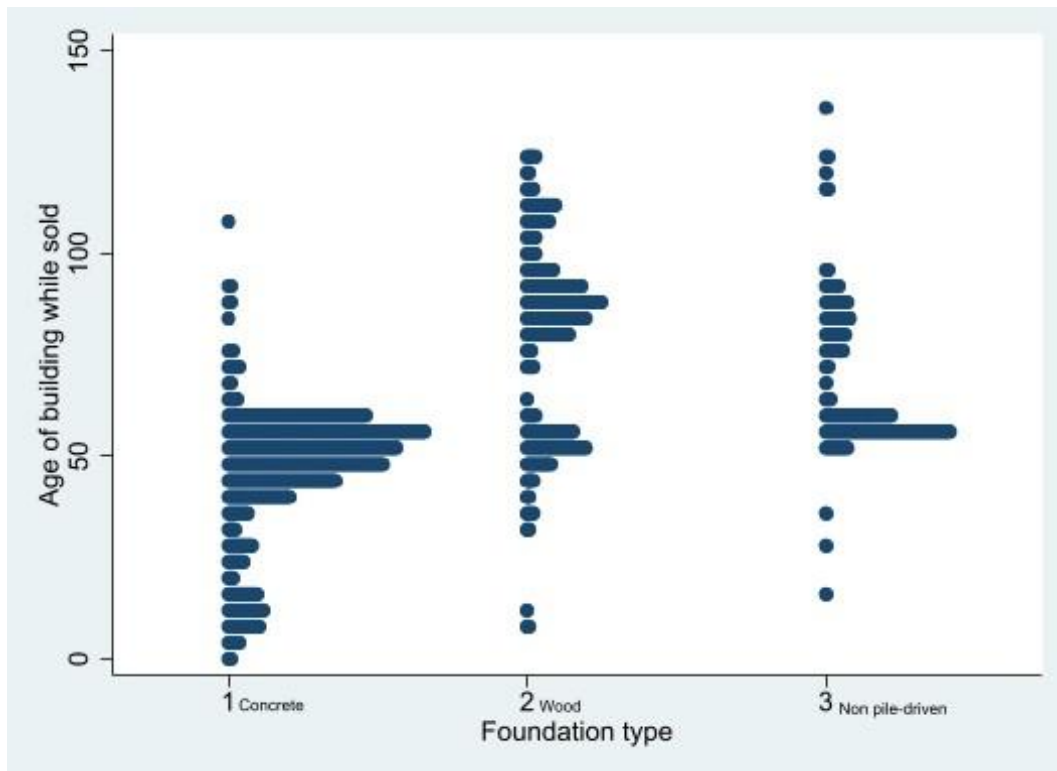
	<b>Insale price</b>	<b>Quality</b>	<b>Surface</b>	<b>Age</b>	<b>Rooms</b>	<b>Found. type</b>	<b>Resid. type</b>	<b>Garage type</b>
<b>Insaleprice</b>	1							
<b>Quality</b>	0.0189	1						
<b>Surface</b>	0.2826	-0.418	1					
<b>Age when sold</b>	0.1472	0.4794	-0.0993	1				
<b>Rooms</b>	0.1426	-0.1325	0.6151	-0.1253	1			
<b>Foundation type</b>	-0.0166	0.7709	-0.1309	0.4647	-0.1949	1		
<b>Residence type</b>	-0.0087	-0.0735	0.2742	-0.3241	0.3318	-0.0626	1	
<b>Garage type</b>	0.0913	-0.0332	0.1776	-0.1666	0.1019	-0.0394	0.068	1
<b>Observations</b>	921							

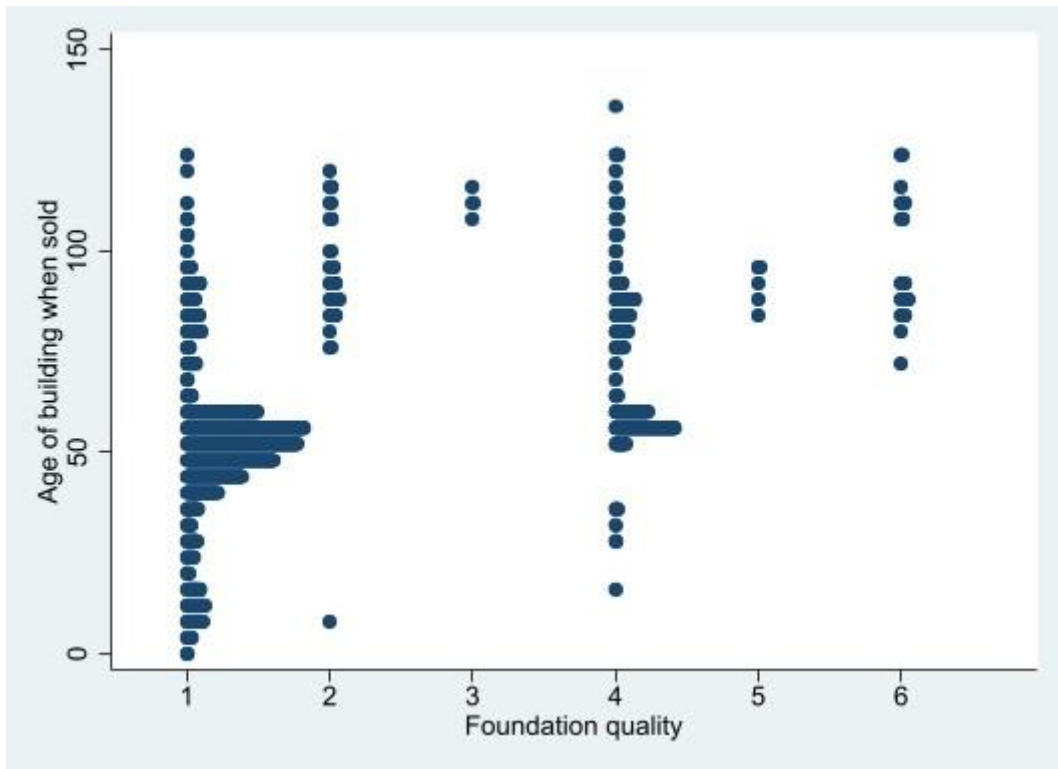
VIF statistics:

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>	<b>Model 5</b>	<b>Model 6</b>	<b>Model 7</b>
<b>Variable</b>	VIF	VIF	VIF	VIF	VIF	VIF	VIF
<b>Quality</b>	1	1.45	2.19	2.27	X	4.53	279.22*
<b>Quality binary</b>	X	X	X	X	2.17	X	X
<b>Rooms</b>	X	1.88	5.33	44.20*	44.15*	44.43*	44.5*
<b>Surface</b>	X	1.82	2.71	2.97	2.97	3.02	3.02
<b>Age</b>	X	1.92	2.37	34.18*	34.27*	35.51*	42.53*
<b>Mean VIF</b>	1	1.77	3.15	2.91	5.07	29.16	92.31

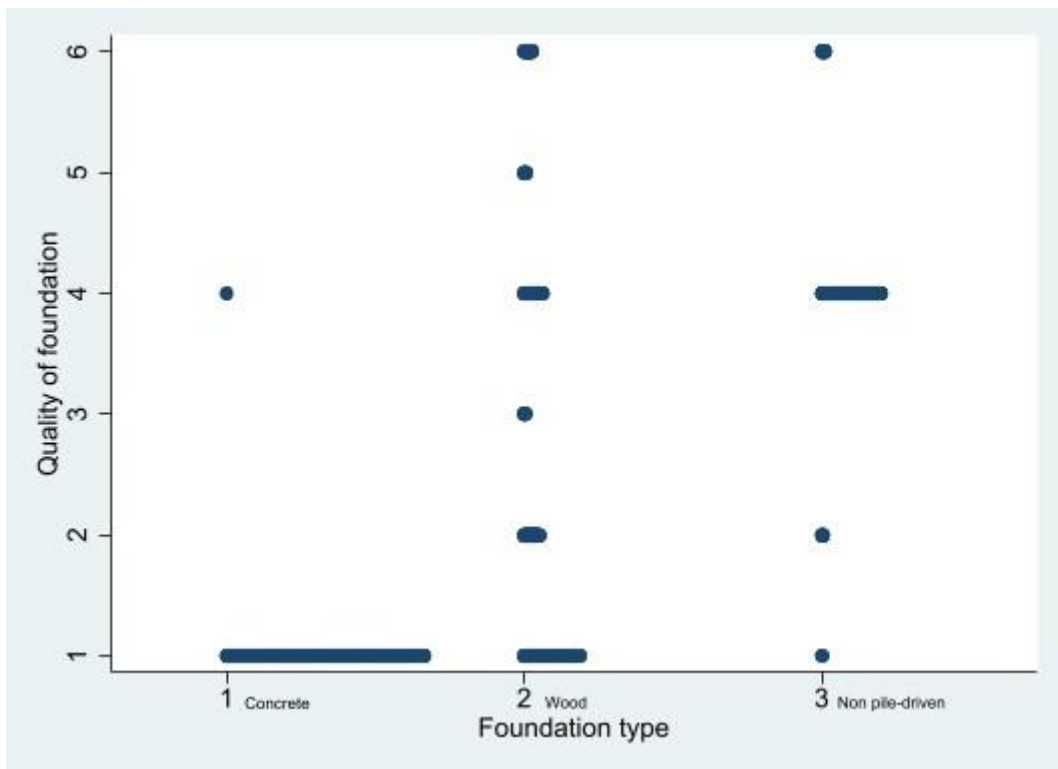
Note: \*variables are polynomials or interacted therefore the VIF is unrepresentative

Dotplot illustrating relations between key variables:



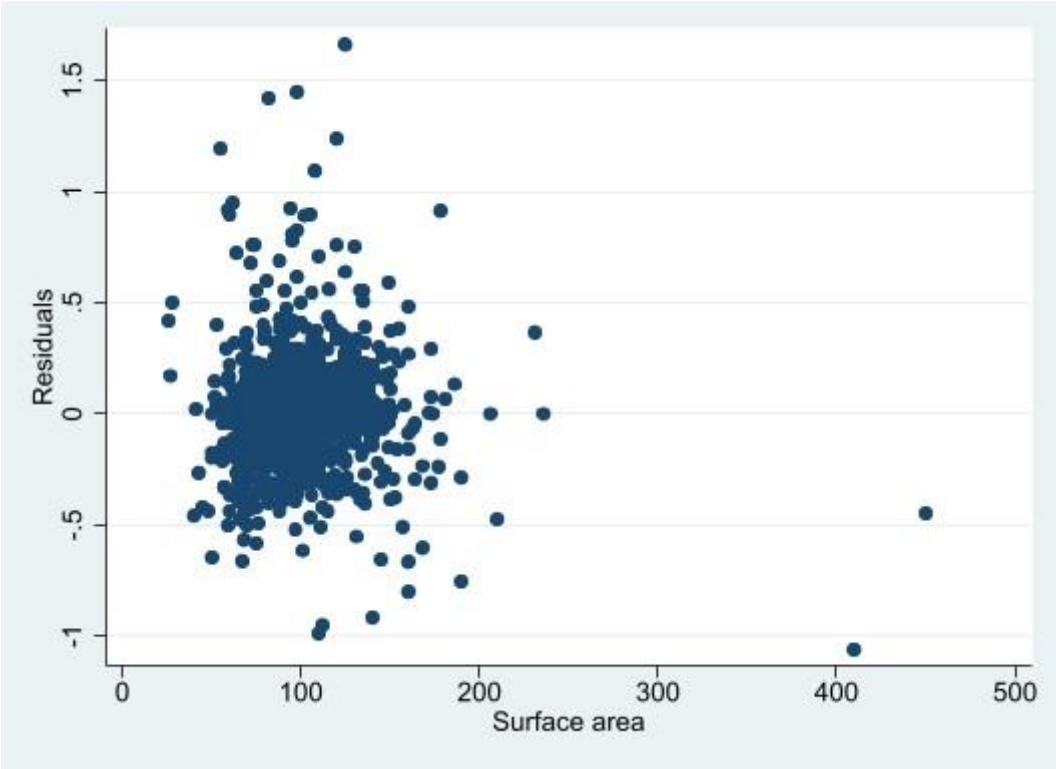
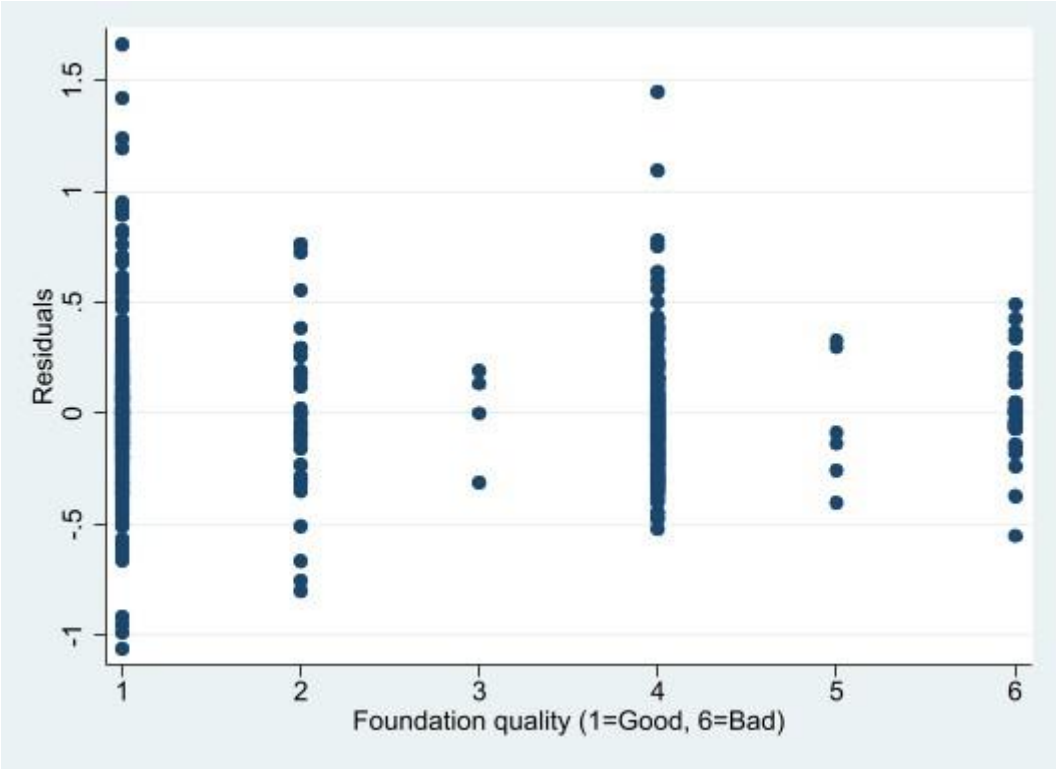


