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Density and Design
The Impact of Urban Densification on Design Qualities in Residential Neighbourhoods

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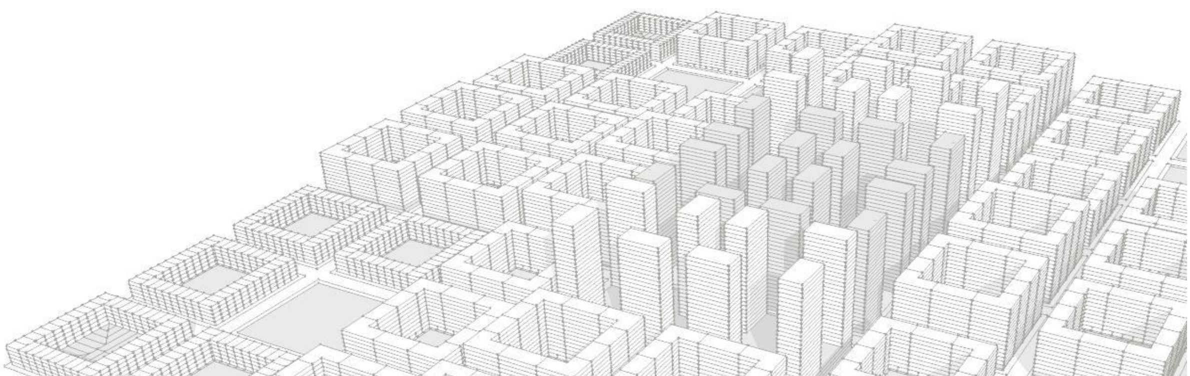

Abstract

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This study is focused on the concept of urban intensification, investigating the costs and benefits of higher density urban development. It attempts to define the exact physical patterns and spatial characteristic of the density of residential urban areas in order to establish the extent to which design qualities are delivered or compromised in high density urban form. In this way, the study attempts to identify any interrelationships between three factors: urban density, urban layout and urban design quality; and to see whether there is a consensus that higher density is linked to changes in urban layout, and has consequences in terms of urban quality. The study covers these three concepts at two spatial scales, namely the urban block and the neighbourhood. The work demonstrates that significant changes in morphological patterns such as plot size or control and ownership of open spaces, result from higher density design and, that there are subsequent impacts on particular design qualities such as overall adaptability or biodiversity of the residential neighbourhood.

An analytical framework, elaborated from the theory, was developed taking into account appropriate measures of urban density (e.g. people or built form density measures), descriptors of urban morphology (e.g. average size of plots and open spaces), and indicators of urban design quality (e.g. mixed use ratios, levels of diversity in house types and sizes). The methods of analysis and testing of the theoretical proposition include, first, the use of computer simulation of urban tissue prototypes in three defined ranges of density; second, testing the acceptability and preferences of design typologies via focus group discussions with designers, developers and potential local users. Finally, this research develops a transferable method for defining and measuring design qualities which are important for specific localities, a method which can be used to evaluate possible emerging urban typologies in high density residential schemes.

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Table of Content

Chapter 2: Urban From

Chapter 3: Urban Design Qualities

Chapter 4: Conceptual Framework

Chapter 5: Overall inquiry by design and analytical Method

Chapter 6: Generic Modelling. Design process

Chapter 7: Generic Modelling. Analysis

Chapter 8: Local Design. Place matters

Chapter 9: Local Design. People matters

Chapter 11: Refinement of Conceptual Framework

Conclusion

List of Figures

List of Tables

Introduction Chapter

0.1 Sustainable urban growth pattern

Over recent decades, the need for a shift in the growth pattern of cities has been emphasized by many authors (ex: Urban Task Force, 1999; Neal, 2003). This literature considers alternatives for new development instead of the peripheral extension of the city. It has been argued that extension from the edge outwards should not be the first choice. The Urban Task Force (1999) suggests learning from medieval European towns which had, to some extent, a high density urban area and an observable border between the urban area and the surrounding green fields. The main point about these traditional cities is that creating concentrated high density urban areas were preferred instead of designing an expanded city with low rise buildings and low populated neighbourhoods. The literature celebrates the active and vibrant urban areas of medieval towns and states that such an active public realm existed because of the concentrated form of the city.

In this way, during the 1990s and the first decade of the 21st century, there have been serious attempts made to change the urban growth pattern in the main cities of the UK such as London to concentrate more development and settlements in the inner part of the city and to reduce the process of extension at the edge of these cities. This new process was known as the British Urban Renaissance, based on the idea of changing the inner city in such a way as to absorb larger populations and attract people to stay in the city instead of migrating to the suburbs (Urban Task Force, 1999; Punter, 2010). It was considered that there were many vacant areas and brownfield sites in the city which could be used for new developments instead of developing new neighbourhoods in the green fields outside of the city (Greater London Authority, (GLA), 2003).

During the last decade of the 20th century, the idea of British Urban Renaissance has been applied to many of the large cities in Britain (Punter, 2010). This urban renaissance was not just about new development of the inner city, but was also seen as a way of improving the quality of public spaces and the quality of inner city life. However, the main point about this phenomenon which is considered in this research is that, after a decade of new development of the inner city and using existing brownfield sites for such development, it appears that there is still a lack of sufficient housing in some major cities like London to respond to the rapid population growth of the city. The point is that the vacant spaces and brownfield areas of the inner city have been filled in the recent decades; however, there remains high demand for more development which will inevitably take place at the edge of the city (GLA, 2003). Therefore, it can be concluded that focusing solely on brownfield sites and the vacant spaces of the inner city will not meet the high demand for new housing in major cities.

Much of the literature in recent years has discussed how to ‘intensify’ the existing urban areas. This idea means that the existing urban form can be changed in such a way as to be able to accommodate a larger number of people. In this way, urban growth would be more concentrated inside the city instead of in the surrounding green spaces. Urban intensification is based on changing the existing form and typologies of the buildings in the city in a way which increases overall urban density. This idea leads us to a new intensified shape of the city which has been called ‘The Compact City’ (Jenks, Burton. 1996; Jenks, Burgess, 2010, Jenks, Dempsey, 2005).

It can be assumed that there are significant morphologic differences between the old and new urban form. The key differences may be focused on the size of the buildings and plots, the height of the buildings, the width of the streets and also the size of the private and public open spaces. Changing each of these urban features will have a significant influence on the shape and overall characteristics of the city.

0.2 Intensification as a sustainable model of urban growth

The theoretical argument is that the compact city model, with its increased density and its restriction of urban dispersal, will lead to a more vibrant urban form characterised by socio-economic diversity (Jenks, 1996; Jenks and Dempsey; 2005; Urban Task force, 1999). Several scholars (for example: Hillman, 1996; Breheny, 1993) who discuss the advantages of urban intensification state that the compact city is one of the best available solutions to restrict urban sprawl and consequently preserve the existing natural environments around cities. Thus, one of the most substantial benefits of this concept relates to its environmental sustainability.