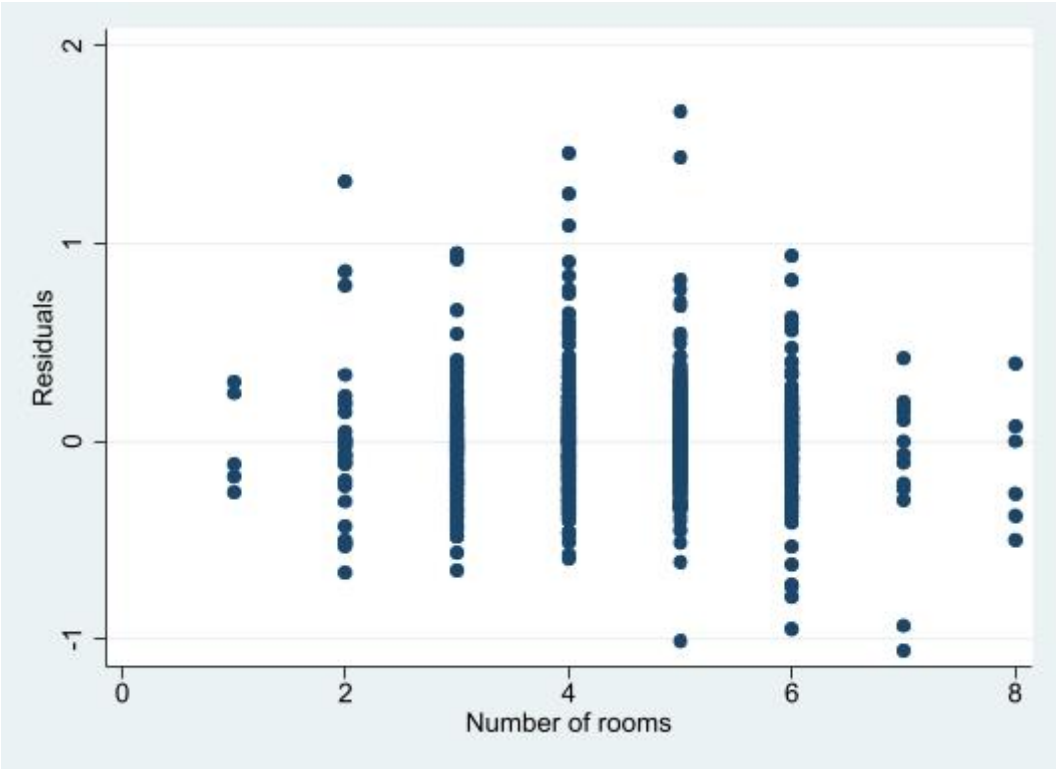
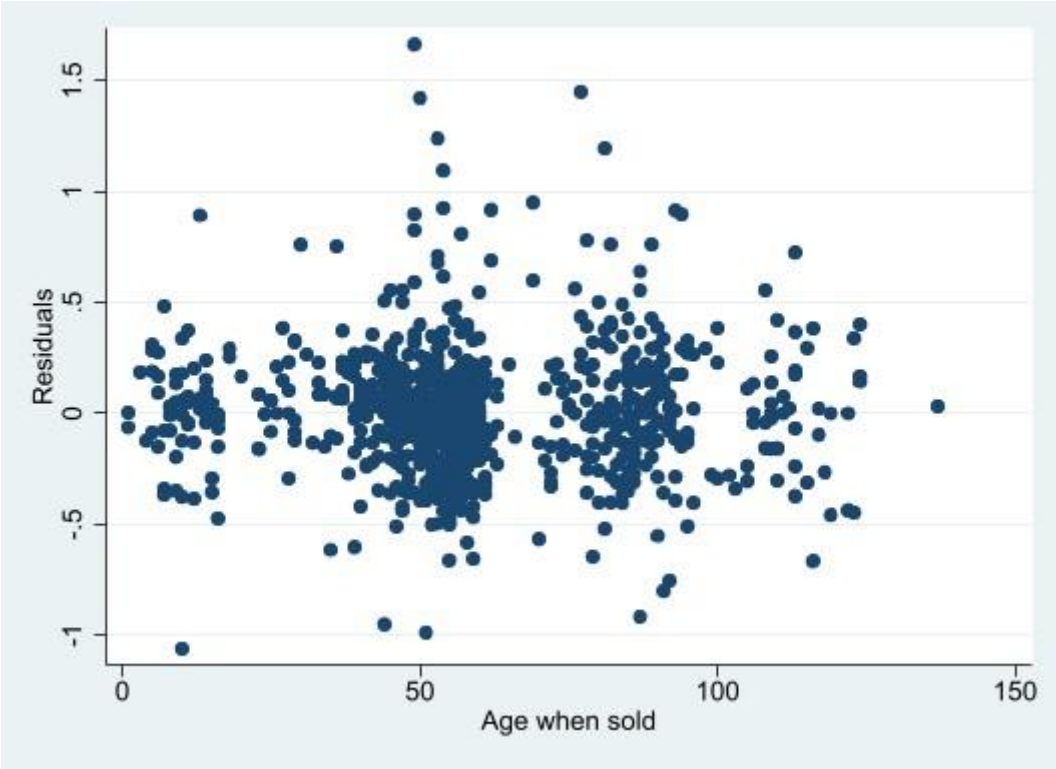
Note: 1 = good, 2 = decent, 3 = mediocre-good, 4 = mediocre, 5 = mediocre-bad 6 = bad



Note: 1 = good, 2 = decent, 3 = mediocre-good, 4 = mediocre, 5 = mediocre-bad 6 = bad

APPENDIX C: RESIDUAL PLOTS





## APPENDIX D: NOTATIONAL GLOSSARY

*Empirical model*

$\ln P$	Logarithm of transaction price
$\beta, \varphi, \gamma$	Parameters to be estimated
$X$	Continuous independent variable
$i$	Property $i=1, \dots, N$
$Z$	Fixed effects
$\varepsilon$	Error term
$c$	Categorical independent variable

Model:	Regression formula
1	$\ln P_i = \beta_0 + \beta_1 X_{1i} + \varepsilon$
2	$\ln P_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \sum_{c=1}^C \varphi_c X_{ci} + \varepsilon$
3	$\ln P_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{3i}^2 + \beta_5 X_{4i}^2 + \sum_{c=1}^C \varphi_c X_{ci} + \varepsilon$
4	$\ln P_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{3i}^2 + \beta_5 X_{4i}^2 + \sum_{c=1}^C \varphi_c X_{ci} + \sum_{z=1}^{64} \gamma_z Z_{zi} + \sum_{z=1}^{130} \gamma_z Z_{zi} + \varepsilon$
5	$\ln P_i = \beta_0 + \sum_{c=1}^2 \beta_c X_{ci} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{3i}^2 + \beta_5 X_{4i}^2 + \sum_{c=1}^C \varphi_c X_{ci} + \sum_{z=1}^{64} \gamma_z Z_{zi} + \sum_{z=1}^{130} \gamma_z Z_{zi} + \varepsilon$
6	$\ln P_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{3i}^2 + \beta_5 X_{4i}^2 + \sum_{c=1}^3 X_{ci} + \sum_{c=1}^C \varphi_c X_{ci} + \sum_{z=1}^{64} \gamma_z Z_{zi} + \sum_{z=1}^{130} \gamma_z Z_{zi} + \varepsilon$
7	$\ln P_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{3i}^2 + \beta_5 X_{4i}^2 + \sum_{c=1}^C \varphi_c X_{ci} + (\beta_5 X_{1i} \sum_{c=1}^3 X_{ci}) + \sum_{z=1}^{64} \gamma_z Z_{zi} + \sum_{z=1}^{130} \gamma_z Z_{zi} + \varepsilon$

**APPENDIX E: STATA DO-FILE**

```
// open dataset
import excel "C:\Users\Gebruiker\Desktop\Master scriptie\AdressenFundering.xls",
sheet("AdressenFundering") firstrow
(18 vars, 32,340 obs)
set maxvar 8000

// drop missing & outdated data
drop if Yearexamination <2010
drop if missing(KwaliteitF)
drop if missing(Type)
drop if Rooms >8
drop if Saleprice =< 1

// generate & encode variables
encode KwaliteitF, gen(Qualityid)
encode funderings, gen(Typefoundation)
encode Garage, gen(GarageID)
encode Type, gen(Typeresidence)
encode postcode, gen(Locationfixed)
encode datumakte, gen(Timefixed)
gen agewhensold = saleyear - Yearbuild
gen Garden = (Perceel > 0)
recode Qualityid (1 = 1) (5 = 2) (3 = 3) (4 = 5) (2 = 4) (6 = 6), gen(Quality)
recode Quality (1 = 1) (2 = 1) (3 = 0) (4 = 0) (5 = 0) (6 = 0), gen(BiQuality)

// descriptive statistics
summarize Saleprice Insaleprice Quality Surface agewhensold Rooms
tab Typefoundation Typeresidence GarageID
correlate Insaleprice Quality Surface agewhensold Rooms Typefoundation Typeresidence GarageID
rvpplot Quality
rvpplot Surface
rvpplot agewhensold
rvpplot Rooms
dotplot Quality, over(Typefoundation3)
dotplot agewhensold, over(Typefoundation3)
dotplot agewhensold, over(Quality)

// dropping the category reasonably good (only 1 observation)
drop if Qualityid==7
```

```
// regression testing
reg lnSaleprice Quality
reg lnSaleprice Quality Surface agewhensold Rooms Typeresidence GarageID Timefixed Locationfixed
vif
regcheck

//drop influential variable
predict var, cook
list var if var > 1 & var !=.
drop in 433

// explore fixed effects interaction
reg lnSaleprice Quality Surface agewhensold Rooms Typeresidence GarageID Timefixed##Locationfixed
regcheck
vif

// explore foundation type
reg lnSaleprice Quality Typefoundation Surface agewhensold Rooms Typeresidence GarageID Timefixed
Locationfixed
regcheck
vif

// transform type of foundation into 3 categories
recode Typefoundation (1 = 1) (2 = 2) (3 = 2) (4 = 2) (5 = 3), gen(Typefoundation3)

// generating polynomials
gen agewhensoldsq = agewhensold^2
gen Roomssq = Rooms^2

// model 1
reg lnSaleprice Quality, vce(robust)
vif

// model 2
reg lnSaleprice Quality Surface agewhensold Rooms i.Typefoundation i.GarageID, vce(robust)
vif
```

```
// model 3
reg Insaleprice Quality Surface agewhensold Rooms i.Typeresidence i.GarageID i.Timefixed
i.Biglocationfixed,vce(robust)
vif

// model 4
reg Insaleprice Quality Surface agewhensold Rooms agewhensoldsq Roomssq i.Typeresidence i.GarageID
i.Timefixed i.Biglocationfixed,vce(robust)
regcheck
vif

//predicting margins
gsem Insaleprice <- Quality Surface agewhensold Rooms agewhensoldsq Roomssq i.Typeresidence
i.GarageID i.Timefixed i.Biglocationfixed,vce(robust) nocapslatent
margins, expression(exp(predict(eta))*(exp((_b[/var(e.Insaleprice)]/2)))) at(Quality=(1(1)6))
marginsplot

// model 5
reg Insaleprice BiQuality Surface agewhensold Rooms agewhensoldsq Roomssq i.Typeresidence i.GarageID
i.Timefixed i.Biglocationfixed,vce(robust)
regcheck
vif

// model 6
reg Insaleprice Quality Typefoundation3 Surface agewhensold Rooms agewhensoldsq Roomssq
i.Typeresidence i.GarageID i.Timefixed i.Biglocationfixed,vce(robust)
regcheck
vif

// model 7
reg Insaleprice Quality##Typefoundation3 Surface agewhensold Rooms agewhensoldsq Roomssq
i.Typeresidence i.GarageID i.Timefixed i.Bocationfixed,vce(robust)
regcheck
vif
```



```
//predicting margins
gsem lnsaleprice <- c.Quality##Typefoundation3 Surface agewhensold Rooms agewhensoldsq Roomssq
i.Typeresidence i.GarageID i.Timefixed i.Biglocationfixed,vce(robust) nocapslatent
margins, expression(exp(predict(eta))*(exp((_b[/var(e.lnsaleprice)]/2)))) at(Quality=(1(1)6))
marginsplot

// export results
outreg2
```

**APPENDIX F: REGRESSION ASSUMPTION TESTS**

		<b>Model 4</b>	<b>Model 5</b>	<b>Model 7</b>	
<b>Test:</b>					p. value tolerance
<b>Breusch-Pagan test</b>	Chi2(1):	44.843	48.676	48.285	
	p. value	0.000*	0.000*	0.000*	> 0.05
<b>Shapiro-Wilk test</b>	z-value:	9.071	9.080	1.88	
	p-value:	0.000*	0.000	0.000*	> 0.01
<b>Link test</b>	t-value:	-0.154	-0.159	0.237	
	p-value:	0.878	0.873	0.813	> 0.05
<b>Reset test</b>	F-value:	1.471	1.409	1.561	
	p-value:	0.221	0.239	0.198	> 0.05
<b>Cook's distance test</b>		There is no distance above the cutoff of 1	There is no distance above the cutoff of 1	There is no distance above the cutoff of 1	

Note: \*assumptions are not met

**APPENDIX G: INTERVIEW GUIDE**

Vooraf: In welke hoedanigheid spreek je de betreffende respondent aan? Als taxateur, verkopend dan wel aankopend makelaar?

1. Loopt u tijdens uw werkzaamheden aan tegen funderingsproblematiek? Zo ja, is dat alleen bij woningen of ook bij andere typen vastgoed? In welke vormen?
2. In welke mate speelt fundering mee in taxatie en verkoopprocessen?
3. Is er een verband tussen funderingskwaliteit en transactiepreisen? Hoe sterk en in welke richting?
4. Is er een verband tussen funderingstypen en transactiepreisen? Hoe sterk en in welke richting?
5. Hangt de mate van prijsdaling ten gevolge van een slechte fundering kwaliteit af van het type fundering? Zo ja, voor welke type fundering is de daling het hoogst?
6. Ontvangt de koper resp. de taxateur sowieso informatie omtrent de fundering? Is de informatievoorziening omtrent funderingen momenteel adequaat?
7. Hoe is de Informatievoorziening naar zowel de taxateur, de eigenaar en de geïnteresseerde koper?
8. Wat weet de taxateur vooraf van de aard en kwaliteit van de fundering of zou moeten weten?
9. Is in de huidige marktomstandigheden sprake van asymmetrische informatie omtrent funderingen tijdens een verkoopproces? (Toelichten)
10. Houden woningzoekenden actief rekening met funderingen? Hoe komt dit tot uiting?
11. Hoe vaak laat een aspirant-koper een bouwtechnisch onderzoek naar de beoogde woning c.q. vatgoedobject uitvoeren? Maakt de fundering(kwaliteit) daar onderdeel van uit?
12. Houden woningzoekenden adequaat rekening met de eventuele risico's die de fundering van een huis met zich mee brengt? Hoe vertaalt dit zich in de prijs?
13. Hebben de recente marktontwikkelingen deze processen beïnvloed? Zo ja, op welke manier?
14. Wordt de funderingsproblematiek voldoende uitgelicht? Zo ja door wie? In welke vorm kan dit verbeterd worden?

**ENGLISH VERSION**

1. In what way do you encounter foundation problems during your work? What forms does it take?
2. In what way do foundations play a role in taxation and sale processes?
3. Is there a relation between foundation quality and transaction prices? How and in what way?
4. Is there a relation between foundation type and transaction prices? How and in what way?
5. Does the price decline as a result of a bad foundation depend on the type of foundation? If yes, in what way and for which type's is this effect the worst?
6. Does the buyer or appraiser receive information regarding foundations per definition? Is the current level of information supply adequate?
7. How is the distribution of information between appraiser, buyer and seller?
8. What does the appraiser know in advance of the nature and quality of foundations?
9. Does, in the current market, asymmetric information regarding foundations in play a role in housing transactions?
10. Do potential home buyers factor in foundation during their search? How does this show?
11. How often does a potential home buyer conduct a structural building inspection to the asset intended? Does this include inspecting foundation(quality)?
12. Do home searchers adequately factor in the eventual risks paired with the foundation of the structure they are looking for? How does this show in the transaction price?
13. Did recent market development influence these processes?
14. Are the foundation problems sufficiently highlighted? In what way can this be improved?