It can also be argued that densification can result in a more vibrant and active mixed use urban form, where infrastructure, like public transport, can be used to its maximum capacity (Jenks et al, 1996; Howley, 2009; Dave, 2010). In addition, higher population densities can support a range of essential amenities such as schools, shops, medical centres, jobs and transport hubs within walking distance of residences (English Partnerships, 2007). It is claimed that such proximity has the potential to reduce the use of private cars and subsequently overall energy consumption (Berheny, 1996; Ingram, 2009). In such high density mixed use urban areas, most of the local jobs and facilities are within a walkable distance from the residential buildings. Moreover, providing public transport facilities is more feasible and affordable for such high density urban areas (English Partnership, 2007). Therefore, it can be predicted that in compact cities, people are less dependent on private cars to travel to work or other amenities and, as a result, the use of cars can be reduced in the urban areas and air pollution and carbon based energy consumption will be reduced. This is one of the major advantages of compact city developments which support the environmental sustainability of the city.

Some critics (Berheny, 1993; Headicar and Echenique, 2011; Vale, 2010) assume that increasing density may result in the weakening of some qualities associated with environmental sustainability, such as access to green and open spaces for recreation, or opportunities for planting and local food production. In addition, traffic congestion, air and noise pollution and the heat islands effect have been identified as environmentally negative consequences of high density urban forms (Edward, 2010). Despite the fact that the idea of the compact city is supported by many researchers and experts, there are others who focus on the disadvantages or limitations of this idea (for example: Vale, 2010). One of the main issues that arise from the compact city is the question of whether such intense urban forms are able to deliver an acceptable quality of life for citizens compared to existing low density suburban developments. As an example, Stretton (1996) notes that such intensified urban areas may reduce the connection of residents to nature because in these 'compact cities' green spaces would be significantly limited in comparison with green spaces in low density urban areas. It has been assumed in this literature that the compact city as an urban form may reduce the connection of future generations to the natural environment and even reduce their consideration of the value of the natural environment.

Similarly, some of the literature (Charlesworth and Adams, 2010) argues that the compact city is not a desirable living arrangement for the majority of people, given the assumption that people typically prefer to live in detached houses with wide open spaces.

All these discussions show that there are still questions about the level of appropriateness of the idea of intensification. There are still many gaps in knowledge about the real benefits and drawbacks of the concept of intensification. Moreover, even if there are global benefits to the compact urban form, the concept should still be rationalized at the local level. Many of the concerns about the feasibility of the high density urban form in the planning literature relate to the challenges at the local scale, which the literature addresses.

Generally, despite the fact that there has been much discussion and much doubt about the idea of intensification, the demand for new housing is still quite high in cities like London. In order to respond to this demand, it is necessary to build new houses at high speed in such cities. Clearly, both ‘sprawl’ [in the shape of urban extensions] and ‘intensification’ [in the shape of higher density urban infill] will occur in cities such as London. However, the question is: which approach will be adapted more commonly in the near future in new housing schemes.

The GLA (2003) assumes that high density urban intensification will be the first option. The main reason for this is that, if new houses are developed with a density similar to the existing residential areas within the city, then a high proportion of green spaces around London will be used for new developments (figure 0.1). This challenge has led to the development of many high density development schemes in London in recent decades (see: London Opportunity Areas Framework: GLA, 2011). In recent years, some of the policies and strategies in favour of high density have been relaxed (Jenks, 2012), so many high density development schemes are still being constructed in this city.

Although rapid urban development has not generally been a feature of growth in the UK over the last few decades, similar concerns have been articulated about major growth areas in the south east of England (Hall and Ward, 1998; CABE, 2005). Moreover, there is clear evidence that the idea of urban densification has influenced planning policy in the UK (Punter, 2010; DCLG, 2006, 2012; Jenks and Jones, 2010); particularly in the context of new developments in East London – such as Greenwich Millennium Village, and the Olympic Village - high density is characteristic of the newly developed or proposed neighbourhoods (CLG, 2006).

Due to copyright reasons, the image has been removed in the online version of thesis.

Figure 0.1: London must accommodate a large number of new homes over the next 15 years. If we continue to build at current average densities, we will require an area of land 20 times the size of Hyde Park.

If we raise densities in suitable locations, the pressure on London's housing capacity can be reduced.

Source: Greater London Authority (GLA), 2003

0.3 Gap in knowledge: relationship between density and urban design

Despite these debates about the environmental costs and benefits of compact development, there persists a lack of understanding about the exact physical and spatial characteristics of the compact city model in terms of urban layout, street patterns, the shape and size of blocks and the height and depth of buildings (Jenks, 2010; CABE, 2005; Cheng, 2010; Gehl, 2010). Given this, it is necessary to define the physical urban forms associated with high density, particularly on a smaller scale such as at neighbourhood or district level.

On the other hand, a review of the current literature (English Partnership, 2007; Bentley et al, 1985) suggests there is a consensus in the urban design community about the key urban qualities which are desirable to make a good urban environment. These include permeability, legibility, variety, robustness and resilience. However, little research has been carried out to establish to what extent such qualities might be delivered or might be compromised in high density urban layouts containing more than 50 dwellings per hectare (Barlow et al, 2002), implied by the compact city concept. Given this apparent gap in knowledge, one question to be explored in this research is: 'what are the consequences of urban densification for urban quality?'

Some evidences suggest that the principles of higher density, have been applied in many cases in London, resulting in greater sustainability (GLA, 2011; CABE, 2005). In such circumstances, studying and understanding the changes in physical form and urban layout of these developments might help to reveal to what extent urban design quality is compromised or enhanced as a result of a particular density standard.

However, many debates related to this type of development remain at the level of critical review and commentary about development projects, or related articles in books and journals. Thus, it can be said that there is a lack of in depth research and analysis about this type of development. Specifically, it can be asked: what is the exact character or typology of a polycentric compact city, and what are the main features of this type of development particularly in terms of urban design principles? There is also some uncertainty about the quality of life in this type of development which has been discussed in previous sections, but needs to be scrutinised and analysed in more depth.

The literature review carried out as part of this thesis shows that the majority of the existing body of theories relating to the concept of intensification has been produced in the field of urban planning. Planning scholars commonly emphasize the global picture of the concept and may narrow it down to city and regional scales. Authors such as Breheny (1996), Jenks (1996) and Hall and Pain (2005) discuss the compact city from a more abstract and large scale point of view. It is likely that one of the reasons for this is that the process of intensification is still at the starting point, and the new intensified developments have not been tested or critically reviewed; a long term review and observations are needed in order to judge their success (Punter, 2010).

For this reason, there is still a gap in knowledge about the practical success of high density urban forms. In particular, this issue has not been strongly scrutinized at the smaller scale, such as neighbourhood and street scale. Research in the field of urban design is mostly focused on this specific scale of built environment.

There are some studies which explore the impacts of intensification at the neighbourhood scale (for example: Jenks, 2012; Lindsay et al, 2010). However, these studies do not exactly show the relationship between design and density, although Jenks and Jones' (2010) study considers some issues related to form and density, using quantitative indicators which show changes of form as a result of changing density. However, one of the issues which is not commonly studied in this field is defining the possible options of urban form and typologies which can be designed in such intensified developments and neighbourhoods. Although some of the existing developments with higher density have been studied, these studies cannot propose which urban form is more appropriate in higher density and how design may influence the qualities and success of these new developments.

Speculations about the relationship between design and urban form are common in the field of urban design. Therefore, looking at the concept of intensification from an urban design point of view is an important part of these studies which to some extent are not scrutinized in depth. In many key texts about urban design, the concept of density has frequently been explored, but, only in very brief and quick reviews (for example: Gehl, 2010; Barton, 2003; English Partnership, 2007; Carmona, 2010). This is because this literature typically points out the main issues which may concern designers in their projects, but does not aim to have an in depth discussion about the relationship between density and design.

One of the challenges here is that the literature which discusses the issue of intensification in urban planning uses quite a different type of vocabulary to that of the urban designers. In the planning field, the main discussions mostly address three dimensions: environmental, social and economic sustainability (For example: Jenks, 1996; 2000, 2010). Such discussions consider the issues of energy consumption, urban pollution and social equity. However, the urban design literature generally focus on different qualities such as permeability, connectivity, legibility, vitality or resilience. These are the qualities of the city which can be delivered via the design process and interventions in the physical form of the city. Obviously, the final aim of these qualities are similar to the sustainability goals of the planning theorists, however this vocabulary shows that the design and form of the city make a limited but significant contribution to the discussion of sustainability. To some extent, these qualities have not been studied in as great a depth as the qualities which are the main concerns of the planning body of knowledge. These are the design qualities of the city which are directly influenced via design and interventions in the physical form of the city.

Within the theorising and debates about intensification, design qualities have been briefly explored in some cases (for example: Jenks, 2012; Williams, 2012). However, in general, the body of knowledge in the field of urban design has not been strongly applied in such research. Hence, there is still some ambiguity as to the extent these urban design qualities may or may not be achieved in the process of urban intensification. In other words: which of these urban design qualities may be compromised or is there a threshold of density for achieving some of these qualities? These are the questions and gaps in knowledge which are not answered just by quantitative studies which are common in the planning body of research, but also require a mix of qualitative and quantitative methods and particularly an inquiry by design approach. It is necessary in this field to identify the options and limitations which exist for designers in order to develop higher density typologies of urban form. Understanding these possible design options and their ability to deliver urban design qualities cannot be done without using inquiry by design methods which are quite rarely used in density studies.

Even those studies which have focused on the relationship between density and the physical form of the city do not take urban design qualities into account (for example: Alexander and Reed, 1988; Pont and Haupt, 2010). However, it is clear that the final goal of any design project or intervention in the physical form of the city aims to achieve such urban design qualities.

Therefore, it can be stated that the unique contribution of this research is to study the interrelationship of the three notions of density, form and urban design qualities all together. In this way, the thesis can ultimately develop a theoretical and practical framework which shows the possible design options with regards to the concept of intensification and also identifying the possible advantages and disadvantages of choosing each design option or each urban typology.

Much of the key planning and urban design literature (for example: Hall, 201; Gehl, 2010, CABE, 2005) points to the importance of design in order to achieve the sustainability goals of the intensification concept. However, there is still a lack of in depth research about the interrelationship between density and design. Much of the literature discusses the fact that good design can improve the quality of life in high density urban areas. However, what is rarely explained is to what extent such good design may be achieved while density increases. This shows the necessity of exploring the interrelationship of the three notions of density, form and urban design quality.

In other words, the significant difference between this study and the existing body of knowledge is that the three notions of density, form and design quality are explored together, while, as previously discussed, many other studies only explore two of these notions, such as density and form (ex: Pont and Haup, 2010), or they focus exclusively on one or two design qualities (ex: Lindsay et al, 2010). The limitation of those approaches is that the final outcome cannot completely inform designers how changes of density can influence their design scheme. This is because, during the process of design, all the various design qualities need to be considered together and normally the designer should be in a position to make trade-offs between these qualities. Therefore, it is necessary to explore all these design qualities together. In this way, the final outcome will be more informative for urban designers in order to help them predict the possible delivery or compromise of design qualities at the starting point of high density design projects.

The challenge with high density development is also the acceptability of the design scheme to local residents. This is also a matter which is only briefly explored in urban design and built environment literature (ex: CABE, 2005a). it is often not clear if the design qualities which are of concern to urban designers are equally important to the local residents or conversely if there are other qualities and design issues which may be of concern to local residents. This is because such matters cannot be explored until an overall understanding of the impact of densification on all design qualities is established. Therefore, after exploring the relationship between density, form and design qualities, this study tries to focus on local residents' preferences and attitudes toward high density residential developments and to devise a method of taking the local community's point of view into account throughout the process of design in regards to the matter of increasing density.

Based on the above discussion, the following aim, objective and main questions of the research are established for this research.

0.4 Aims and objectives and main question of the research

The following is the aim of the research which focuses the study in order to answer the above mentioned questions.

Aims of the investigation:

1. To develop a theoretical framework and method to explain the consequence of urban densification on urban form and delivery of urban design qualities in residential neighbourhoods.

Secondary aims of the research

The following secondary aims are also established for the research.

1. To develop a theoretical framework and method to explain the interrelationship between densification, urban form and urban design qualities.

2. To develop a method that enables designers to produce urban design principles that could be applied in practice to develop locally appropriate densification schemes in scale of residential neighbourhoods.

Main research question

1. What urban design qualities are compromised or what new qualities may be delivered at different urban densities?

Secondary research questions

2. What are the specific types and characteristics of urban form associated with different levels of densification in practice?
3. How do such different urban layouts affect design quality?
4. What body of theory and urban design principles can be recommended in order to improve urban quality at different levels of urban density?

Objectives

In order to reach the aims of the study the following objectives are introduced which shows the key steps of the study.

1. To develop a conceptual framework to define the concepts of densification, urban layout and urban design qualities and to identify the interrelationship between these components.

2. To produce an analytical method for evaluating urban design quality in urban layouts associated with high density and to develop a set of indicators and measures of urban quality, layout and density.

3. To produce generic neighbourhood models with different ranges of density as a primary part of the inquiry by design process

4. To use the analytical framework to evaluate changes of urban form and urban design qualities in generic models and to propose preliminary theoretical propositions and urban design principles in order to improve urban design qualities in densification schemes.

5. To test the theoretical propositions by applying the urban design principles to a realistic densification scheme for a local neighbourhood in London.

6. To use the results of the testing to refine the theoretical proposition, urban design principles and guidance.

The following is a brief explanation to clarify each of the objectives in order to showing the overall procedure in the study.

Objective 1: Conceptual Framework

A literature review is carried out in order to develop a conceptual framework which empirically identifies the morphological characteristics of different urban densities, and theoretically demonstrates the relationship between density (Cheng, 2010; CABE, 2005), physical urban form (Kropf, 2009; Osmond, 2010) and urban design quality (Bentley et al, 1985; Punter and Carmona, 1997; English Partnership, 2007; Carmona et al, 2001; Barton, 2003; Butina Watson et al, 2004).