## APPENDIX H: REGRESSION OUTPUT

Variables	Model 4 Log sale price	Model 5 Log sale Price	Model 7 Log sale price
Quality	-0.0231** (0.0117)	X X	-0.152*** (0.0436)
Impaired foundation <sup>[1]</sup>	X	-0.0794** (0.0394697)	X X
Wooden foundation <sup>[2]</sup>	X	X	-0.0985 (0.0809)
Non piledriven foundation <sup>[2]</sup>	X	X	-0.401** (0.162)
Quality*Wooden foundation <sup>[2]</sup>	X	X	0.139*** (0.0454)
Quality*Non-piledriven foundation <sup>[2]</sup>	X	X	0.187*** (0.0571)
Surface area	0.00252*** (0.000807)	0.002513*** (0.0008)	0.00239*** (0.000807)
Age when sold	-0.00474* (0.00245)	-0.00449* (0.00243)	-0.00454* (0.00244)
Age when sold squared	4.02e-05* (2.41e-05)	0.000038 (0.0000235)	3.78e-05 (2.36e-05)
Rooms	0.123* (0.0687)	0.1243* (0.0682)	0.128* (0.0686)
Rooms squared	-0.0150* (0.00769)	-0.0152** (0.0076)	-0.0159** (0.00769)
Appartement	0.0595 (0.136)	0.0526 (0.1397)	0.0334 (0.136)
Ground floor apartment <sup>[3]</sup>	-0.0657 (0.0784)	-0.0665 (0.0783)	-0.0766 (0.0785)
Upstairs apartment <sup>[3]</sup>	-0.111 (0.0760)	-0.1170 (0.0763)	-0.119 (0.0765)
Double ground floor home <sup>[3]</sup>	-0.107 (0.202)	-0.1018 (0.2028)	-0.129 (0.199)
End house <sup>[3]</sup>	0.0860 (0.0618)	0.0878 (0.0622)	0.0756 (0.0613)
Flat <sup>[3]</sup>	-0.0565 (0.0835)	-0.0574 (0.0837)	-0.0570 (0.0843)
Corner house <sup>[3]</sup>	0.0218 (0.0281)	0.0222 (0.0281)	0.0217 (0.0281)
Maisonette <sup>[3]</sup>	-0.154 (0.0937)	-0.1538 (0.0944)	-0.157* (0.0934)
Tenement <sup>[3]</sup>	-0.0780 (0.142)	-0.0791 (0.1426)	-0.0888 (0.143)
Semi-detached house <sup>[3]</sup>	0.336*** (0.0899)	0.3401*** (0.0898)	0.322*** (0.0898)
Detached house <sup>[3]</sup>	0.180 (0.154)	0.188879** (0.153)	0.202 (0.155)
Stone building extension <sup>[3]</sup>	0.0862 (0.0949)	0.0861 (0.0944)	0.140 (0.0950)
Carport <sup>[4]</sup>	0.370*** (0.139)	0.369* (0.136)	0.355*** (0.136)
Inside <sup>[4]</sup>	-0.0107 (0.205)	-0.0122 (0.2038)	-0.0103 (0.201)
Parking cellar <sup>[4]</sup>	0.460*** (0.162)	0.4685 (0.1627)	0.511*** (0.163)
Parking place <sup>[4]</sup>	0.0935 (0.0603)	0.0952 (0.0602)	0.0940 (0.0614)
Detached stone <sup>[4]</sup>	-0.107 (0.0854)	-0.1039 (0.0856)	-0.0919 (0.0854)
Observations	921	921	921
Adjusted R-squared	0.5118	0.5122	0.5127

Robust standard errors in parentheses. \*\*\*, \*\*, \* indicating significant at 1%, 5% and 10%, respectively. <sup>[1]</sup>Reference category includes good

<sup>[1]</sup>Reference category includes Concrete foundation. <sup>[2]</sup>Reference category includes terraced house. <sup>[3]</sup>Reference category includes no parking.

## APPENDIX I: INTERVIEW TRANSCRIPTIONS

### ORIGINAL DUTCH VERISION

#### Interview 1 – Expert A

- Loopt u tijdens uw werkzaamheden aan tegen funderingsproblematiek?

ja en vooral tegen funderingsonzekerheid, is het dan meteen problematiek, dat is de vraag. De gemeente Rotterdam heeft een risicokaart en daar heb je 5 smaken op, minder dan 1 % 1 tot 5 en 5 tot 30 procent. En ik vergelijk dat altijd met als ik 's ochtends voor mijn kledingkast sta en ik moet kiezen wat ik aan moet trekken en het kan 5 en het kan 30 graden worden. Dat scheelt nogal. Doe ik nu een zwembroek aan of een winterjas? Dat verschilt nogal. De informatie die vanuit de archieven beschikbaar is niet zodanig dat je daar zinnige informatie uit kunt afleiden. dat maakt het lastig om daar een goed advies in te geven . Dus als er geen funderingsonderzoek is dan moet je afgaan op uiterlijke kenmerken, scheefstand, scheurvorming, is het blok bekend, is er in de directe omgeving onderzoek gedaan, zijn er peilbuizen waar je wellicht iets uit kunt afleiden. Zijn er verzakkingen die je kunt waarnemen of heeft die satelliet die overvliegt wat gemeten. Dus er is wel het een en ander te vinden maar het geeft nooit een 100% beeld totdat je natuurlijk onder de grond bent geweest. Dat is het lastige. Dus ja heb ik last van funderingsproblemen, mogelijk wel, maar we weten het pas als er daadwerkelijk een onderzoek gedaan wordt. En ben je verkoopmakelaar dan zit de verkoper er niet op te wachten dat er een rapport komt te liggen. En ben je aankopend makelaar dan is de kans dat jij een ontbindende voorwaarde kan inbouwen dat je een funderingsonderzoek wil laten doen is nihil want er is altijd iemand anders die dat niet gaat doen en die krijgt dan de voorkeur. Los van het feit dat de verkoper als die het al zou toestaan ineens geconfronteerd word met een funderingsonderzoek dat niet in zijn voordeel uitpakt en ineens minder geld voor zijn huis krijgt. Dus het is een beetje, ehm, hoe moet ik dat uitleggen. Een beetje een ondergeschoven kindje zeker in een markt als deze als als het minder druk is op de markt er is meer aanbod en mensen hebben meer te kiezen dan ga je beter kijken. Op het moment dat de markt is zoals die nu is ja dan zijn mensen al lang blij dat het dak niet lekt. Dan kopen we het gewoon want anders hebben we weer niks. Dat is wel eens moeilijk.

- is dat alleen bij woningen of ook bij andere typen vastgoed? In welke vormen?

Nouja, ik heb eigenlijk niet zo veel met andere typen vastgoed te maken. wij doen 99% wonen.

- In welke mate speelt fundering mee in taxatie en verkoopprocessen?

Ja kijk op het moment dat er geen scheefstand is, ehm er zijn geen ramen en deuren die moeilijk sluiten en er zijn geen indicaties dat er iets aan de hand is maar hij ligt wel binnen het risicogebied, maar ik heb geen onderzoek dan gaan we er vanuit dat er op dit moment niks met de fundering aan de hand is. En dan heeft dat in een markt als deze geen effect op de prijs. Heb je gewoon echt serieuze scheefstand dan kunnen er 2 dingen aan de hand zijn: het ene is het heeft in het verleden bewogen is gestabiliseerd. De architectonische scheefstand blijf je houden. Dus dat is iets daar zul je een oplossing voor moeten zoeken door ofwel de vloeren opnieuw te leggen of het te accepteren. ehm of je moet, of het zou kunnen zijn dat er wel wat aan de hand is en dat het een actief funderingsprobleem is. Dan heb je natuurlijke een heel andere situatie want dan moet je gewoon gaan calculeren met dat er straks voor 1500 euro per vierkante meter mogelijk aan funderingsherstel gedaan moet worden. Dat kan natuurlijk behoorlijk in de papieren lopen. Dan gaat ie absoluut meetellen.

- Is er een verband tussen funderingskwaliteit en transactiepreizen?

Ja absoluut, maar dat is zoals ik net ook al zijn inherent aan de tijd waarin we leven. Dat is nu anders dan in 2015/16 was. Toen was een huis in een wijk met bekende funderingsproblematiek ineens een dingetje. nu stappen mensen te snel eroverheen. Dit heeft ook nog eens te maken met het moment van de markt waarin mensen aan het kopen zijn.

- Hangt de mate van prijsdaling ten gevolge van een slechte funderings kwaliteit af van het type fundering?

hmm. nouja kijk we hebben, ja dat denk ik wel. We hebben bevoorbeeld in het Kleiwegkwartier de echte Rotterdamse fundering en de echte houten funderingen met betonnen funderingsbalk, dat waren de wat duurere woningen. Dat zijn woningen waaraan je eigenlijk niks ziet. Ook uit alle fundering onderzoeken is gebleken dat die een handhavingstermijn van 10 tot 15 jaar hebben onder gelijke omstandigheden. Daar was de grondwaterstand op het moment van het onderzoek laag. En vervolgens heeft de gemeente gezorgd dat het water op niveau kwam. Hiermee nam het risico af. De huizen met de Rotterdamse fundering die waren gewoon al ernstiger aangetast. Bijvoorbeeld de Lisbloemstraat waar ze de arbeiderswoningen hebben die hebben dat. Daar moest op een gegeven moment funderingsherstel plaatsvinden. Daar was geen andere oplossing voor. Er waren ook blokken waar dit ook zo was maar ik heb nog geen huizen voorbij zien komen die een betonnen funderingsbalk hadden waarbij het nodig was om dat aan te pakken. Ehm, en je ziet het ook pas veel later, want als er een slechte paal tussen zit het gewicht van de opstal word opgevangen door de andere palen het word zeg maar verdeeld. Dus je zult daar veel minder snel de uiterlijke kenmerken zien van een funderingsprobleem, waardoor je ook een stuk minder snel de rekening daarvoor gepresenteerd krijgt. Op het moment wanneer je gaat kijken wat is het waard. Bij zon woning op Rotterdamse funderingen zakt gewone een stuk metselwerk tussen de palen door waardoor je een lelijke scheur krijgt. Dit valt ook niet op te vijzelen waardoor je er structureel al iets aan moet gaan doen.

- Rotterdamse fundering is een fundering op houten palen neem ik aan?

Ja, maar funderingen met een betonnen funderingsbalk staan ook op houten palen. De Rotterdamse fundering daar ligt langshout over de palen heen. Hierop, gewoon een plank in feite, is gemetseld. Ehm, op het moment dat de grondwaterstand laag is dan word die plank natuurlijk als aller eerste aangepast, de paal is veel dikker zeg maar, en kan veel meer aantasting hebben dan een plank van 5 cm. Als al het metselwerk hier op een gegeven moment doorheen zakt dan drukt die muur gewoon krak, door de funderingsplank heen in feite. De ander fundering die we in Rotterdam kennen zijn houten palen en daarop een betonnen ring gestort zodat en de palen die wat dieper liggen veel minder snel droogstand zullen laten zien. Maar op het moment dat er ook een plank dunner is, van slechter kwaliteit is of aangepast door grondwaterdaling dan wordt het gewicht van de opstal door die ring van beton verdeeld over de andere palen dus zul je veel minder snel een lokale verzakking zien dan bij een Rotterdamse fundering. Dat heeft uiteindelijk echt wel effect op de waarde. Staat iets op een betonnen fundering heb je als het ware niks om je zorgen over te maken. We hebben in Rotterdam ook nog funderingen die helemaal niet op een fundering staan die gewoon op staal gefundeerd zijn of gewoon op dierenhuiden. wat dat betreft hebben we nogal wat variaties.

- Ontvangt de koper resp. de taxateur sowieso informatie omtrent de fundering ?

Ehm nee kijk op het moment dat er geen funderingsrapport is dan zal er hooguit in de dossiers van de makelaar een uitdraai zitten van de funderingskaart. Meer kunnen we er ook niet over zeggen. Wanneer er een rapport beschikbaar is dan moeten we die beschikbaar stellen. Of iedereen zich daar aan houdt weet ik niet. Maar dat is wel het minimale vereiste. Dat hoort gewoon tot je mededelingsplicht als verkoper en als makelaar. En waarschijnlijk is in de meeste gevallen, niet allemaal, zo dat je dan ook zekerder bent dat je iets goeds aan het kopen bent. Dus ja we horen er informatie over te geven alleen ehm niet iedereen schat die informatie ook op waarde in, een hoop mensen, zoals ik net al aangaf, die zijn gewoon keihard op zoek naar een huis en bijna tegen elke prijs. En alles wat je ze verteld wat hun niet aanstaat gaat het ene oor in en de ander uit. Dat is wel het gekke van deze markt. Ik heb het totaal omgekeerde ook meegemaakt. Dat huizen waar mogelijk heel misschien wat mee aan de hand was niet wouden gaan zolang er geen duidelijkheid was. En dat merken we in het Kleiwegkwartier heel sterk. In de tijd dat er nog geen funderingsonderzoek gedaan was had ik bijvoorbeeld heel veel moeite om huizen aan de Iisbloemstraat te verkopen. Terwijl toen het rapport er lag en er uit kwam dat de handhavingstermijn 10-15 jaar was en dat er geen maatregelen waren die aanwijsbaar effect hebben op de grondwater stand gingen de huizen ineens toch als warme broodjes om dat iedereen dacht 10-15 jaar wie dan leeft wie dan zorgt. Dat is een beetje hoe mensen werken. pas als mensen dichterbij jou in de buurt scheuren in huizen zien i.v.m. de gasvelden dat gaat ineens iedereen stuiten. Maar als we zeggen binnen 10 tot 15 jaar ga je iets aan je fundering moeten doen denken mensen ach, dat zien we dan wel weer. En dat vind ik wel eens bijzonder.

- Hoe is de informatievoorziening naar zowel de taxateur, de eigenaar en de geïnteresseerde koper

Ja ik denk niet dat de gemeente Rotterdam meer kan geven. Ik vind zelf de inschatting tussen de 5 en 13 procent nietszeggend. Maar heb ik iets beters, nee. Zolang er geen funderingsonderzoeken zijn gedaan is het heel lastig om hierover sluitende informatie te geven. Als ik kijk wat voor informatie de gemeente beschikbaar heeft met peilbuizen, met funderingsonderzoeken, met zakkingskaarten, vind ik eigenlijk dat we boven gemiddeld georganiseerd zijn en dat ik als aankoop of verkoop makelaar daar gewoon prima mijn informatie uit kan halen om mensen een zo goed mogelijk georganiseerd advies moet aangeven dat ik niet met volle 100% zeker weet hoe het zich over 10 of 15 jaar zich zou houden omdat we niet onder de grond geweest zijn.

- Hoe is de Informatievoorziening naar zowel de taxateur, de eigenaar en de geïnteresseerde koper?

Nouja wat ik doe is sowieso het funderingsrapport, als ik voor een koper werk dan doe ik natuurlijk nader onderzoek, dan ga ik niet zomaar kijken wat heeft de verkoper in zijn dossier zitten. En op het moment dat ik iets moet verkopen in een gebied waarvan ik denk joh hier is geen onderzoek gedaan maar wel een risico gebied dan zorg ik in ieder geval dat er een risicokaart in het dossier zit. En dat ik bij bezichtigingen vertel aan de gene wie er in geïnteresseerd zijn hoe het werkt in Rotterdam en wat voor maatregelen genomen worden, wat ze kunnen verwachten als het toch tot schade zou komen.

- Wat weet de taxateur vooraf van de aard en kwaliteit van de fundering of zou moeten weten?



Ja kijk ehm een taxateur moet tegenwoordig in de nieuwe taxatieregels, ik ben geen taxateur meer over 11 dagen, ehm maar goed ik weet nog wel wat ze moeten doen tegenwoordig. Zij moeten veel meer naar de bouwkundige staat kijken van een gebouw. Banken weten tegenwoordig ook wel dat Rotterdam een gebied is waar 60 000 woningen zijn met een potentieel funderingsrisico. Dus dat is echt wel iets wat meegenomen wordt tijdens een taxatie. De taxateur kijkt gewoon naar de waarnemingen tijdens een taxatie naar van nouja zie ik aanleiding om te verwachten dat er aanleiding is tot funderingsproblemen en doet daarna zijn onderzoek in het zelfde archief van joh wat zie ik voor typen fundering wat zie ik aan funderingsrisico kaarten, wat zie ik aan peilbuizen et cetera. Hoe meer aanleiding er is om iets te verwachten hoe verder je onderzoek gaat. dat is eigenlijk een beetje hoe het gaat.

- Is in de huidige marktomstandigheden sprake van asymmetrische informatie omtrent funderingen tijdens een verkoopproces?

Asymmetrische informatie wat bedoel je daarmee?

- Dat bijvoorbeeld de eigenaar wel bekend met funderingsproblemen maar de aankoper niet.

Dat zou absoluut zo zijn ja, ik heb dat zelf wel eens zien gebeuren, op de Azaliastraat moest ik een woning verkopen, die mensen hadden een funderingsrapport met een handhaving van 5-10 jaar, toen moest ik ze vertellen dat dat invloed had op de verkoopprijs. En dat ik het belangrijk vond om open over die informatie te zijn en dat te delen met alle kopers, vervolgens een heel leuk gesprek gehad en zag ik dat het pand bij een andere makelaar in de verkoop kwam. Ik had toen daar een klant voor en die wilde dat zien en toen werd er mij een dossier aangeboden en daar was het funderingsrapport niet bij ingesloten. Dus ja ik denk dat er asymmetrische informatie is ja.

En dat makelaars, dan wel verkopers, misschien heb ik deze klant wel wakker geschud door te hameren op het feit dat ik vond dat je daar transparant in moest zijn. Dat ze dachten nou dan doen we bij de volgende makelaar gewoon alsof onze neus bloed, en de makelaar deed ook alsof z'n neus bloed. Die kwam niet uit Rotterdam en wist gewoon niet hoe de wijk in elkaar stak en heeft het gedaan met wat die had. De uiteindelijke koper zou er uiteindelijk wel achter zijn gekomen dat er een funderingsonderzoek was, maar ja de vraag is natuurlijk of die daar de verkoper natuurlijk voor aangesproken heeft. Dan moet er schade zijn en zolang er geen schade is word dat lastig.