In order to understand these relationships, the indicators and measures of urban quality and associated specific qualities is identified. Existing design reviews (CABE, 2005) and secondary data (Jenks and Jones, 2010; Schiller, et al, 2006) will be reviewed in order to define appropriate methods of measuring these indicators of urban quality.

Objective 2: Analytical Method

Based on the previous stage, an analytical methodology will be developed in order to evaluate the differences in physical form and urban design quality at different densities. The analytical framework in order to identify the main measures of density, the physical elements of urban form and the indicators of design qualities appropriate for the analysis in this research. Moreover, the criteria for comparing the changes in these measures and indicators are explored. The analytical table of the research developed in this part is then used to help achieve objectives three and five.

Objective 3: Producing generic models

At this stage, the inquiry by design method (Ziesel, 2006) is used to develop design models with different ranges of density and evaluate them in next objective. Generic and semi-abstract models of neighbourhoods with different ranges of density are simulated at this stage.

Objective 4: Evaluating design qualities in generic models

The models are evaluated based on the analytical framework developed during the previous stage. The analysis shows to what extent the design qualities are delivered in each of the generic neighbourhood models. Using the results of the analysis, the conceptual framework and analytical method will be refined and preliminary theoretical propositions related to the impact of densification on different urban qualities will be developed.

Objective 5: Testing the design principles on a realistic site

In order to validate the appropriateness and acceptability of the findings and theories developed in previous stages, the design principles are used to develop design (densification) proposals for a residential neighbourhood within London applying and adapting the generic models developed in objective three. In this stage focus group discussion and semi-structured interviews with local users (Creswell, 2009) are carried out in order to adapt the densification scheme according to the local needs. The design proposals are again evaluated based on the analytical method developed in Objective two. Such process of design and analysis on an actual neighbourhood helps to understand the practicality of the theories and findings from previous stages of the study.

Objective 6: Refining the propositions and conceptual framework

The results of the analysis are used to refine and finalise the theoretical propositions and design principles.

0.5 Research scope

As previously explained, this thesis explores the interrelationship between the three concepts of density, form and urban design qualities. Part of the research method is therefore to identify the existing possible typologies of urban form within different ranges of density. For the in depth case study, this research has narrowed these down to urban typologies which commonly exist in western cities, particularly in the UK context. One of the reasons for this decision is that the challenges and issues related to the concept of intensification are different in developed compared to developing countries (Williams, 2007). In order to produce a more in depth analysis, the case study has therefore been focused on the UK context.

Highly intensified urban areas in some developing countries have completely different types of housing and urban typologies compared with western urban typologies. As an example, the slums in countries such as Nairobi or India may have extremely high population density but their urban typology is very different from that of western urban areas. There are many reasons for these differences such as: the economic context, the size of households, life style, quality of life expectations and the socio-cultural characteristics of the community. For example, the acceptable standards of living spaces in residential building are different in developing countries compared to European cities. These factors result in highly different housing typologies in developing countries despite the fact that these urban areas may have high population density. Hence, it is important to mention that this study focused on UK urban typologies which have significant similarities to other European and North American countries.

On the other hand, it is necessary to explore all possible urban typologies which exist in the context of western cities. This is because the goal of this thesis is to show all possible design options in high density urban forms. Therefore, in the theoretical stage of the research, (objective 1) the typologies from other countries are also covered via a literature review or through the use of maps and photos. However, for the in depth case study and inquiry by design methods, the research is narrowed down to the UK context.

0.6 Research Approach

The main concern of this study relates to changes in urban density. In other words, urban density is treated as an independent variable. The purpose of the study is to evaluate how

changes to this variable influence the two dependent variables of urban form and urban design qualities.
Having studied different research approaches and methods, the author reached the conclusion that there are two main ways to carry out the evaluation process. The first approach is to observe existing urban forms with different ranges of density and analyse the degree to which design qualities are delivered in these actual examples of urban form. This is the approach which has been partly adopted in other studies. For example, studies such as those by Steadman (2014) and Pont and Haupt (2010) focus on the influence of changes in density on urban form. Along similar lines, Jenks and Jones (2010) study the changes of particular qualities as a result of changing density.

The limitation of such an approach is that the research is focused on just one particular quality, while, throughout the design process, the delivery of each of these qualities may affect the degree to which other qualities can be delivered. In other words, focusing on one quality may not show the trade-offs which can be made throughout the design process to deliver other design qualities. Real examples may not completely show the ideal or optimum way of delivering all design qualities as there may still be the potential to improve the design of those particular examples. Although this approach is partly used in this research, it is not the main element of this study.

The second approach, which is the main method used in this research, is to carry out a process of design using different ranges of density and to evaluate the final design outcome with regards to the changes in urban form and urban design qualities. This is essentially an inquiry by design method, which is used to identify the changes of form and design as a result of changing the urban density. The main idea of this approach is to use the theories and literature review to identify standards and design principles and then to use these theories as the basis and rationale for the design process to develop models of neighbourhoods with different densities; finally, an evaluation is made of the changes in form and design qualities in the models generated.

Such an approach has specific advantages over the first one. As explained, the first approach may not show the maximum potential to deliver design qualities or the optimum possible urban form because it just focuses on existing examples. This is because, in practice, some of the qualities may be neglected during the design process. On the other hand, by using the second approach (inquiry by design) and completing the entire process of design, there are more opportunities to control the delivery of all the design qualities which are of concern in this research. Hence, the evaluation of the final models in different density ranges can more precisely reveal the actual delivery or compromise in design qualities.

Furthermore, evaluation of urban forms with different ranges of density is not the only goal of this study. In order to make a better and more useful contribution to the body of knowledge, part of the aim of this study is to devise a practical method and make recommendations for designers to help them deliver particular design qualities in their urban design projects. The ultimate aim of using an inquiry by design method is to develop a design process which is transferable into practice to facilitate better design in high density residential developments; in other words, using the inquiry by design method can produce more practical recommendations at the end of the thesis, both in terms of design principles and also in the process of design for high density residential areas.

The inquiry by design process in this research is carried out in two main parts:
The first part uses a mostly deductive approach. In this part, the existing body of theories related to standards and principles in residential neighbourhood design are used to generate ideal models of neighbourhoods at different densities. These models are then evaluated, identifying the main changes in urban form and design qualities which accrue as a result of changing density. This approach is carried out in the first part of the thesis.
The second part of the inquiry by design has more of an inductive approach. In this part, the limitations that an actual site can place on the previously generated model are identified. Moreover, the preferences and attitudes of local residents are also taken into account in the design. Then, with a new design based on data from the site and the preferences of local residents, new models are generated specifically for the chosen site. This approach is carried out in the second part of the thesis.

In other words, to test the theories of the research, there are two parts to the design and evaluation in this thesis. The first part of the modelling is mainly carried out based on the theoretical discussion about density principles in residential neighbourhoods using a deductive design approach. The second part of the modelling is carried out after having gathered the ideas and concerns of the local residents about their neighbourhood in order to refine the previously developed design. In this way, the study can show to what extent urban design theories might vary from practical implications in the reality of the local context. Moreover, this process can show to what extent there is a difference between professionals' point of view in the built environment literature and the demands and concerns of local residents with regards to densification at the neighbourhood scale.

0.7 Structure of the thesis and the stages of the research

In order to answer the main research questions, the study has been conducted in three main steps. In the first step, the theoretical basis for the research is deducted mostly by a literature review. In the next part of the thesis, the theoretical answers are tested via more practical methods comprising a process of design and analysis. In other words, the thesis first produces theoretical propositions and then validates these propositions via an inquiry by design process.

Conducting the research is clearly not just a linear process. At some stages, it is necessary to look back and revise some of the methods or propositions or just consider other new perspectives regarding the main questions of the research. Based on what has been done so far, three main tools or methods of study are used in parallel throughout the research process as a whole. First, the theoretical body of knowledge related to this study has been reviewed. Secondly, an analysis of existing urban typologies and forms in relation to their density has been completed. This has sometimes been achieved by reviewing existing case studies in research conducted by other scholars or by the author of this research generating brief case studies using maps and photos of related urban developments. Thirdly, producing generic models of different urban typologies has also been a helpful tool in understanding some aspects of urban form and particularly design issues which may not be revealed from a review of the literature. Although each of these methods becomes more important in specific parts of the research, they are all used throughout this thesis, even for developing the primary theoretical propositions of the research in the first chapters. For example, the modelling may be more significantly used in the last stages of the research and for introducing new proposals during the focus group discussions, but even in the first stages this method is used to enhance the quality of the theoretical discussion and to help find new aspects of design which may need to be covered in the theoretical part of this research.

The following is a more in depth explanation of the three main parts of the research and the chapters related to each.

0.7.1 Part One: theory

The first stage of the study, which is about developing the primary theoretical propositions, is presented in the first four chapters. At the end of this stage, the conceptual framework of the thesis is developed. This framework is then validated in the next two stages.

As discussed the conceptual framework explains the interrelationship between the three notions of density, urban form and urban design qualities. Therefore, the first three chapters are allocated to these three concepts:

Chapter 1: Urban density

Chapter 2: Urban form

Chapter 3: Urban design qualities.

For each of these chapters, the main concepts and their relationship to the other two concepts are identified mainly via a literature review. In addition, the main methods of measuring these concepts in the case studies are briefly explained which is helpful for the further stages of the research.

In Chapter Four, all three concepts and the results of the literature review are combined to develop the primary theoretical propositions of the research. Based on the literature review, the main hypothesis of the research is identified. This hypothesis explains the main patterns of change in the typology of urban forms with regards to changes of density and explains the consequences of these changes for urban design qualities.

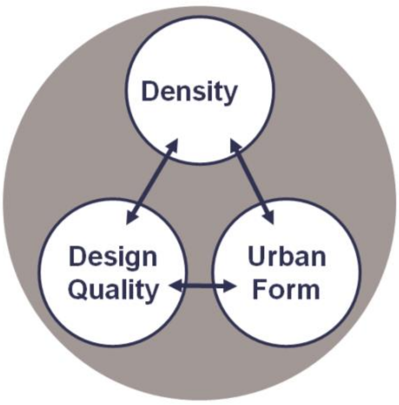

Figure 0.2:
The conceptual framework explains the interrelationship of the three main concepts of the thesis

While these propositions are primarily based on existing theory, it is necessary to validate the results via practical analysis and evaluation of the hypothesis. Therefore, the testing stage of the study begins in the section covered by Chapters Five to Ten.

Testing stages of the research

Parts two and three of the research are about testing the theoretical viewpoints developed in the first part. The testing has been carried out via a process of inquiry by design in two stages. This means that, for the first test, an inquiry by design process takes place in Part Two of the research; then, based on the findings of this, a second inquiry by design process is carried out in part three.

The author chose to use the inquiry by design method (Zeisel, 2006) instead of carrying out case study analysis of existing high density residential developments to test the theories of the research. The benefit of this approach is that the complete process of design can be followed through the research and different obstacles and challenges with regards to increasing density in neighbourhood design can be identified in a more precise manner. In other words, the inquiry by design method helps to identify the maximum potential for delivering urban design qualities by checking the whole design process according to established theories and criteria identified in the theoretical stage of the research. Furthermore, in this way, a method can be produced which may be useful for designers not just to evaluate one case of high density development, but also to check the design process which should be carried out to produce high density design schemes in general.

The test sections progress from a more general type of inquiry by design method at first, to a more precise and site oriented type of design and analysis at the end. Part Two of the research (the first test) includes a generic, abstract design and modelling process to find the ideal and optimum way to deliver design qualities in a high density residential development. This part covers Objectives Three and Four of the thesis. In part three (the second test) the findings and models from the previous test are applied to a real site to see to what extent the findings are practical and applicable to a real residential neighbourhood.

0.7.2 Part Two: initial testing

Part two of the research (test one) is explained in three chapters, between Chapters Five to Seven.

In Chapter Five, the overall analytical method for the testing is introduced. The main part of this chapter is about devising an analytical framework which can be used to evaluate the models and design schemes produced through the inquiry by design process of the research. This analytical framework shows the structure of how the changes in all three concepts of density, form and design quality are analysed in the thesis. This is achieved by establishing appropriate measurements, criteria and indicators to evaluate changes in density, urban form and urban design qualities through the research. This analytical framework provides a cohesive method of analysis which is used in both testing parts of the research. Therefore, although the inquiry by design happens in two stages, the same analytical method introduced in this chapter is used to evaluate the design outcomes so that the results can be comparable across the two stages of testing.

Chapter Six is the first part of the inquiry by design process. At this stage, generic models are designed to see the changes of form which result from increasing density. Generic models help to simplify the process of design and ignore the limitations and restrictions that an actual site may dictate in the design process. In this chapter, generic models of residential neighbourhoods with different ranges of density are produced. In this way, to what extent various design qualities can be delivered in a high density neighbourhood regardless of local conditions and in an ideal and abstract scenario can be evaluated. This process can help show the maximum potential for delivery of design qualities before focusing on a real site.

In Chapter Seven, the generic models are analysed based on the analytical framework produced in Chapter Five. While the models have different densities, the analysis shows the main changes in urban form patterns through the models. Moreover, the analysis shows to what extent the design qualities may be improved or compromised as a result of these changes of form and density. Based on this, the preliminary findings of the research are developed and these are then used in the second part of the testing.

Figure 0.3:
Generic modelling of a neighbourhood with a variety of densities in the second part of the study

0.7.3 Part Three: the main testing

Part Three of the research (test two) is explained in three chapters between Chapters Eight to Ten. In this part, the inquiry by design process takes place at a real site in London. In this way, a more practical and accurate test is completed to refine the findings from the previous section and to understand the opportunities and limitations which localities may force on the process of densification.

There are two main forces at work at the real site which influence the design schemes. The first is the existing physical form and condition of the neighbourhood. The character and existing morphological patterns within the site can influence design decisions and therefore can have an impact on the final densification scheme. The issue of the existing physical form of the local site is called 'place matters' in this research. Secondly, the preferences and attitudes of the local residents towards increases in density can also influence design decisions so that the final outcome will be more locally acceptable. The concerns of local residents are referred to as 'people matters' in this study. Taking place and people matters into account in this part of the thesis, the findings from the 'ideal' generic models may need to be altered at this stage to be applied to the real site and to find a more locally acceptable densification scheme.