- Schat u dit probleem groot in? van de asymmetrische informatie?

Nah nee ik denk het niet want ik denk dat het beroepsrisico voor de makelaar te groot is om je daarbij in de luren te laten leggen door een verkoper, dan wel jezelf in je voeten schieten om het zelf achterwege te laten. Je moet als je jezelf enigszins respecteert, natuurlijk zien we wel eens makelaars die uit Lutjebroek komen en waarschijnlijk niet van de hoed in de rand weten. Het is een keuze van de klant en ook een keuze van de makelaar om zich niet te verdiepen in de werkregio en het risico lopen dat je je later met je beroepsaansprakelijkheid-verzekering opgepakt gaat worden omdat je je werk niet goed hebt gedaan. Maar ik denk dat een dusdanig percentage van het aantal huizen in rotterdam gekocht word

door lokale makelaars dat die problematiek wel mee valt. Ja ik denk wel eigenlijk dat makelaars de neiging hebben om het te bagatelliseren maar dat ze de informatie wel hebben.

- Houden woningzoekenden actief rekening met funderingen?

Nee onvoldoende denk ik, maar dat zien we ook met erfpacht. dat zien we met allerlei zaken waarvan je als ik zelf een huis zou kopen zou denken van wat zou ik het liefst niet willen. Nou ik zou niet willen dat het een funderingsprobleem had, of een potentieel funderingsprobleem. En ik zou het liefst ook niet willen dat ik over 25 jaar nog een keer mag betalen voor de erfpacht te kopen. ehm, en het lijkt op dit moment in de markt gewoon niet uit te maken. Maar zoals ik eerder al zei is dit gewoon inherent aan de woningmarkt en heeft het vooral te maken met het economisch getij en woningmarkt waarin we nu zitten eh voor jou 10 andere kopers. Je word op een gegeven moment minder kritisch om op een gegeven moment maar een keer geluk te hebben dat je eens iets hebt kunnen kopen.

- Hoe vaak laat een aspirant-koper een bouwtechnisch onderzoek naar de beoogde woning c.q. vatgoedobject uitvoeren?

Ehm,

- Ook met betrekking op de funderingen?

Nouja op de fundering dat is mij in ehm 17 jaar tijd 2 keer gebeurd. Dat een koper uiteindelijk dus, bij een klant die ik vertegenwoordigde een funderingsonderzoek heeft laten verrichten. In het Kleiwegkwartier is denk ik zowat 90 % van alle woningen heeft een collectief funderingsonderzoek. Daar hebben ze gewoon steekproeven bij bepaalde blokken gedaan. Maar ik denk dat het verder heel weinig gebeurd, juist omdat de verkoper er helemaal niet op zit te wachten dat ie ineens een funderingsonderzoek in zn mik krijgt. En een koper zou het ook niet zo snel doen aangezien een beetje goed onderzoek al gauw zowat 2800 euro kost. Ehm, dus dat, ja dat doe je niet even met het risico dat het tegenvalt. Ik had pas, inmiddels een jaartje geleden, een aankoop gedaan in Kralingen. En Kralingen staat ook bekend om zijn potentiële funderingsproblemen, vooral Kralingen-oost. En we zagen ook wel wat in het pand, dat er mogelijk iets aan de hand zou zijn. En toen hebben we, om dat het daar niet zo storm liep op dat moment, ingeschoten als voorwaarde nou die werd afgewezen en in plaats daarvan kregen wij een lager voorstel terug van de verkoper, die zeiden van joh, we willen hem wel aan je verkopen maar we willen geen funderingsonderzoek. Je krijgt een korting op de koopsom als je het accepteert voor wat het nu is. in dat hebben mijn klanten gedaan omdat ze het ingecalculeerd hebben. Stel dat het komt hebben ze er in ieder geval een vergoeding voor hebben gekregen. Een bouwkundig onderzoek gaat veel minder ver dan dat, een bouwkundig onderzoek dat kijkt alleen maar optisch, dat houdt een spiegeltje op de dakkapel om te kijken of de dakbedekking goed is, die kijkt of de leidingen goed verzekerd zijn, die kijkt of de elektra goed voor elkaar is en of er geen houtrot is. Ze kijken naar optische dingen. En op het moment dat hij scheuren ziet, of scheefstand, dan zal hij er iets over zeggen. Maar dat is niet het zelfde als een fundering onderzoek. Want de enige manier om een funderingsonderzoek te doen is om een paalkop op te graven, houtmonsters te nemen, inslagmeting doen, vloerwatermeting. en dat kost 2800 en is niet zo maar 1 2 3 gebeurt. Dus dat gebeurt op dit moment bijna niet, en een bouwkundige keuring eigenlijk ook te weinig. Ehm omdat als je als bieder aan het bieden bent op een huis wat je heel graag wil hebben, en er zijn met jouw nog 15 anderen die dat ook willen, dan kun jij een voorwaarde voor bouwkundige keuring inbouwen maar op het moment dat dit uiteindelijk in de vergelijking word meegenomen en er zijn mensen met een vergelijkbare prijs en voorwaarden zonder de voorwaarde voor bouwkundige keuring, ja dan kies je voor het bod met de

meeste zekerheid. En dat is met de minste voorwaarden. In de praktijk zie je dat er relatief weinig gekeurd wordt.

- Houden woningzoekenden adequaat rekening met de eventuele risico's die de fundering van een huis met zich mee brengt?

Ja, ik hoop altijd van wel maar in de praktijk zie ik van niet. En dat is altijd het lastige. Ja wij van WC eend adviseren WC eend. Dat ze een aankoopmakelaar moeten meenemen. Ehm want op het moment dat jij denkt dat je het allemaal wel zelf in de smiezen hebt welke risico's je loopt en waar je op moet letten. Dan kom je waarschijnlijk bedrogen uit. Want het enige waar je op dat ene moment van de eerste bezichtiging, want vaak is een 2e ook niet eens mogelijk, is kan ik hier mijn spulletjes kwijt. vind ik het leuk? Kan ik hier met mijn vrienden eten? voel ik me thuis? En je bent niet aan het kijken naar de aansluitingen en of er eventueel groot onderhoud uitgevoerd moet worden et cetera. Dus ik denk dat daar veel en veel te weinig rekening me gehouden wordt.

- En hoe vertaalt dit zich in de prijs?

Nou niet op dit moment, dat is ook weer inherent aan hoe de markt nu in elkaar steekt. Eten of gegeten worden, dus ja als je iets wil kopen moet je maar slikken, wat er ook maar op je pad komt. En sommige mensen zijn verstandig en realistisch, maar het merendeel moet gewoon kopen en houden eigenlijk nergens rekening mee.

- Hebben de recente marktontwikkelingen deze processen beïnvloed? Zo ja, op welke manier?

Ja, nouja, zo recent zijn ze ook iet meer natuurlijk want het is nu al zon 2,5 jaar bezig, in ieder geval in Rotterdam, dat er eigenlijk geen maat op staat en dat ondanks wat er aan de hand is er bizarre biedingen worden gedaan om het maar te kunnen kopen. Dat ik als aankoopmakelaar er ook niet meer achter kan staan. Dat ik dan zeg van ik vind het 340 waard maar mijn klant zegt ik ben nog wel in staat iets meer te bieden, dus die bied 355. En uiteindelijk gaat iemand er met 380 er nog eens flink overheen, terwijl wij al 40 000 overboden hadden. Dat je echt denkt van het is niet meer te onderbouwen. En dat is al over zon lange tijd gaande nu dat mensen daar echt een keer de rekening van gepresenteerd krijgen denk ik. Het is gewoon koopzucht geworden. En ik snap het, want als jij al 2,5 jaar langer dan gepland bij je ouders thuis woont, of je hebt zelf ook een enorme berg geld gekregen bij de verkoop van je eigen huis, ja dan geef je het ook makkelijker uit. Maarja, er komt een moment dat je misschien moet verkopen en dan zou het sommetje misschien anders uit kunnen vallen.

- Wordt de funderingsproblematiek voldoende uitgelicht?

Nouja de gemeente Rotterdam is er wel goed mee bezig, maar ze hadden op een gegeven moment landelijk iets uitgerold. Toen was ongeveer heel Nederland over de zeik omdat het iets te vroeg was. Ik heb er toen ook zelf naar lopen kijken en het was eigenlijk iets te ongenueanceerd om aan het Nederlandse publiek te ehm presenteren. Want we zien allemaal wat er gebeurd als er grote maatschappelijke thema's besproken worden op social media, dan gaat heel de wereld over de zeik. Iemand heeft ergens een klok horen hangen en die begint daar over te roepen en over te schrijven. En vervolgens gaat de kamer er weer iets van vinden want die zijn ook weer door iemand aan de baard getrokken maar vakinhoudelijk er niet in thuis. En zo word iets wat eigenlijk niet zo bezwaarlijk is een heel ding. Ik denk dat Rotterdam er goed mee bezig is. Dat makelaars er misschien ook wel eens wat meer mee bezig mogen zijn, dat ze zich iets meer verdiepen. Maarja het lastige is natuurlijk dat een makelaar moet steeds meer huizen

verkopen want iedereen vind maar dat een makelaar het makkelijk heeft. Dat ie alleen maar een bezichtiging hoeft te doen en het huis verkocht heeft. Dus de courtage moet omlaag. Nouja wat betekend dit voor je omzet, dat je meer huizen moet verkopen om je kosten te dekken en een beetje winst te maken. En op het moment dat je meer huizen moet verkopen betekend dat dat je minder tijd hebt om gedegen onderzoek te doen. Dus ja consumenten zijn er ook een beetje debet aan dat de informatievoorziening niet op gang komt zoals die zou moeten, en dan kun je als makelaar stug volhouden van, hallo, ik blijf gewoon mijn oude courtage rekenen want anders kan ik geen gedegen advies geven, ik ben er zo eentje, het leid uiteindelijk tot minder omzet en heel tevreden klanten. Maar je zult op een gegeven moment een keer een knip moeten maken om te zorgen dat je het anders gaat doen.

- Beïnvloedt dat streven naar winst door makelaars ook het advies rond de funderingskwaliteit?

Ja ik denk wel eens dat er makelaars zijn die problemen bagatelliseren, en problemen is een groot woord, die risico's bagatelliseren om maar te zorgen dat het een deal niet in de weg zit. Ik denk dat dat gebeurt ja. Ik heb het in de praktijk zien gebeuren. Dat ik als verkoopmakelaar rond liep en vragen stelde en dat de andere makelaar zegt "nouja er is hier niks aan de hand" dat ik denk van joh ik ken het type huis, ik ken het type fundering en ik weet toevallig dat de grondwaterstand iets wat aan de lage kant is. Hoe kun jij dat zomaar zeggen? omdat het huis stabiel staat zeg jij dat er niks aan de hand is maar dat kun je niet zeggen. Dat ligt voor een deel aan kennisniveau, je gezicht een dauw geven om maar antwoord te kunnen geven, en het ligt voor een deel ook aan het feit dat ze niet het risico willen lopen dat het een winkeldochter wordt die niet verkoopt en dus geen omzet oplevert. Maar goed daar hoeven we in deze markt ons minder zorgen over te maken want wat je ook zegt, het verkoopt toch uiteindelijk wel.

## **Interview 2 – expert B**

- Loopt u tijdens uw werk aan tegen funderingsproblematiek?

Ja natuurlijk wel maar niet bij elk pandje natuurlijk, er zijn een paar gebieden, ja het komt wel voor.

- Alleen bij woningen of ook bij andere typen vastgoed?

Ja woningen en appartementen, dat is natuurlijk waar wij ons mee bezig houden.

- In welke vorm loopt u er tegen aan?

Ehm, soms dat het echt gedaan moet worden en soms dat het discutabel is. Dus dat we weten dat in een bepaald gebied wat speelt, en wat tekenen ziet, dat je mensen er wel voor waarschuwt.

- in welke mate loopt u aan tegen funderingsproblematiek in taxatie en verkoop processen?

Ehm dat ligt aan de mate dat ze het al weten zeg maar, en soms zeggen ze over 15 jaar moet het wel gebeuren. Dus dan speelt het wel een klein beetje mee maar in deze oververhitte markt denken mensen van nou dat zou mijn tijd nog wel ff duren. Maar je ziet wel dat het invloed heeft want er zijn ook mensen echt er bang van, terughoudend, zeker als ze zeggen van nou ik wil hier 5 jaar wonen, dan kopen ze dit soort huizen niet. En het heeft absoluut invloed natuurlijk op de waarde maar dat ligt helemaal natuurlijk

aan de gradatie, moet dat meteen gebeuren? Of heeft het nog een paar jaar de tijd? Hoe ver zijn de bureaus al dat ze mee willen? Dus dat is per pand verschillend.

- Is er een verband tussen funderingskwaliteit en transactiepreizen? Hoe sterk en in welke richting?

Ja.

- Hoe sterk? en in welke richting?

Dat ligt er natuurlijk weer aan wanneer het moet gebeuren. Kijk als het direct moet gebeuren dat weten mensen het meteen en heeft het 1 op 1 invloed op de waarde. Alleen wanneer het in de toekomst moet, en dat ze er nog voor kunnen sparen, dan heeft het minder invloed. Want dan kunnen ze er gewoon nog voor sparen.

- Hangt de mate van prijsdaling ten gevolge van een slechte funderings kwaliteit af van het type fundering?

Ja, want het is een houten fundering dan. ja.

- Er zit dus verschil tussen te typen?

Ja je heb hout of beton, bij hout heeft het invloed, en bij beton niet want dan weet je zeker dat er niets aan de hand is.

- Er kan geen slechte betonnen fundering zijn?

Nee heb ik nog niet gezien nee, nee dat zijn beton palen he, die zakken niet.

- Ontvangt de koper resp. de taxateur sowieso informatie omtrent de fundering?

Jazeker, we hebben in Rotterdam hebben we het funderingsloket. We zijn natuurlijk plaatselijk bekend. Maar in Rotterdam hebben we echt een speciale website daarvoor, met een risicokaart dus daar kun je zo alles op nakijken. En soms zijn er ook oude onderzoeken bekend, en dan kun je daar ook iets mee.

- Ontvangt de koper resp. de taxateur sowieso informatie omtrent de fundering ?

Nee want niet ieder huis heeft natuurlijk een funderingsonderzoek gedaan, soms is het een beetje onzeker. Dan moet je echt, dat je de woning kent zeg maar bekijkt en dat je ervaring hebt met scheuren en de gevolgen. Daar moet je dan op af gaan maar niet ieder huis heeft een onderzoek.

- Hoe is de informatievoorziening naar zowel de taxateur, de eigenaar en de geïnteresseerde koper

Hoe bedoel je?

- Hoe de informatievoorziening, bijvoorbeeld naar een verkoper of aankoper is.

Ehm, nouja het is eigenlijk voornamelijk het funderingsloket, dat gewoon een website, daar begin je mee. En dan is het afhankelijk van de verkoper of die het heeft laten onderzoeken, of een vve heeft het laten onderzoeken, waar een appartement deel van uitmaakt.

- Gebeurt dat vaak?

Nee, te weinig.

- Waarom denkt u?

Struisvogelpolitiek, mensen willen het vaak niet weten omdat ze bang zijn dat er iets aan de hand is.

Maar voor bepaalde gebieden weet je zeker dat er wat aan de hand is, en dat zeg ik ook tegen mijn aankoop klanten.

- Gebeurt het dan wel is dat de koper een onderzoek opvraagt?

Niet in deze tijd, want op het moment dat je dat opvraagt dan word je vaak de koper niet.

- Wat weet de taxateur vooraf van de aard en kwaliteit van de fundering of zou moeten weten?

Nou niet zo veel, we gaan met name natuurlijk van het funderingsloket uit, of de informatie die de verkoper levert.

- Ja en idealiter, wat voor info zou de taxateur het liefst hebben?

Het liefst zou ik gewoon een funderingsrapport hebben. Maarja dan moeten ze gaan graven en monsters nemen en dat duurt 6 tot 8 weken. dat niet zo makkelijk. En het kost 3000 euro ook nog daarbij.

- Is in de huidige marktomstandigheden sprake van asymmetrische informatie omtrent funderingen tijdens een verkoopproces?

Nee eigenlijk niet, als er een makelaar tussen zit en die weet waar die z'n informatie vandaan kan halen dan niet nee. De verkoper als die iets weet en hij verteld het niet dan is het een verborgen gebrek. En eh dat heb ik nog niet gezien, dat mensen daar niet eerlijk in zijn.

- Dat komt niet voor?

Nee, of de makelaar weet het niet, of die weet niet waar ie de informatie vandaan moet halen en hij weet het gewoon niet. Maarja je moet dan een beetje op je eigen kennis afgaan zeg maar.

- Houden woningzoekenden actief rekening met funderingen?

Ja

- En hoe uit dit zich?

Wordt altijd gevraagd, zeker als je een scheurtje ziet, wordt er altijd naar gevraagd.

- Hoe vaak laat een aspirant-koper een bouwtechnisch onderzoek naar de beoogde woning c.q. vatgoedobject uitvoeren

Dat ligt natuurlijk ook weer aan het huis, kijk als de staat goed is van het pandje, had vanmorgen weer een appartementje, meerjarig onderhoudsplan, dus al groot onderhoud geweest, het was een jaren dertig huis maar gewoon helemaal up to date dan hoef je dat niet te doen. Dat is per pand verschillend. Had er laatst een huis daar stonden vloeren krom. En dan ben je zo gelukkig dat de verkopende partij dat toestaat, daar ben je van afhankelijk.

- Maakt fundering en funderings kwaliteit deel uit van zon onderzoek?

Vaak niet.

- dat is echt een apart onderzoek?

Ja, ja, en dan vraag je natuurlijk keurder goh wat denk jij. En dan kunnen ze er vaak wel wat over zeggen, maar niet altijd. En dan blijft er een soort onzekerheid en dat is dan aan de koper. En daar probeer je ze dan zo bewust mogelijk van te maken.

- Houden woningzoekenden adequaat rekening met de eventuele risico's die de fundering van een huis met zich mee brengt?

Mijn klanten wel, ik ben daar, wij zijn daar enorm op beducht. Want het heeft enorme gevolgen funderingsproblemen. Qua kosten, qua onzekerheid dus wij zetten het altijd op papier en we noemen het sowieso tegen onze aankoop klant maar ook kopers. Want eh we willen het gewoon goed weten. En als je het niet weet is dat ook een antwoord en moet je dat gewoon vermelden.

- En over het algemeen? Buiten uw klanten om? wat denkt u?

Wat?

- Wordt er adequaat rekening gehouden met de risico's?

Mensen die er een beetje op verdacht zijn en naar oude gebouwen kijken die houden wel rekening met de risico's. Maar niet allemaal. We hebben ook wel veel expat mensen die dat allemaal niet weten. Of mensen uit Amsterdam of Utrecht, weet ik veel, ouders die in Vlissingen wonen en voor hun kind een huis kopen die kennen dat allemaal niet. Dus dan moet je dat wel benoemen. En dat weet je niet altijd in hoeverre de mensen geen leek meer zijn of ervaring hebben. Das voor ons als aankoopmakelaar best wel een doorvraagje. In hoeverre ben je bekend in Rotterdam.

- Hoe vertaalt dit zich in de verkoopprijs?

Je bedoelt de funderingsproblemen?

- Ja en de mate waarin mensen er rekening mee houden.

Ja dat is ook weer verschillend. Das een lastige, kijk het is niet altijd zwart wit natuurlijk. Kijk je hebt een pandje en een nieuwe fundering kost een ton, je deelt het met z'n vieren of met z'n tweeën dat maakt heel veel uit. Maar het heeft zeker invloed. Wat ik zeg, als dit allemaal binnen 5 jaar moet gebeuren dan heeft dit bijna 1 op 1 invloed. En er is ook gewoon minder animo voor de woning als er een funderingsprobleem is

- Hebben de recente marktontwikkelingen deze processen beïnvloed? Zo ja, op welke manier?

Ehm mensen zijn wel heel bang van de funderingen, dus als het op korte termijn moet gebeuren dan heeft het direct invloed. Op langere termijn is de markt verkopers goed gezind, dat mensen denken van nou, dat zou nog wel even duren dan kan ik ten minste nu een huis kopen. Maar vaak is die woning natuurlijk wel goedkoper om een reden. Maar op lange termijn als op langere termijn een nieuwe fundering nodig is dan helpt de markt wel en worden er hogere prijzen voor betaald.

- En de aantrekkende markt de afgelopen jaren heeft die nog invloed gehad?

Ja wat ik zeg, op langere termijn gedaan moet worden dan gaan mensen er makkelijker aan voorbij. Als het direct moet gebeuren zijn ze er veel bewuster van. Want het heeft ook invloed op het verkrijgen van een hypotheek, want je moet het dan meteen mee financieren en dat wil niet iedereen. Want je stopt zo 30 duizend euro onder de grond zeg maar, daar kopen ze liever een nieuwe keuken van.

- Wordt de funderingsproblematiek voldoende uitgelicht?

Ja! vind ik wel, bij ons wel laat ik het zo zeggen.

- En in het algemeen?

Kan beter

- In welke vorm kan het verbeterd worden?

Ehm, informatievoorziening van de verkopende partij. Dus dat er ook met name naar makelaars natuurlijk dat ze iets opener zijn in van wacht dit is een risico gebied. Dat je daar misschien problemen mee gaat krijgen. Gewoon eerlijk over zijn

Dus er is af en toe wel sprake van asymmetrische informatie?

Ja, nouja, bij ons, wij zijn er heel beducht op. Ik kan het natuurlijk niet voor iedereen zeggen. En je hebt ook heel veel makelaars die de woning gewoon online zetten en de verkoper moet het zelf maar doen. Dat zijn gewoon leken, die weten dat gewoon niet. Ja dus asymmetrisch, het is niet zo dat ze er niet eerlijk over zijn maar dat ze gewoon echt zelf de kennis niet hebben.



### Interview 3 – Expert C

- Loopt u tijdens uw werkzaamheden aan tegen funderingsproblematiek?

Dagelijks

- In welke vormen?

Huizen verkopen in risico gebieden waarbij we de afweging moeten maken wat nu de vraagprijs wordt en hoe wegen we de verantwoordelijkheden af, en hoe regelen we de dekking in de toekomst? Hoe dek ik mijn cliënten zo goed mogelijk in om te voorkomen dat we later claims krijgen. Daarover dus dat is een kwestie van informeren en ook opnemen in de uiteindelijke koopakte onder welke voorwaarden het verkocht wordt.

- Is dit alleen bij woningen of ook bij andere typen vastgoed?

Wij zijn zeer gefocust op woningen, zowel woonhuizen als appartementen, soms ook wel eens winkels, maar dit is heel zelden. Dat doen we dan voor relaties die dit aan ons vragen.

- In welke mate speelt fundering mee in taxatie en verkoopprocessen?

Enorm, want een fundering opknappen kost voor een gewoon pand, en dan heb ik het over 12 meter diep 5.50 breed, een beetje de standaard maten in Rotterdam, over tussen de 80 en 100 duizend euro. En als je fundering naar z'n grootje is kun je dit rechtstreeks van de prijs aftrekken, soms kan je nog wel iets van de prijs redden door meteen een souterrain te maken. Zo kun je de waarde weer een beetje terug verdienen. En als je met dit verhaal en dan goed voorbereid dan heb je wel eens mensen met dan een huis van 100 meter kopen met een slechte fundering om vervolgens meteen de fundering aan te pakken souterrain te maken en dan hebben ze ineens 140 vierkante meter. En dan zit er een stukje meerwaarde, want die 40 meter heeft een waarde van 2 ton in de markt terwijl de nieuwe kelderbak maken maar 120 duizend kost. Dus dan kun je door goed adviseren meer waarde creëren voor de klant.

- Is er een verband tussen funderingskwaliteit en transactiepreizen?

Ja precies wat ik zojuist al zei bij de vorige vraag eigenlijk.

- Hoe sterk is dit effect dan?

Nou wat je ziet dit is afhankelijk van handhavingstermijnen. Je hebt als het goed is 5 handhavingstermijnen. Even uit mijn hoofd, 0 jaar, je moet het gewoon opknappen. 5 jaar het zit er aan te komen. 5 tot 15 jaar het is een beetje matig. En dan 25 jaar, vroeger had je ook 40 jaar maar dat wordt niet meer afgegeven. oudere rapporten staat dat nog wel eens in. Ehm en wat je ziet met een onderzoek, als je een huis hebt in een risicogebied, dat is bijna heel Rotterdam, en er is geen scheefstand te merken dan kun je hem goed verkopen en is de prijs vergelijkbaar met een onderzoek van 25 jaar. Met een goed onderzoek misschien een beetje hoger maar dat ligt aan het verkoopproces. Alles wat minder is dan begin je dat al terug te zien. En als dit 15 tot 20 jaar is, ja ik kan er geen bedrag op plakken. Maar als het minder loopt dan verkoop je zo voor 40 50 duizend euro minder. En is het korter dan die 15 jaar dan gaat er gewoon een ton van af. Behalve appartementen natuurlijk want dan deel je die kosten ook weer.

Heb je 1 derde appartementsrecht dan wordt dit 33 duizend. En het is altijd afhankelijk he, verkoop is geen rocket science, het is maar net waar het uitkomt.

- Is er een verband tussen funderingstypen en transactie prijzen?

Ja zeker, kijk, tot nu toe, het is leuk dat je dat zegt, heb ik het over houten palen gehad. Fundering op staal is anders, dat is nog meer maatwerk. omdat het op staal is zie je dat er bijna nooit onderzoek wordt gedaan naar de fundering en het kent hele andere problemen. Als een huis op staal gefundeerd is en een beetje scheef staat dan verkoop je hem gewoon voor een goede prijs. Maar heb je een huis en de scheefstand is zo dat de woning inmiddels onder het maaiveld ligt waardoor er water naar binnen komt dan daalt de waarde gewoon hard. Eh en is soms het beste alternatief sloop-nieuwbouw.

- En kom je ook wel eens slechte betonnen funderingen tegen?

Nee, nee, wat ik wel eens tegenkom is paalkopverlaging. In de jaren tachtig en negentig ja om je uit te leggen om je even uit te leggen hoe de fundering er toen uitzag. De paalkoppen gaan verrotten en uh in de jaren tachtig en negentig wat ze dan deden was de palen één voor één droog leggen en doorzagen met een betonnen paal erop. de top van de paal is vervangen door beton maar nog steeds de draagkracht zoeken in het oude met name met grenen funderingen zie je dat de huizen die toen zijn aangepakt nu weer moeten worden aangepakt, datgene gaat de schimmel toch inzitten in het kern van het hout en word het toch slechter onder. Deze kosten zijn bijna even duur als een fundering, soms zelfs nog hoger, omdat het nog kapot gemaakt moet worden om er nieuwe palen onder te zetten.

- Hangt de mate van prijsdaling ten gevolge van een slechte funderings kwaliteit af van het type fundering?

Ja ja, altijd het kaartje risicoanalyse van de gemeente doen we er bij. En als er een rapport beschikbaar is dan doen we deze er sowieso bij. Maar er zijn wel veel huizen die nog niet zijn onderzocht.

- Ontvangt de koper resp. de taxateur sowieso informatie omtrent de fundering ? Is de informatievoorziening omtrent funderingen momenteel adequaat?

Ja, ik vind wel dat er in Rotterdam erg veel gebeurd. Kijk je in andere steden zijn er geen risicokaarten of registers dus dat is in Rotterdam goed geregeld.

- Hoe is de informatievoorziening naar zowel de taxateur, de eigenaar en de geïnteresseerde koper?

In principe is de verkoper de gene die de informatie aanlevert. Wij kijken in de registers en als er wat in opgenomen is dan stoppen we dat in de bijlage en krijgen ze de bijlage opgestuurd.

- Wat weet de taxateur vooraf van de aard en kwaliteit van de fundering of zou moeten weten?

De taxateur heeft de plicht om dezelfde registers na te gaan en ook zelf een risicoanalyse te maken. Of dit altijd goed gebeurt weet ik niet. Ik ben niet iedere taxateur, kan niet voor alle taxateurs praten, maar ik denk dat dit wel goed gebeurt.

- Is in de huidige marktomstandigheden sprake van asymmetrische informatie omtrent funderingen tijdens een verkoopproces?

Nee, zie ik nauwelijks. Ik heb wel eens het idee, ik doe ook wel eens wat aankoop, nee, nee, wat ik wel vind, en dan wijk ik een beetje van je vraag af, is dat er best wel wat kopers zijn die een pand kopen in een risico gebied, en dat gaat een beetje, je heb er een hele mooie Franse term voor. ehm ik kom er even niet op. Een beetje laat maar, we zien wel waar het schip strand. Das een beetje een platte term, ehm wat is het nou.

- Laissez-faire?

Ja precies, precies

En als je met z'n houding in een pand stapt waar je een dure prijs voor betaald, dan denk ik wel eens doe je daar goed aan? Ik probeer mijn kopers daar altijd voor te behoeden, mijn aankoop klanten. Maar als verkoop makelaar heb je die rol niet, dan ga je gewoon verkopen. En als mensen daar dan zo in willen stappen, ook nog eens met de conclusie, ehm constructie in de koopacte dat ze nooit kunnen terug komen bij die verkoper daarover, gewoon dat ze goed geïnformeerd zijn en zelf die keuze maken, dat staat er dan in. En dan ben ik niet dan heb ik daar geen rol in om dat tegen te houden maar denk ik tjeetje. En dan met name met appartementen omdat, ja koop je een woonhuis dan is het een geldkwestie als je voor een ton het schip in gaat dan is dat heel vervelend maar de rente is laag, over het algemeen hebben wij klanten die dat wel kunnen opvangen met een eventuele lening. Maar eh koop je een appartementen complex, en wonen daar ook een paar senioren met weinig geld, dan moet je wel alle neuzen de zelfde kant op krijgen om te zorgen dat iedereen gaat investeren in de fundering en als daar niet iedereen mee eens is dan word het een lastig verhaal.

- Oké, maar je maakt niet mee dat de ene partij op de hoogte is van zijn slechte fundering en dit niet deelt?

Nee, nee ik heb wel eens meegemaakt dat de verkoper een onderzoekje heeft gehad in de straat en ik vraag heb je een onderzoek? En hij zegt van nee, en dan kom ik er later in de registers achter dat het er toch is. Dan zijn we daar toch nog een beetje een vangnet in.

- Ja

Ik heb niet het idee dat ik dit in mijn werk actief tegen kom.

- Houden woningzoekenden actief rekening met funderingen? Hoe komt dit tot uiting?

Absoluut, de meest gestelde vraag tijdens bezichtigingen.

- Hoe de funderingen er voor staan?

Ja, ja.

- Hoe vaak laat een aspirant-koper een bouwtechnisch onderzoek naar de beoogde woning c.q. vatgoedobject uitvoeren?

Niet.

- En een onderzoek naar de funderingen?

Nee ik dacht dat je dat bedoelde, bouwkundige keuring gebeurt wel hoor, bij de helft van de gevallen. Maar dat zegt niks over funderingen. Funderingsonderzoek is denk ik vier jaar geleden in mijn praktijk. En dat heeft er alles mee te maken dat er altijd meerdere potentiële kopers zijn, en als de biedingen op tafel liggen en iemand stelt daarin de eis voor een funderingsonderzoek, dan weet die ook dat ie onder op de stapel komt te liggen. Want daar zit de verkoper helemaal niet op te wachten.

- Houden woningzoekenden adequaat rekening met de eventuele risico's die de fundering van een huis met zich mee brengt?

Ja daar hadden we het net al even kort over eigenlijk, ehm, ze houden daar zeker wel rekening mee, alleen ik vind wel dat de risico's die ze nemen dat ze die vrij makkelijk nemen. Maar ze doen het wel bewust. Ook omdat ze daardoor toch het huis kunnen kopen wat ze anders niet zouden kunnen kopen.

- En hoe vertaalt dit zich in de prijs?

Ja dan wordt ie goedkoper, maar niet altijd hoor. Wat ik ook wel eens zie is dat een huis in een risico gebied ligt met wat scheefstand en dat mensen toch gewoon willen kopen, een hoge prijs ook. Maar als er een onderzoek ligt en het moet gebeuren, dan daalt het hard.

- Hebben de recente marktontwikkelingen deze processen beïnvloed?

Jazeker, daarvoor was er veel meer onderzoek. Maar door de schaarstes en de potentiële kopers zie je dat mensen daar overheen stappen.

- Wordt de funderingsproblematiek voldoende uitgelicht?

Ja dat denk ik wel, zeker in Rotterdam.

- In welke vorm?