Following this rationale, this part of the thesis covers place and people matters before starting the design for the actual local site. Chapter Eight of this thesis covers place matters and Chapter Nine covers people matters.

Chapter Eight is related to place matters. It explores the issues related to the existing physical form and morphological characteristics of the site chosen for the study. The analytical framework of the research from Chapter Five is used again to study the existing urban form and the degree to which design qualities are already delivered in the neighbourhood before increasing the density and developing new design schemes. Primary data are gathered from the site by observation, photos and maps of the area to analyse the morphological patterns which exist at the site. Secondary data are used from local plans and local council studies related to future developments and new housing in the area. Based on this, the main threats and opportunities are explored, showing the potential for changes in urban form and consequently in design qualities within the neighbourhood.

The following is a set of data collection methods that are employed in the case study work:

- Maps, photos, proposed master plans and local development documents will be collected in order to analyse the physical urban form at different morphological levels from the large scale such as neighbourhoods, to the small scale of plots and individual buildings (Conzen et al, 1982).
- The size and arrangement of the blocks will be examined in order to measure the permeability of the urban form (Jacobs, 1961; Bentley, 1985).
- The energy efficiency of the urban form will be investigated by analysing the orientation of the blocks and street patterns and the number of daylight hours (Barton et al, 2010).
- Specific elements such as nodes and landmarks will be mapped to understand qualities such as legibility (Lynch, 1980).
- The design quality of open spaces will be evaluated including consideration of the different typologies and sizes as well as the distribution of open spaces (Carmona, 2010).
- The function of buildings will be considered, determining the level of variety and mix of uses in each urban form and the consequent degree of self-sufficiency of the neighbourhood (Barton et al, 2010; Bentley et al, 1985).

Chapter Nine explores people matters at the site identifying the main attitudes and concerns of the local residents regarding the issue of design and increasing the housing in the area. A research method called the Q Methodology is used in this part of the research in order to identify the main priorities of local users related to density and design matters. The investigation in this section comprises focus group discussions, semi structured interviews and email responses which have been carried out according to the Q methodology. The Q method is explained in detail throughout this chapter and the findings from this method are presented as new recommendations and design principles. These principles can then be used for the design stage to produce a locally acceptable design scheme to increase density at the site.

Chapter Ten is the final stage of the local design. At this stage, all the results addressing the people and place matters and also the findings from the generic modelling are used to make design schemes appropriate for densification at the selected site. The design schemes have been developed with different densities so that the changes of form and design qualities can be evaluated and compared across the schemes. The analysis process is the same as for the generic models and is based on the analytical framework of the thesis. At the end of the analysis, the research shows to what extent design qualities may be improved or compromised by changing the residential density of the neighbourhood.

Figure 0.4:
Intensification scheme for a real neighbourhood in the third part of the study

Finally, in Chapter Eleven, the findings of the research are presented based on the testing process as a whole. While, in the theoretical framework, the influence of increasing density on form and design qualities is explained and the relationship between these three concepts is explored, here, the findings are more practical and applicable for high density design schemes. The findings fall into two main categories: first, the facts about changes of form and design qualities throughout this process of research are explained. Secondly, recommendations are presented as design principles for designers to use to maximise delivery of design qualities in densification projects.

At the end, Chapter Eleven reviews the theoretical framework of the study in order to refine the propositions which have been established in the conceptual framework so that the overall theory and method of the study can become applicable and transferable to evaluating the densification process in other localities.

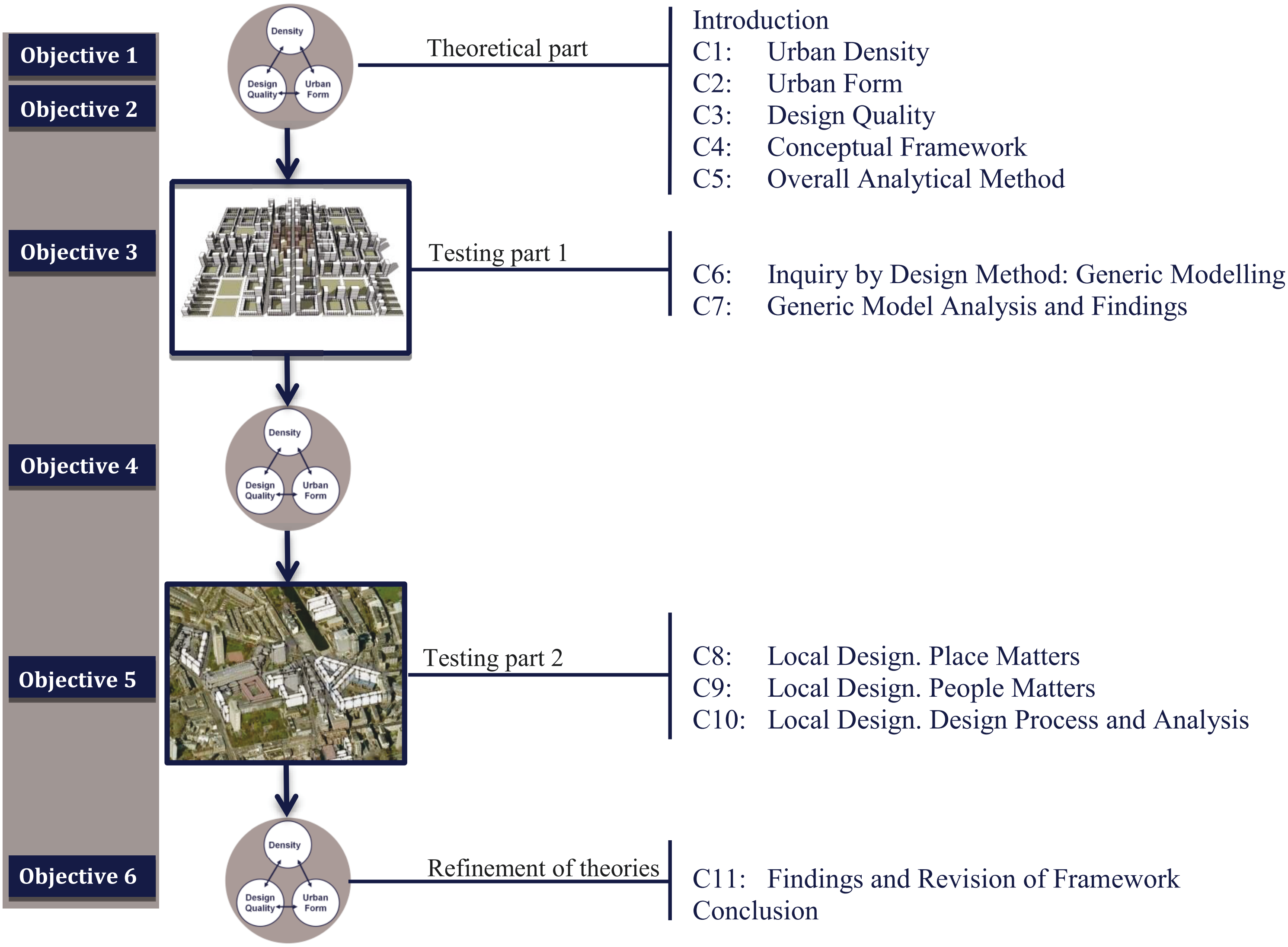

Figure 0.5: Thesis structure

0.8 Research Outcomes and Value

This study aims to contribute to the existing body of knowledge in planning and urban design by suggesting a new transferable methodology which is capable of evaluating models of urban densification in relation to their consequences for urban quality, particularly from the urban design point of view. A second contribution to the body of knowledge will take the form of a set of proposed design principles, theories and practical methods intended to improve design quality in high density new developments.

This thesis will result in the development of a theoretical framework which precisely explains the relationship of density, form and urban design qualities. Therefore, it will contribute to the existing body of knowledge about the concept of intensification with a greater focus on design and from the point of view of urban designers instead of planning and architecture. Therefore, the new theoretical propositions are intended to be useful in general for all fields of built environment which are concerned with design issues related to urban intensification, and also, more specifically, will be useful for urban designers or any experts in the field of developing residential neighbourhood masterplans primarily to understand the possible consequences of choosing different ranges of density in their design schemes.

This research also develops a methodology and analytical framework to analyse the impact of increasing density on the design process and subsequently on design quality. The thesis covers some of the most common urban typologies with regards to their density. The methodology of this research can also be used for other urban typologies which may emerge. It is clear that the analytical framework may need to be slightly modified for different cases, but the methodology of this thesis may provide significant transferable learning for similar types of analysis. In particular, some of the imaginary futuristic typologies for high density high rise developments, which are not common yet, but are being proposed by designers**,** can be fundamentally evaluated by the analytical methods which proposed in this thesis. In this way, as a result of the research, a new methodology is produced which can be applied to the evaluation of design schemes and possible new urban typologies emerging to respond to the demand for high density urban development.

Finally, the theoretical and practical propositions at the end of the research are developed as a toolkit to inform designers about their possible design options and types of urban form in different ranges of density, to improve their understanding of the pro and cons - or opportunities and limitations - of choosing each typology and the necessary design considerations for that specific typology.

Chapter one

Urban Density

1.1 Introduction

The concept of density is the main focus of this research and is therefore the first step in developing a conceptual framework which will provide a clear understanding of this idea. This chapter will discuss “why density?”, in other words, why understanding the impact of increasing density is an important issue in the built environment literature. The possible implications of changing density in a city will also be discussed. Supporting these arguments, a historical review of the general changes and preferences in the planning policies of the UK with regards to the issue of density, will be introduced.

After the theoretical and historical review, the study focuses on developing the more practical dimensions of density. In this case, it will investigate if it is possible to measure density and how different types of measurement can result in different understandings of the concept. The aforementioned review will help clarify the influence of density on the urban form of the city.

1.2 The importance of density and the issue of densification

As mentioned in the introduction chapter, in recent decades, the issue of density has become more significant in both the planning and built environment literature. The concept has been referred to using different names in the UK, such as the compact city, intensification and urban renaissance (Urban Task Force, 1999; Punter, 2010), which run parallel to the New Urbanism and Smart Growth planning approaches in the US (Renne et al, 2009; Dittmar and Ohland, 2003; Tregoning, 2006).

One of the general arguments, which appears repeatedly in all of these contemporary discussions, is the need for redevelopment and regeneration of urban areas with a higher density than is currently the case. As Jenks et al (1996) indicate, a common assumption is that one of the main motivations for suggesting an increase in density is in response to urban sprawl and zoning systems, making the practice commonly accepted in the planning policies of western countries in the post-war period. The literature, mostly from the 1990s to the present, suggests that higher density development can contribute to the overall sustainability of urban areas in western cities (ex: Williams, 2000; Greater London Authority (GLA), 2003).

The issue of the impact of intensification on the sustainability of the city is discussed in the following sections (1.3 and 1.4). The focus of the discussion in these sections are the three main dimensions of sustainable development which are environmental, social and economic sustainability. Firstly, in terms of environmental sustainability, the focus of the study is on reducing energy consumption and the carbon footprint of cities and also saving the existing green environment (Jenks et al, 1996; United Nations Environment Programme (UNEP), 2009). Secondly, in terms of social sustainability, the key issue relates to delivering a sense of community, belonging and safety to the urban areas (Masnavi, 2000; Williams, 2000). Thirdly, in terms of economic sustainability, the key concern is to promote social equity in terms of accessing services, jobs and opportunities in the city (Burton, 2000).

1.3 Defining urban density

In this part of the chapter, measurements which are useful in the analysis and case study are defined, and the role, importance and limitations of each measurement will be discussed. As also admitted by Ng (2010) and Dovey and Pafka (2014), there are various and complicated types and methods of density measurement. However, the aim here has been to focus on measurements that are relevant in the context of UK planning and also ones which can provide appropriate information regard to the study of urban form in residential neighbourhoods.

'Urban density' is a term which is used to indicate the number of people inhabiting a specific urban area. In this study, this term is also used to show the number of people accommodated in a specific area or, in other words, the number of dwellings in an area. It is helpful to define this term precisely from the start to prevent confusion.

In addition, the term 'urban intensity' is commonly used in the planning literature. There is a slight difference in meaning between these two terms. Commonly, the term ‘intensity’ is used for the level of concentration of activities and uses by people in an area; however, the term ‘density’ is more often used for the number of residents or dwellings. To some extent, there is confusion and a mix of these two terms in the literature that makes it necessary to define the difference between them here.

Density is the main concern of this study. The later part of the chapter explains how increasing density may contribute to the sustainability of city. The main sustainability advantages of higher density are to reduce the need for green field developments and, secondly, to reduce car dependency by accommodating a higher number of residents close to public transport. Therefore, studying density can show to what extent these sustainability goals have been achieved. On the other hand, the term ‘urban intensity’ can indicate activities and vibrancy in an urban area. Logically, intensity is more likely to be the result of changing the density of the built form because if the number of dwellings in an area increases, there will be more people living there. However, the relationship between these two terms is not completely linear. The intensity also depends on variables such as the size of households, residents’ lifestyles and the amount of time they spend in the area and also the services and facilities of the area which temporarily absorb additional population from outside neighbourhoods (CABE, 2005b). Therefore, it is worth bearing in mind that a change in building density, which is the main concern of this research, is just one aspect of changing usage intensity.

1.4 Historic review of densification in British cities

Reviewing historical changes in urban density can assist scholars in developing a better understanding of the major motivations and reactions to the concept of increasing density. A review of recent urbanization history in Britain shows that there have been two significant periods in which there was a substantial increase in density levels in urban development.

The first major intensification period occurred during the Industrial Revolution. Increased urbanization and labour force poverty were the main factors which led to a growth in new, higher density developments (Carmona, 2010). This was reflected in a more compact size of house and living space, mostly located in inner city areas, in close proximity to centrally located jobs in factories.