De gemeente heeft zelfs hele campagnes daarover gehad. Daardoor is het ook zo goed dat alle potentiële kopers vragen hoe is de fundering? En dat vervolgens het antwoord vaak is het is een risicogebied, en fundering schade is herkend maar er is nooit onderzoek naar gedaan. En dat zij dan vervolgens er voor kiezen om gewoon dat risico te nemen dat is een tweede. Maar dat begrijp ik ook heel goed want anders, je moet het gewoon meenemen. Ik zeg wel eens tegen een aankoop klant als ik een beetje scheefstand zie in een pand uit 1910-1930 en er is geen onderzoek bekend: als we een onderzoek gaan doen dan wordt je het niet, hou er gewoon rekening mee dat het in de toekomst een keer moet gebeuren en dat het je dan 100.000 euro kost.

**Interview 4 – expert D**

- Loopt u tijdens uw werkzaamheden aan tegen funderingsproblematiek?

Zeker.

- In welke vormen

Ehm, bij verkoop van panden die wij in verkoop krijgen af en toe heb je een pand met funderingsproblemen of potentiële funderingsproblemen en dan merk je dat het soms iets lastiger wordt om te verkopen.

- Ja, en is dit alleen bij woningen of ook bij andere typen vastgoed?

Nee wij zijn sec woningmakelaar.

- In welke mate speelt fundering mee in taxatie en verkoopprocessen?

Taxatie absoluut het is verplicht om bij taxatie iets te roepen over funderingen en dan wordt van je verwacht dat je aangeeft wat de aard van de fundering is, op staal, beton, houten palen. En het liefst ook iets over de kwaliteit. Dat is zonder onderzoeksrapport uiteraard niet helemaal mogelijk maar je kunt wel aangeven of er aandachtspunten zijn, scheuren in gevels, scheefstand, enzovoort.

- Is er een verband tussen funderingskwaliteit en transactiepreizen?

Beslist.

- Hoe sterk en in welke richting?

Twee mogelijkheden, of er is onzekerheid over de fundering. En dan heb ik het over verkoop. Onzekerheid levert altijd lagere transactiepreizen op. Zekerheid, ja voel je je zeker dan bied je meer. Eh onzekerheid is een ding, ander ding is als duidelijk is dat er iets aan de fundering moet gebeuren op minimaal middellange termijn dan heeft dat een zeker waarde drukkend effect. Er wordt altijd gevraagd wat zijn de kosten van eventueel herstel en dat wordt min of meer integraal van de transactieprijs afgetrokken, of zeker de transactieprijs die je zou kunnen bereiken als er geen funderingsprobleem was.

- Loopt u hier vaak tegen aan?

Gelukkig niet al te vaak aan de noordkant van de rivier komt het niet heel veel voor op een paar wijken na, je bent er wel gespicht op, maar de hoeveelheid huizen waarbij je het tegenkomt valt nog relatief mee, in mijn praktijk, zeg ik erbij. en wij doen misschien zón 100 transacties per jaar.

- Is er een verband tussen funderingstypen en transactie preizen?

Ja, fundering op staal op een zandlaag daar valt het erg mee, dan is wel je doelgroep van potentiële kopers kleiner, dus ook je transactieprijs. Maar het is technisch niet zón groot probleem. Er is in de loop van de jaren scheefstand ontstaan, thats it, misschien dat het nog wat toeneemt maar het leidt niet tot het

instorten van de constructie. Als het op palen staat dan moet er gewoon gegraven worden en de fundering aangepakt worden. En dat laat zich altijd wel in een pand als kostenpost uitdrukken en dat is wel 1 op 1 uit te drukken in de transactieprijs. Soms, moet ik er bij zeggen, levert het voor de koper ook wel mogelijkheden op. We hebben dit jaar een begaande grond woning verkocht aan het G.W Beursplein. Hartje centrum, maakt deel uit van een rijtje huizen die funderingsherstel behoeft. Dit huis viel het mee maar je doet uiteraard mee in de rij funderingsaanpak. Toen waren er ineens mogelijkheden om er een hele souterrain onder te maken, meer vierkante meters, dan is je investering, als je dat wil, natuurlijk kleiner. Met z'n allen een fundering aanpakken is natuurlijk goedkoper dan wanneer je het in je eentje doet. Dus soms is het een kans.

- Komt u ook wel eens betonnen funderingen tegen met een slechte kwaliteit?

Tot nog toe nee.

- Ontvangt de koper resp. de taxateur sowieso informatie omtrent de fundering?

Nee hij ontvangt niks, je bent wel door de form van het taxatierapport toe gedwongen om er vragen over te stellen, dat kan bij de eigenaar, nou die weet er over het algemeen geen moer van, je wordt geacht om ook bij het funderingsloket dingen op te vragen, nou de informatie daar is uiterst mager om eerlijk te zijn. Tenzij er een funderingsrapport is, nou dat vind ik altijd heel interessant.

- Hoe is de informatievoorziening naar zowel de taxateur, de eigenaar en de geïnteresseerde koper

Ehm in mijn rol als taxateur ga ik op zoek naar funderingsproblemen als ik dat nodig acht en dat houd ik bij een huis dat bij beton hoort niet doen, en zou ik bij Hilleegersberg en het kleiwegkwartier wel doen, ehm maar ik moet het zelf opzoeken. Als ik in mijn rol ben als verkoopmakelaar, als ik weet dat er onderzoeksrapporten zijn en potentieel funderingsproblematiek dan helpt het alleen maar bij de verkoop als ik er ook iets over kan zeggen. En zorg ik dat ik geen flauwekul uitsla maar me ook echt voorbereid. We hebben net nu in verkoop de Kootsekade 24, daar is funderingsproblematiek er is een funderingsrapport uit 2009, die is eigenlijk nu niet meer relevant dat was bedoeld voor een hoekpand daar op de hoek om vast te stellen waar de sloopgrens is ehm maar dit pand wordt er wel in genoemd, uiteraard deel ik dit funderingsrapport met alle potentiële bidders.

- Wat weet de taxateur vooraf van de aard en kwaliteit van de fundering of zou moeten weten?

Vooraf hangt dit een beetje van de taxateur af, Soms werken ze gewoon hun agenda af en zien ze pas bij het huis a, dit is er een met potentieel funderingsproblematiek, of door plaatselijke bekendheid, of doordat er bouwkundig het een en ander mankeert aan het huis. Eerlijk gezegd 90% van de taxateurs werkt zo, de taxatie word pas uitgebracht als hij iets over de funderingen naar boven heeft gebracht.

- Is in de huidige marktomstandigheden sprake van asymmetrische informatie omtrent funderingen tijdens een verkoopproces?

Asymmetrisch in de zin dat je als verkopend makelaar wel wat weet maar als koper niet?

- Ja

Dat de verkoper het weet en er eerlijk in is daar probeer je als verkopend makelaar op aan te dringen. Verkoper en eigenaar moeten ook een vragenformulier invullen en dat formulier is ook onderdeel van de uiteindelijke koopakte, met wordt geacht daar naar waarheid op te antwoorden. het is aan de verkopend makelaar, en in mijn vakgebied scheelt dat, of daar verder onderzoek naar gedaan wordt. Wij zijn misschien, nou dat is niet waar, de echte NVM makelaars die ook een eed hebben afgelegd zullen er alles aan doen om alles naar boven te halen. Als die info er is en als zij het weten dan moeten zij dit delen met de koper. Dus zoals ik net zei bij de Kootsekade, er is een oud rapport beschikbaar, de bieder krijgt dat te zien voor hij het gaat kopen.

- Houden woningzoekenden actief rekening met funderingen?

Ja, meer en meer, het is bijna een standaard vraag, ook in gebieden waar bijna geen funderingsproblematiek voorkomt is het bijna een standaard vraag.

- Waar komt dit door denkt u?

Nou er wordt wel veel aandacht aan besteed, er is, zeker de laatste jaren toch wel veel publiciteit over voor het afgelopen jaar was er een rapport dat ongeveer 20% van de Nederlandse huizenvoorraad problemen gaat krijgen met funderingsproblematiek. Ja dat zet mensen toch wel aan het denken. Terecht,

- Hoe vaak laat een aspirant-koper een bouwtechnisch onderzoek naar de beoogde woning c.q. vatgoedobject uitvoeren?

Ehm, Ik schat z'n 1 op de 4 keer, bij appartementen ligt dat lager en bij hele huizen ligt dat hoger. Bij moderne huizen ligt dat zeer laag en bij oude misschien wel 50/50.

- Worden funderingen hier in meegenomen?

Nauwelijks, in de bouwkundige keuring stelt expliciet in zijn voorwaarden dat het een visuele keuring is. Eh hij zou wel aangeven of er aanleiding is voor nader onderzoek naar de fundering maar op basis van een visuele keuring, dus wat hij ziet. Sommige kopers denken van nou met een bouwkundige keuring heb ik het wel gedekt maar dat is absoluut niet het geval. Funderingsonderzoek is echt totaal iets anders dan een bouwkundige keuring.

- Komt het wel eens voor dan iemand een funderingsonderzoek doet?

Ja, ja, overigens moet een eigenaar hier wel aan meewerken en soms wil een eigenaar dit niet.

- En in welke gevallen gaat met over tot een funderingsonderzoek?

Komt vooral voor in straten waar veel fundering problematiek is. En vooral waar veel scheuren en scheefstand is, dus klemmende deuren, als er echt bouwkundig gezien aanleiding toe is. Een bouwkundige keuring roept hier ook wel regelmatig toe op, begrijpelijk.

- Houden woningzoekenden adequaat rekening met de eventuele risico's die de fundering van een huis met zich mee brengt?

Over het algemeen ja.

- En hoe uit dat zich?

Nou als er onzekerheid is dan gaan ze of naar een ander huis kijken, of ze willen een garantie van de verkoper, of ze laten toch een bouwkundige komen en als die aanleiding ziet om nader onderzoek naar de fundering uit te laten voeren, nou, heel soms laten ze dat dan doen, maar vaak haken potentiële kopers dan af.

- Hebben de recente marktontwikkelingen deze processen beïnvloed?

Eh eerlijk gezegd niet, ik weet dat er word gedacht dat er minder bouwkundige keuringen worden uitgevoerd omdat men anders niet aan een huis komt maar ik denk niet dat dat zo is. De financiële consequenties van niet goede funderingen zijn zo groot dat mensen dat echt mee willen nemen als er aanleiding is om funderingsproblemen te verwachten.

- De aantrekkende markt heeft er niet voor gezorgd dat mensen minder rekening houden met funderingen?

Correct.

- Wordt de funderingsproblematiek voldoende uitgelicht?

Door wie?

- Door gemeente, overheid, de maatschappij.

In Rotterdam, ja. Het funderingsloket is heel makkelijk benaderbaar. Het funderingsloket dat ze zijn gestart is eigenlijk de voorloper van het systeem dat nu ook landelijk wordt uitgerold. Dus ja, ik vind dat ze dat heel erg netjes doen.

- En landelijk?

Ehm weinig, ik geloof niet dat er landelijk beleid voor is. Niet om er aan mee te betalen maar ik geloof ook niet dat ze potentiële kopers daar erg voor waarschuwen. Nee het is meer gemeentelijk dan landelijk.

- En in welke vormen kan het verbeterd worden?

Ja je hebt natuurlijk de ouderwetse postbus 51 spotjes op tv, ik weet niet of het helpt hoor, maar het zou mensen wel bewuster maken. Dan gaat het ineens een onderwerp worden bij feesten partijen en borrels denk ik.

- Denkt u dat betaling via courtage ook meespeelt in het advies rondom de funderingsproblematiek?

In de rol van verkopend of aankopend?

- Verkopend



Nee absoluut niet, een makelaar moet mededelen wat hij weet en als achteraf blijkt dat hij dit niet heeft gedaan dan krijg je daar gesteggel over, en dan krijg je juridisch zal dat waarschijnlijk toch bij de verkoper liggen aangezien hij hier onderzoek naar doet. Maar als makelaar word je dan zowat uit het vak gegooid, het is een doodzonde

## ENGLISH TRANSLATION

### Interview 1 - expert A

- Do you encounter foundation problems during your work?

Yes and especially foundation uncertainty, is it then immediately a problem, that is the question. The municipality of Rotterdam has a risk map and there are five flavours on it: less than 1%, 1% to 5% and 5% to 30%. And I always compare that with standing in front of my wardrobe in the morning and having to choose what to wear and it could be 5 degrees and it could be 30. That makes quite a difference. Do I put on a bathing suit or a winter jacket? That makes quite a difference. The information available from the archives is not such that you can derive meaningful information from it, which makes it difficult to give good advice. So if there's no foundation research, you have to rely on external characteristics, misalignment, crack formation, is the foundation status of the block known, has there been research in the immediate vicinity, are there any monitoring wells that you can perhaps deduce from this? Is there any subsidence that you can observe, or has the satellite that flies over measured anything? So there are some things that can be found, but they never give a 100% picture until you have been underground, of course. That's the tricky part. So yes, I might have foundation problems, but we won't know until an actual investigation has been carried out. And if you are a selling agent, then the seller is not eager for a report. And if you are a buying agent, the chance that you can build in a resolute condition that you want a foundation study done is nil because there is always someone else who is not going to do it and they will be given preference. Apart from the fact that the seller, if he were to allow it, would suddenly be faced with a foundation study that didn't work out in his favour and would suddenly get less money for his house. So it's a bit, um, how should I put it. It's a bit of a forgotten child, especially in a market like this, when the market is less crowded and there's more supply and people have more to choose from, then you start looking more closely. When the market is as it is now, people are already happy that the roof is not leaking. Then we just buy it, because otherwise we have nothing. That is sometimes difficult.

- Is that only in homes or also in other types of real estate? In what forms?

Well, I don't really deal with other types of real estate that much. we do 99% residential.

- To what extent does foundation play a role in valuation and sales processes?

Yes, look, at the moment there is no misalignment, there are no doors or windows that are difficult to close and there are no indications that something is wrong with it, but it does lie within the risk area, but I don't have any research, then we assume that at the moment there is nothing wrong with the foundation. And then in a market like this it has no effect on the price. If you have really serious misalignment, then there are two things going on: one is that it has moved in the past and stabilised. The architectural skew you will continue to have. So that's something you'll have to find a solution for, either by re-laying the floors or by accepting it. Then, of course, there is a completely different situation where a active

foundation problem is present. In that case, you just have to calculate that 1500 euros per square metre may need to be spent on foundation repair. That, of course, can get very expensive. Then it will definitely count.

- Is there a link between foundation quality and transaction prices?

Yes absolutely, but that is, as I have just said, inherent in the times in which we live. It is different now than in 2015/2016. In those times a home in a neighbourhood with known foundation problems became a thing. These days people are stepping over it too easily. This has to do with the moment of the market wherein people are buying.

- Does the extent of price reduction due to poor foundation quality depend on the type of foundation?

hmm. well look we have, yes I think so. We have for example in the Kleiwegquarter the real Rotterdam foundation and the real wooden foundations with concrete foundation beams, the latter being the more expensive houses. Those are houses where you don't really see anything. All foundation studies have also shown that they have a lifespan of 10 to 15 years under the same conditions. At the time of the research, the groundwater level was low. And then the municipality ensured that the water level rose. This reduced the risk. The houses with the Rotterdam foundations were just more seriously affected. Take the Lisbloemstraat, for example, where they have the older workers' dwellings. At some point, they had to have their foundations repaired. There was no other solution. There were also other blocks where this was the case, but I haven't seen any houses that had a concrete foundation beam where it was necessary to tackle that. Ehm, and you also see it much later, because if there is a bad pile, the weight of the building is absorbed by the other piles, so to speak, it is distributed. So you are much less likely to see the outward signs of a foundation problem there, which means you are much less likely to be presented with the bill for it. The moment you start looking, what is it worth? In the case of a house built on Rotterdam foundations, a piece of masonry simply falls through between the piles, giving rise to an unsightly crack. This cannot easily fixed either, which means that you have to do something about it structurally.

- Rotterdam foundation is a foundation on wooden piles I assume?

Yes, but foundations with a concrete foundation beam also stand on wooden piles. With the Rotterdam foundation there is a longitudinal timber over the piles. On top of this, just a plank in fact, is masonry. Erm, when the groundwater level is low, that plank will of course be the first to be affected; the pile is much thicker, so to speak, and can withstand a lot more damage than a 5 cm plank. If all the masonry sinks through at some point, the wall will simply buckle, through the foundation board in fact. The other type of foundation that we have in Rotterdam consists of wooden piles with a concrete ring poured on top, so that the piles that are a little deeper are much less likely to show dry spots. But as soon as one of the boards is thinner, of poorer quality or adjusted due to groundwater subsidence, the weight of the building is distributed over the other piles by that ring of concrete, so local subsidence is much less likely than in a Rotterdam foundation. Ultimately, this does have an effect on the value. If something is placed on a concrete foundation, you have nothing to worry about, as it were. In Rotterdam, we also have foundations that are not on a foundation at all, which are simply founded on steel or on animal skins.

- Does the buyer or appraiser receive information regarding foundations per definition?

Erm no, look, at the moment there is no foundation report, at the most there will be a printout of the foundation map in the estate agent's files. That's all we can say about it. When a report is available, we have to make it available. I don't know if everyone abides by that. But that is the minimum requirement. That is part of your duty as a seller and as a real estate agent. And probably in most cases, not all, you can be more certain that you are buying something good. So yes, we are supposed to give information about it, but um, not everyone appreciates that information, a lot of people, as I just said, are just desperately looking for a house and almost at any price. And everything you tell them that doesn't suit them goes in one ear and out the other. That is what is so strange about this market. I have also experienced the complete opposite. I've also seen the complete opposite: that houses where there might very well have been something wrong with them didn't want to go until there was clarity. And we've noticed that very strongly in the Kleiwegkwartier. In the time that no foundation research had been done, I had a lot of trouble selling houses on Lisbloemstraat, for example. But when the report came out that the maintenance period was 10-15 years and that there were no measures that had a demonstrable effect on the groundwater level, the houses suddenly went up like hot cakes. Everyone thinks 10 to 15 years, don't cross the bridges before you come to them. That's how people work. Only when people closer to you see cracks in houses related to the gas fields does everyone suddenly start bouncing. But if we say that in 10 to 15 years' time you will have to do something to your foundations, people think, oh well, we'll see about that. And I find that quite remarkable.

- Is the current level of information supply adequate?

Yes I don't think the municipality of Rotterdam can do more. I myself find the estimate between 5 and 13 percent meaningless. But do I have anything better, no. As long as no foundation studies have been carried out, it's very difficult to give conclusive information on this. When I look at the information the municipality has available in the form of monitoring wells, foundation studies and subsidence maps, I find that our organisation is above average and that I, as a purchasing or sales agent, can take my information from this and give people the best possible advice, even though I'm not 100% sure how it will behave in 10 or 15 years' time because we haven't been underground.

- How is the distribution of information between appraiser, buyer and seller?

Well, what I do is the foundation report in any case, and if I work for a buyer then of course I investigate further, I don't just go and look at what the seller has in his file. And the moment I have to sell something in an area of which I think no research has been done but it is a risk area, I make sure that there is a risk map in the file. And that during viewings I tell those who are interested how it works in Rotterdam and what measures are taken, what they can expect if it does come to damage.

- What does the appraiser know or should know in advance about the nature and quality of the foundation?

Yes look ehm what an appraiser has to do nowadays with the new appraisal rules, I won't be an appraiser anymore in 11 days, ehm but well I still know what they have to do nowadays. They have to look much more at the architectural state of a building. Nowadays banks also know that Rotterdam is an area with 60,000 homes with a potential foundation risk. So that really is something that is taken into account during an appraisal. The appraiser simply looks at the observations during an appraisal to see, well, do

I see any reason to expect foundation problems and then he does his research in the same archive of, well, what types of foundations do I see, what do I see in terms of foundation risk maps, what do I see in terms of monitoring wells, et cetera. The more reason there is to expect something, the further your investigation goes.

- In the current market conditions, is there asymmetrical information about foundations during a sales process?

What do you mean by asymmetrical information?

- That, for example, the owner knows about foundation problems but the purchaser does not.

That would absolutely be the case, yes, I've seen it happen myself once, on Azaliastraat I had to sell a house, the people had a foundation report that was maintained for 5-10 years, then I had to tell them that it had an influence on the selling price. And that I thought it was important to be open about that information and to share it with all the buyers. I had a client there at the time and he wanted to see it and then I was offered a file and the foundation report was not included. So yes, I think there is asymmetrical information.

And that estate agents, or sellers, I may have woken up this client by hammering away at the fact that I thought you should be transparent about this. They thought, well, we'll just turn a blind eye to the next estate agent, and the estate agent also turned a blind eye. He was not from Rotterdam and did not know how the neighbourhood worked and made do with what he had. The eventual buyer would have eventually found out that there was a foundation study, but the question is of course whether he would have sued the seller for that. Then there must be damage and as long as there is no damage it becomes difficult.

- Do you rate this problem highly? of asymmetric information?

Nah no I don't think so because I think the professional risk for the estate agent is too great to let himself be fooled by a seller, or to shoot yourself in the foot for not doing it. You have to have some respect for yourself, of course we sometimes see estate agents who come from Lutjebroek and probably don't know the ins and outs. It is a choice of the client and also a choice of the estate agent not to delve into the working region and risk being caught later with your professional liability insurance because you did not do your job properly. But I think that such a percentage of the houses in Rotterdam are bought by local estate agents that this problem is not so big. Yes I do actually think that estate agents tend to play it down but they do have the information.

- Do potential home buyers factor in foundation during their search?

No, inadequately I think. But that is a tendency we also observe with ground lease. If I were to buy a house myself, I would think, what would I prefer not to do? Well, I wouldn't want it to have a foundation problem, or a potential foundation problem. And I would also prefer not to have to pay for the ground rent again in 25 years' time. And it just doesn't seem to matter at the moment in the market. But as I said before, this is just inherent to the housing market and it mainly has to do with the economic tide and

housing market we are in at the moment, eh for you 10 other buyers. You become less critical at a certain point, just to be lucky enough to be able to buy something once.

- How often does a potential home buyer conduct a structural building inspection to the asset intended?

Ehm

- Also with concern to the foundations?

Well, on the foundation, that has happened to me twice in 17 years. That a buyer finally had a foundation survey done for a client I represented. In the Kleiwegquarter I think 90% of all houses have a collective foundation investigation. They just did random tests on certain blocks. But I think that it happens very little, precisely because the seller is not at all waiting for a foundation investigation. And a buyer would not be so quick to do it, because a good investigation costs about 2800 euros. Erm, so that, yes, you don't just do that with the risk of it being disappointing. I recently bought a house in Kralingen, about a year ago now. And Kralingen is also known for its potential foundation problems, especially Kralingen-east. And we saw something in the property, that indicates there might be something wrong with it. And then, because there wasn't much of a demand storm there at the time, we put in a bid as a condition, which was rejected, and instead we got a lower proposal from the seller, who said, hey, we're happy to sell it to you but we don't want a foundation study. You get a discount on the purchase price if you accept it for what it is. If it comes to it, at least they have been compensated for it. A structural survey goes much less far than that, a structural survey looks only visually, it holds a mirror on the dormer to see if the roofing is good, it looks if the pipes are well insured, it looks if the electricity is well organized and if there is no wood rot. They look at optical things. And the moment he sees cracks, or crookedness, he will say something about it. But that's not the same as a foundation examination. Because the only way to do a foundation investigation is to dig up a pile head, take wood samples, do an impact measurement, a floor water meter, and that costs 2800 and isn't done in 1 2 3 minutes. So that hardly ever happens at the moment, and an structural inspection is actually too little to say something about that. Um, because if you are bidding on a house that you really want, and you have 15 other people who want it too, then you can include a condition for an architectural inspection, but when it eventually comes to making a comparison and there are people with a similar price and conditions without the condition for an architectural inspection, then yes, you will choose the offer with the most certainty. And that is the one with the fewest conditions. In practice, you see that relatively few houses are inspected.

- Do home searchers adequately factor in the eventual risks paired with the foundation of the structure they are looking for?

Yes, I always hope so, but in practice I don't see it. And that is always the tricky part. Yes, we real estate agents of course advise that they should take a buying agent with them. Ehm, because the moment you think you have it all figured out, which risks you are running and what you need to pay attention to. Then you will probably be deceived. Because the only thing you have to consider at that one moment of the first viewing, because often a second viewing is not even possible, is: Can I put my things here? Can I eat here with my friends? do I feel at home? And you're not looking at the connections and whether or not major maintenance needs to be done, etcetera. So I think that far too little consideration is given to that.

- And how does this translate into price?

Well, not at the moment, but that is inherent in the way the market works at the moment. Eat or be eaten, so yes, if you want to buy something, you have to take whatever comes your way. And some people are sensible and realistic, but the majority just have to buy and don't really take anything into account.

- Have recent market developments affected these processes? If so, in what way?

Yes, well, they're not that recent anymore of course, because it's been going on for about two and a half years now, at least in Rotterdam, that there's really no measure and that despite what's going on bizarre offers are being made just to be able to buy. That as a purchasing agent, I can no longer support it either. That I then say I think it's worth 340 but my client says I'm still able to offer something more, so he bids 355. And in the end, someone goes over with 380, while we had already outbid them by 40,000. You really think that there is no basis for it anymore. And this has been going on for so long now that I think people are really going to be presented with a bill for this. It has become greed. And I get it, because if you have been living at home with your parents for 2.5 years longer than planned, or you have received a huge amount of money from the sale of your own house, then yes, it is easier to spend. But then again, there may come a time when you have to sell, and then the outcome may be different.

- Is the foundation issue sufficiently highlighted?

Well, the municipality of Rotterdam is doing well with it, but at one point they had rolled out something nationwide. Then about the whole of the Netherlands was pissed off because it was a bit too early. I watched it myself and it was actually a bit too unsubtle to present to the Dutch public. Because we all see what happens when big social issues are discussed on social media, the whole world gets pissed off. Someone somewhere has heard a bell and they start shouting and writing about it. And then the chamber starts to think something about it, because someone has tipped them of but they're not really into the business. And so something that is actually not that objectionable becomes a whole thing. I think Rotterdam is doing well. Perhaps estate agents should also be a bit more involved, and get to know the subject a bit more. But of course, the tricky thing is that an estate agent has to sell more and more houses because everyone thinks that estate agents have it easy. That he only has to do a visit and the house is sold. So the commission has to come down. Well what does this mean for your turnover, that you have to sell more houses to cover your costs and make a little profit. And the moment you have to sell more houses, it means you have less time to do thorough research. So yes, consumers are also partly to blame for the fact that the provision of information does not get off the ground as it should, and then as a real estate agent you can insist on saying, hello, I'll just keep charging my old commission or else I won't be able to give sound advice, I'm one of those people, it ultimately leads to less turnover and very satisfied customers. But at some point, you will have to make a cut to ensure that you do things differently.

- Does this pursuit of profit by estate agents also influence the advice on foundation quality?

Yes, I sometimes think that there are people who play down problems, and problems is a big word, who play down risks just to make sure that it doesn't get in the way of a deal. I think that is what happens. I have seen it happen in practice. I've seen it happen in practice. I was walking around as a sales agent asking questions and the other agent says "well, there's nothing wrong here" and I think "well, I know the type of house, I know the type of foundation and I happen to know that the groundwater level is a bit on the low side". Because the house is stable, you say that nothing is wrong, but you can't say that. That's partly due to the level of knowledge, keeping your face straight just to be able to answer, and partly due to the fact that they don't want to run the risk of it becoming a regular customer that doesn't



sell and therefore doesn't generate turnover. But anyway, in this market, we don't need to worry about that as much, because whatever you say, it will sell eventually.

## **Interview 2 - expert B**

- Do you encounter foundation problems during your work?

Yes, of course, but not at every property, there are a few areas, yes it does happen

- Only for homes or also for other types of real estate?

Yes houses and flats, that is of course what we are concerned with.

- In what form do you encounter it?

Um, sometimes it really has to be done and sometimes it's debatable. So we know that in a certain area something is going on, and we see some signs, that you do warn people about it.

- To what extent do you encounter foundation problems in valuation and sales processes?

That depends on the extent to which they already know, and Sometimes we say "in about 15 years it really needs to happen". So then it plays a little part but in this overheated market people often think: "it will last my time. But you can see that it has an influence, because there are also people who are really afraid of it, who are reluctant, especially if they say, well, I want to live here for five years, then they won't buy these kinds of houses. And it definitely has an influence on the value, of course, but that depends entirely on the degree to which it has to be done right away. Or does it still have a few years time? How far along are the neighbours? So that's different for each property.

- Is there a link between foundation quality and transaction prices?

Yes.

- How strong and in what direction?

It depends, of course, on when it has to happen. Look, if there is urgency, then it will have a 1 on 1 influence on the value. However, when it has to be done in the future, and people have to save up for it, it will lessen the influence.

- Does the extent of price reduction due to poor foundation quality depend on the type of foundation?

Yes, because it is a wooden foundation then. yes.

- So there is a difference between typing?

You have wood or concrete, with wooden foundations it has influence, with concrete it does not, then one is sure there is nothing wrong.

- There cannot be a bad concrete foundation?

No, I haven't seen that yet, no, those are concrete piles, they don't sink.

- Does the buyer or the appraiser receive information about the foundation in any case?

Yes, we have the foundation counter in Rotterdam. We are experienced locally, of course. But in Rotterdam we have a special website with a risk map, so you can check everything there. And sometimes there are old surveys, and you can use them for that.

- Does the buyer or appraiser receive information regarding foundations per definition?

No, because of course not every house has a foundation study, sometimes it's a bit uncertain. Then you really have to know the house and have experience with cracks and the consequences. You have to rely on that but not every house has an investigation.

- How is the information provided to both the surveyor, the owner and the interested buyer

What do you mean?

- How is the distribution of information between appraiser, buyer and seller?

Erm, well, it's actually mainly the foundation desk, which is just a website, that's where you start. And then it depends on the seller whether he has had it investigated, or a owners association has had it investigated, of which a flat is a part.

- Does this happen often?

No, too little.

- Why do you think?

Ostrich politics, people often do not want to know because they are afraid that something is wrong.

But for certain areas you can be sure that something is going on, and that is what I tell my purchasing customers.

- Does it happen that the buyer requests an investigation?

Not in this day and age, because the moment you ask, you then often don't become the buyer.

- What does the appraiser know or should know in advance about the nature and quality of the foundation?



Well, not so much, of course, we rely on the foundation counter or the information provided by the seller.

- Yes and ideally, what kind of info would the appraiser prefer?

I would prefer to just have a foundation report. But then they have to dig and take samples and that takes 6 to 8 weeks. And it costs 3000 euro on top of that.

- In the current market conditions, is there asymmetrical information about foundations during a sales process?

No, not really, if there is an estate agent in between and he knows where to get his information from then no. The seller, if he knows something and doesn't tell you, then it's a hidden defect. And eh I haven't seen that yet, that people are not honest about that.

- That does not happen?

No, either the estate agent doesn't know, or he doesn't know where to get the information from and he just doesn't know. But then you have to rely a bit on your own knowledge, so to speak.

- Do house hunters actively consider foundations?

Yes

- And how does this manifest itself?

Is always asked, especially when you see a crack.

- How often does a prospective buyer have a structural survey carried out of the intended home or property?

Of course, that also depends on the house, look, if the condition of the property is good, I had another flat this morning, multi-year maintenance plan, so major maintenance had already been done, it was a 1930s house but completely up to date, then you don't have to do that. That is different for each building. I recently had a house where the floors were crooked. And then you are so lucky that the selling party allows it, you depend on that.

- Is foundation and foundation quality part of sun research?

Often not.

- that is really a separate investigation?

Yes, yes, and then of course you ask the judge what do you think? And then they can often say something about it, but not always. And then there remains a kind of uncertainty and that is up to the buyer. And you try to make them as aware of that as possible.

- Do potential home buyers adequately consider the possible risks involved in the foundation of a house?

My clients do, I am there, we are very much aware of that. Because it has enormous consequences in terms of foundation problems. In terms of costs, in terms of uncertainty, so we always put it down on paper and we mention it anyway to our purchasing client but also to buyers. Because eh we just want to know. And if you don't know, that's also an answer and you just have to mention it.

- And in general? Outside your customers? What do you think?

What?

- Are the risks adequately taken into account?

People who are a bit wary and look at old buildings do take the risks into account. But not all of them. We also have a lot of expat people who don't know all that. Or people from Amsterdam or Utrecht, I don't know, parents who live in Vlissingen and buy a house for their children, they don't know all that. So you have to mention it. And you don't always know to what extent people are no longer laymen or have experience. For us, as purchasing agents, that is quite a question. To what extent are you known in Rotterdam?

- How does this translate into the selling price?

You mean the foundation problems?

- Yes and the extent to which people take it into account.

Yes, that too is different. That's a tricky one; it's not always black and white, of course. Look, you have a small building and a new foundation costs a ton, you share it with four or two people, that makes a lot of difference. But it certainly has an influence. What I am saying is that if all this has to be done within five years, it will have an influence almost 1 to 1. And there is also simply less interest in the house if there is a foundation problem.

- Have recent market developments affected these processes? If so, in what way?

Um, people are very afraid of the foundations, so if it has to be done in the short term, it has an immediate impact. In the longer term, sellers are in a good mood, so people think, well, it will take a while yet so at least I can buy a house now. But of course that house is often cheaper for a reason. But in the long term, if a new foundation is needed, then the market does help and higher prices are paid for it.

- And has the market picked up in recent years had any influence?

Yes, what I'm saying is, if it has to be done in the long term, then people are more likely to overlook it. If it has to be done immediately, they are much more aware of it. Because it also has an influence on getting a mortgage, because you have to co-finance it right away and not everyone wants to do that. Because you just put 30 thousand euros under the ground, so to speak, and they'd rather buy a new kitchen with that.

- Is the foundation issue sufficiently highlighted?

Yes, I think so, with us, let's put it that way.

- And in general?

Could be better

- In what form can it be improved?

Um, information from the selling party. So that, of course, especially to estate agents, they should be a bit more open about 'wait, this is a risk area'. That you might have problems with it. Just be honest about it

So there is asymmetrical information from time to time?

Yes, well, with us, we are very wary of it. I can't say the same for everyone, of course. And you also have a lot of estate agents who just put the house online and the seller has to do it himself. They are just laymen, they just don't know. Yes, so asymmetrical, it's not that they are not honest about it but that they just don't have the knowledge.

### **Interview 3 - expert C**

- Do you encounter foundation problems during your work?

Daily

- In what forms?

Selling houses in high-risk areas where we have to weigh up what the asking price will be, how we will balance the responsibilities, and how do we arrange cover in the future? How do I cover my clients as well as possible to prevent claims later on? So that's a matter of providing information and also including in the final deed of sale the conditions under which the property is sold.

- Is this only for homes or also for other types of real estate?

We are very focused on homes, both houses and flats, sometimes also shops, but this is very rare. We then do this for relations who ask us to do this.

- To what extent does foundation play a role in valuation and sales processes?

Enormous, because it costs between 80 and 100 thousand euro to repair a foundation for an ordinary building, and I'm talking about 12 metres deep and 5.50 metres wide, which is about the standard size in Rotterdam. And if your foundation is ruined you can deduct this directly from the price, sometimes you can still save some of the price by immediately building a basement. That way you can earn the value back a bit. And if you go with this story and then prepare it well, you sometimes have people who

buy a 100 metre house with a bad foundation and then immediately tackle the foundation and build a basement and then suddenly they have 140 square metres. And then there's a bit of added value, because that 40 metres has a value of 2 tonnes on the market while making a new basement costs only 120 thousand. So by giving good advice, you can create more value for the customer.

- Is there a link between foundation quality and transaction prices?

Yes, exactly what I said in the previous question.

- How strong is this effect then?

Well what you see this depends on maintenance terms. You have 5 maintenance terms if I'm right. Just off the top of my head, 0 years, you just have to fix it. 5 years it's coming. 5 to 15 years it's a bit moderate. And then 25 years, you used to have 40 years as well but they don't issue that anymore. Older reports still have that in them sometimes. Ehm and what you see with an investigation, if you have a house in a risk area, which is almost all of Rotterdam, and there is no misalignment to be noticed then you can sell it well and the price is comparable to a 25-year term. With a good survey maybe a little higher but that depends on the sales process. Anything less than that you start to see it. And if this is 15 to 20 years, yes, I can't put a figure on it. But if it is less than that, you can sell it for 40 to 50 thousand euros less. And if it is less than 15 years, then a tonne is deducted. Except for flats of course, because then you share those costs again. If you have one third flat right then it becomes 33 thousand. And it always depends, selling is not rocket science, it's just where it comes out.

- Is there a link between foundation types and transaction prices?

Yes, look, up to now, it's nice that you say that, I've been talking about wooden piles. Non-piledriven foundations are different, you see that almost no research is ever done on these foundation and it has very different problems. If a house has a non-piledriven foundation and is a bit crooked, you can just sell it for a good price. But if you have a house and the leaning is such that the house is now below ground level and water is coming in, then the value is going to fall. And sometimes the best alternative is demolition and new construction.

- And do you ever come across bad concrete foundations?

No, no, what I do encounter is pile head lowering. In the eighties and nineties, yes to explain to you what the foundations looked like then. The pile heads started to rot and in the eighties and nineties what they did was to dig out the piles one by one and saw them through while adding a concrete pile on top. The top of the pile was replaced with concrete but still looking for the bearing capacity in the old especially with pine foundations you see that the houses that were then restored then have to be tackled again now, the fungus gets into the core of the wood and it gets worse underneath. These costs are almost as expensive as a foundation, sometimes even higher, because it has to be broken down to put new piles under it.

- Does the extent of price reduction due to poor foundation quality depend on the type of foundation?

Yes, we always include the map of the municipality's risk analysis. And if a report is available, we always include it. But there are many houses that have not been investigated yet.

- Does the buyer or the appraiser receive information about the foundations in any case? Is the provision of information about foundations currently adequate?

Yes, I do think that a lot is happening in Rotterdam. If you look in other cities, there are no risk maps or registers, so in Rotterdam this is well organised.

- How is the information provided to both the appraiser, the owner and the interested buyer?

In principle, the seller is the one who provides the information. We look in the registers and if there is anything in them, we put it in the attachment and they get the attachment.

- What does the appraiser know or should know in advance about the nature and quality of the foundation?

The appraiser has a duty to check the same registers and also to make his own risk analysis. Whether this always happens properly I do not know. I am not every surveyor, I cannot speak for all surveyors, but I think it is done well.

- In the current market conditions, is there asymmetrical information about foundations during a sales process?

No, I hardly see it. No, no, what I do find, and then I'm straying a bit from your question, is that there are quite a few buyers who buy property in a high-risk area, and that goes a bit, there's a very nice French term for it. A bit late, but we'll see what happens. That's a bit of a flat term, erm, what is it?

- Laissez-faire?

Yes, exactly

And when you step into a property for which you have paid an expensive price with such an attitude, I sometimes think, are you doing the right thing? I always try to protect my buyers from that, my purchasing clients. But as a sales agent, you don't have that role, you just sell. And if people then want to step into that situation, also with the conclusion, ehm construction in the sales contract that they can never come back to the seller about it, just that they are well informed and make that choice themselves, that's what it says. And I don't have a role to play in that, but I think to myself. And especially with flats because, yes, if you buy a house, it's a matter of money, if you lose a ton of money, that's very unpleasant, but the interest rates are low, and in general we have clients who can absorb that with a possible loan. But if you buy an apartment complex, and a few senior citizens with little money live there too, then you have to get everyone on the same page to ensure that everyone will invest in the foundation, and if not everyone agrees, then it becomes a difficult story.

- Okay, but you don't see one party knowing about its bad foundation and not sharing it?

No, no I have experienced that the seller has had an investigation in the street and I ask him do you have an investigation? And he says no, and then I find out later in the registers that there is one. Then we are still a bit of a safety net in that.

- Yes

I do not feel that I actively encounter this in my work.

- Do potential home buyers actively consider foundations? How is this expressed?

Absolutely, the most frequently asked question during viewings.

- What is the state of the foundations?

Yes, yes.

- How often does a prospective buyer have a structural survey carried out of the intended home or property?

Not.

- And an investigation into the foundations?

No, I thought that's what you meant, architectural inspection does happen, in half the cases. But that says nothing about foundations. In my practice, foundation testing is something that happened last like four years ago. And that had everything to do with the fact that there are always several potential buyers, and if the offers are on the table and someone makes a demand for a foundation investigation, then that person also knows that he will end up at the bottom of the pile. Because that's not what the seller wants.

- Do potential home buyers adequately consider the possible risks involved in the foundation of a house?

Yes, we talked about that briefly earlier, actually, um, they certainly take that into account, but I do think that the risks they take, they take them quite easily. But they do it consciously. Also because it allows them to buy the house they otherwise would not be able to buy.

- And how does this translate into price?

Yes, then it becomes cheaper, but not always. What I also see sometimes is that a house is in a risk area with some skew and that people still want to buy it, a high price too. But if there is an investigation and it has to be done, then it goes down fast.

- Have recent market developments affected these processes?

Yes, before that there was much more research. But because of the scarcity and the potential buyers, you see people stepping over that.

- Is the foundation issue sufficiently highlighted?

Yes, I think so, especially in Rotterdam.

- In what form?

The municipality has even had whole campaigns about it. That's why it's so good that all potential buyers ask how is the foundation? And that the answer is often that it is a high-risk area, and foundation damage has been recognised but never investigated. And that they then choose to simply take that risk is another matter. But I understand that very well, because otherwise you just have to take it. I sometimes say to a purchasing client if I see some misalignment in a building dating from 1910-1930 and there has been no investigation: if we are going to do an investigation then it won't be you, just bear in mind that it will have to be done at some point in the future and that it will cost you 100,000 euros.

#### **Interview 4 - expert D**

- Do you encounter foundation problems during your work?

Certainly.

- In what forms

Ehm, when selling properties that we get for sale, sometimes you have a property with foundation problems or potential foundation problems and then you notice that it sometimes becomes a bit more difficult to sell.

- Yes, and is this only for homes or also for other types of real estate?

No, we are only residential real estate agents.

- To what extent does foundation play a role in valuation and sales processes?

It is absolutely compulsory to state something about foundations at the appraisal and you are expected to indicate the nature of the foundation: non-piledriven, concrete or wooden piles. And preferably also something about the quality. Of course, this is not entirely possible without an investigation report, but you can indicate whether there are any points of interest, cracks in walls, misalignment, and so on.

- Is there a link between foundation quality and transaction prices?

Certainly.

- How strong and in which direction

Two possibilities, or there is uncertainty about the foundation. Uncertainty always results in lower transaction prices. Certainty, yes you feel certain, then you bid more. Uncertainty is one thing, another is if it is clear that something must be done about the foundation in the medium term at least, then that has a certain value-reducing effect. People always ask what the costs of possible repairs are, and that is

more or less deducted from the transaction price, or certainly the transaction price that you could achieve if there were no foundation problem.

- Do you often encounter this?

Fortunately, it is not very common on the north side of the river, apart from a few neighbourhoods; you are aware of it, but the number of houses where you come across it is still relatively low, in my practice, I would add. and we do maybe 100 transactions a year.

- Is there a link between foundation types and transaction prices?

Yes, a non-piledriven foundation on a sand layer is not so bad, but then your target group of potential buyers is smaller, so is your transaction price. But technically it is not such a big problem. Over the years, it has become skewed, that's it, maybe it will increase a bit but it won't lead to the collapse of the construction. If it stands on piles, then you just have to dig and tackle the foundation. And that can always be expressed as a cost item in a building and it can be expressed 1:1 in the transaction price. Sometimes, I have to say, it also creates opportunities for the buyer. This year, we sold a ground floor flat on the G.W. Beursplein. Right in the centre, part of a row of houses that needed foundation repair. This house wasn't too bad, but of course you join in the row of foundation repair. Then suddenly there were possibilities to make a whole basement underneath, more square metres, then your investment, if you want it, is of course smaller. Working together to tackle a foundation is of course cheaper than doing it on your own. So sometimes it's an opportunity.

- Do you also sometimes come across concrete foundations of poor quality?

So far, no.

- Does the buyer or the appraiser receive information about the foundation in any case?

No, he doesn't receive anything, you are forced by the form of the valuation report to ask questions about it, which can be done with the owner, who generally doesn't know a thing about it, you are also supposed to ask the foundation desk for information, well the information there is extremely meagre to be honest. Unless there is a foundation report, which I always find very interesting.

- How is the information provided to both the surveyor, the owner and the interested buyer

Ehm in my role as a surveyor I look for foundation problems if I think it's necessary and I don't do that with a house that belongs to concrete, and I would do it with Hillegersberg and the kleiwegkwartier, ehm but I have to look it up myself. If I'm in my role as a sales agent, if I know that there are research reports and potential foundation problems then it only helps the sale if I can say something about it. And I make sure that I don't just blurt it out but that I am really prepared. We have just now sold Kootsekade 24, there are foundation problems. There is a foundation report from 2009, which is actually no longer relevant, it was meant for a corner building there on the corner to determine where the demolition limit is, um, but this building is mentioned in it, of course I share this foundation report with all potential bidders.



- What does the appraiser know or should know in advance about the nature and quality of the foundation?

Sometimes they just work through their agenda and only see the house a, this is one with potential foundation problems, or because of local fame, or because there are structural defects in the house. To be honest, 90% of the appraisers work like this, they only give an appraisal when they have found out something about the foundations.

- In the current market conditions, is there asymmetrical information about foundations during a sales process?

Asymmetrical in the sense that you know something as a selling agent but not as a buyer?

- Yes,

As a selling agent, you try to insist that the seller knows and is honest about this. The seller and owner also have to fill in a questionnaire and that form is also part of the final purchase deed, and they are expected to answer it truthfully. We may be, well that is not true, the real NVM estate agents who have also taken an oath will do everything in their power to bring everything to light. If the information is there and if they know it, they have to share it with the buyer. So as I just said with the Kootsekade, there is an old report available, the bidder gets to see that before they buy.

- Do potential home buyers actively consider foundations?

Yes, more and more, it is almost a standard question, even in areas where there are almost no foundation problems it is almost a standard question.

- What do you think is the reason for this?

Well, a lot of attention is being paid to it; certainly in recent years, there has been a lot of publicity about it. Last year, there was a report that about 20% of the Dutch housing stock will have problems with its foundations. Yes, that does make people think. And rightly so,

- How often does a prospective buyer have a building survey carried out on the intended home or property?

Um, I estimate about 1 in 4 times, with flats it is lower and with whole houses it is higher. With modern houses it is very low and with old houses it is maybe 50 50.

- Are foundations included in this?

Hardly, the building inspection explicitly states in its conditions that it is a visual inspection. Um, he would indicate whether there is reason for further investigation of the foundation, but on the basis of a visual inspection, so what he sees. Some buyers think that an architectural inspection will cover it, but that is absolutely not the case. A foundation survey is really something completely different from an architectural survey.

- Does it ever happen that someone does a foundation study?

Yes, by the way, an owner has to cooperate in this and sometimes an owner does not want to.

- And in which cases will a foundation investigation be carried out?

This is especially the case in streets with many foundation problems. And especially where there are a lot of cracks and misalignments, so sticking doors, if there is a real reason from a structural point of view. A structural inspection often calls for this, which is understandable.

- Do house hunters adequately consider the possible risks involved in the foundation of a house?

In general, yes.

- And how does that manifest itself?

Well, if there is uncertainty, they will either look at another house, or they want a guarantee from the seller, or they will send for a structural engineer and if he sees a reason to carry out a further investigation into the foundation, well, sometimes they will have that done, but often potential buyers will then drop out.

- Have recent market developments affected these processes?

To be honest, I don't think so. I know people think that fewer structural inspections are carried out because otherwise they wouldn't buy a house, but I don't think that's true. The financial consequences of not having good foundations are so great that people really want to take that into account if there is a reason to expect foundation problems.

- Hasn't the recovering market caused people to take less notice of foundations?

Correct.

- Is the foundation issue sufficiently highlighted?

By whom?

- By municipality, government, society

In Rotterdam, yes. The foundation desk is very easy to approach. The foundation desk that they started is actually the forerunner of the system that is now being rolled out nationwide. So yes, I think they are doing a very good job.

- And nationwide?

Um, not much, I don't think there is a national policy for that. Not to pay for it, but I don't think they warn potential buyers about it either. No it is more municipal than national.

- And in what ways can it be improved?

Yes, of course, there are the old-fashioned Postbus 51 commercials on TV, I don't know if it helps, but it would make people more aware. Then suddenly it becomes a topic at parties and get-togethers, I think.

- Do you think that payment by brokerage also plays a role in the advice on the foundation problem?

In the role of selling or buying?

- Selling

No absolutely not, an estate agent must disclose what he knows and if it turns out afterwards that he has not done so, then you get into a fight about that, and then legally it will probably be up to the seller since he is investigating the matter. But as a real estate agent, you are pretty much thrown out of the profession, it is a mortal sin