The second intensification period took place during the post-war era (between the 1950s and 1970s). During this time there was an urgent need for new housing developments that incorporated modern technology and architectural methods to be achieved in new types of urban form such as high-rise residential tower blocks.

From the 1950's, planning policies tended to favour low-density developments (Carmona, 2010). Moreover, residents' preferences mirrored these policies, as they also supported lower density urban forms. Various authors, including Lawson (2012), assume that in consumers' perception high-density urban forms are associated with crime and poverty. To some extent, such perceptions may be the direct result of the past two experiences of urban intensification.

However, the idea of intensification has emerged during recent decades from a completely different standpoint. In current circumstances, as discussed in the introduction chapter, the most important argument in favour of increasing density is to save and improve the environmental sustainability of the city. Today, where there is rapid development and a high demand for housing, policies have slightly shifted in favour of higher density developments or, in other words, policies have tended to limit very low-density development.

As a consequence of the two previous periods of significantly higher density development in the UK, there are some general concerns among public about whether an increase in urban density may again result in a lower quality of life. There have been several studies about the perceptions and acceptability of higher density living and there have been some major points of concern; CABE (2005) summarizes some of the main issues which concern users about possible conflicts within higher density areas. Some of the main problems highlighted are issues around lack of parking spaces, compromises in privacy, overcrowding, overuse of local facilities and also negative changes to the local character of urban areas.

On the other hand, even in the academic literature, there is a polarised debate about whether an increase in density may provide a solution to achieving a sustainable form of city (Williams, 2005; Vale, 2012). Therefore, in order to develop a general understanding about the advantages and disadvantages of intensification, based on a review of the literature, the next part of the chapter focuses on this academic debate regarding 'density' or the concept of 'compactness'. This review shows the main concerns about urban intensification among academic scholars. The result of this debate can primarily help to point out the main qualities which may be influenced by intensification, and therefore this debate supports the main in depth discussions about urban design qualities in the following chapters.

1.5 The impact of densification on the city, different points of view from academics

Over the last two decades, there has been an ongoing academic debate about the concept of ‘intensification’ or ‘compactness’ within the literature (for example: Jenks, 1996; Williams, 2000). The studies of Jenks et al (1996, 2012) and Williams et al (2000) have been among the main attempts to understand different aspects of urban intensification. However, there are still some gaps in this field as some of the literature recognises (for example: Jenks, 2012).

The literature which is in favour of intensification explains some of the critical benefits of the compact city form in making a more sustainable city. Hillman (1996) states that it is necessary to think on a global scale in order to accept the importance and necessity of the compact city idea. Although there are local benefits to this idea, the main benefits of compactness are evident on the wider national or global scale.

It has been claimed that the main benefits of the intensified compact city form lie in its environmental sustainability (Breheny, 1996). As population growth and urbanisation are still occurring at high speed, it is obvious that existing cities are growing quickly. This is not just an issue in developing countries; even cities such as London are dealing with the challenge of high density developments to provide new housing (GLA, 2003). Organizations such as the Campaign to Protect Rural England (CPRE) (2006) state that, if the growth of such cities continues with a density similar to existing urban areas, then much of the green land around city would need to be demolished for new housing. Therefore, one of the main benefits of the compact or dense city form would be to prevent the loss of a large proportion of the existing green space around the cities in Britain.

Another key issue related to the environmental benefits of intensification is the reduction of the gas emission footprint of cities. It is assumed that higher density development around town centres and transport nodes results in residents having closer proximity to services which therefore reduces their use of and dependency on private cars (Hillman, 1996). In this way, walking, cycling and the use of public transport will be promoted and fossil fuel consumption will be reduced (see figure 1.1). Typically, such a reduction of fuel consumption will reduce air pollution at the global scale. Studies, such as that by Masnavi (1998), show that these claims are quite correct and that residents in higher density areas are less dependent on private cars.

It has been stated that high density urban forms can also have benefits in terms of social sustainability. A high density urban form will normally accommodate a higher population, which may result in more active and vibrant public spaces. Jacobs (1956) pointed out the activity and vibrancy of medium to highly dense neighbourhoods in the US compared to low density suburban areas. Such vibrancy can result in more local social interaction and can lead to a greater sense of community for residents.

In addition, the study of Burton (2005) shows that, to some extent, intensification contributes to social equity. The main claim here is that in higher density areas residents of different social and economic classes have the same level of access to services within a city. This assumption becomes clearer when one compares high density areas to low density suburban districts because car ownership can have a great influence on access to services and facilities in low density urban areas.

Due to copyright reasons, the image has been removed in the online version of thesis.

Figure 1.1:
Urban density and transport related energy consumption.
Cities with higher urban density have less transport-related energy consumption
UNEP, 2009

Moreover, from the perspective of economic sustainability, it is claimed that intensification makes other positive contributions to the city. In a medium to high density urban area, services such as transport, health and education can be used to their maximum capacity. In addition, new services and jobs may become more viable. This is one of the main reasons for considering the appropriate density in design schemes. English Partnerships (2007) and Barton (2003) point out the importance of considering density in residential development schemes in order to be assured about the viability and efficiency of other services.

Notwithstanding these arguments, the other side of this debate is the literature which questions the benefits and appropriateness of intensification. Focusing on some other aspects of intensification, it is claimed that, in terms of the three main dimensions of urban sustainability (table 1.1), some challenges may result from promoting compactness.

Firstly, with regards to the issue of environmental sustainability, some commentators believe that the benefits of high density have been exaggerated. For example, Breheny (1996) doubts that the reduction in energy use which may stem from increasing density can be so significant so as to warrant changing the form of the city for this purpose. One major challenge is that high density urban forms may result in more congestion in central areas and therefore, conversely, this may increase fuel consumption. Moreover, even if, on a global scale, energy consumption and pollution is reduced by compact city forms, on the local scale, this approach may result in more polluted urban areas (Jenks, 1996).

In addition, while compactness saves green spaces around the city, intensification can greatly reduce the green spaces within the city. This can reduce the opportunity for local food production and also opportunities for connections between and use of green areas (Vale, 2010).

In terms of social sustainability, the historical experiences of high density development within Europe suggest more caution in accepting this type of urban form. Lawson (2010) points out that some of the historical high rise developments which were mostly developed after the Second World War have not been successful in terms of creating safe and cohesive communities. The work of William et al (2000) also shows that the sense of community and social interaction between local residents are both higher in lower density neighbourhoods. These studies admit that creating a safe and cohesive community in higher density areas is more challenging than in low density areas.

The economic advantages of high density urban forms are also challenged by some critics (Echenique, 2011). It has been claimed that focusing on intensification around transport nodes cannot, on its own, improve local economic conditions. Although in high density areas new jobs and services may become more viable, Echenique (2011) believes that a commercially-based urban sprawl can provide more economic benefits than intensification around transport hubs. The main reason for this argument is that the demand for housing around some existing business centres will be high; therefore, it is not appropriate to ignore this existing demand and focus instead on new developments around transport hubs which may not provide good opportunities for local jobs.

Roaf (2010) also points out that there are many existing high rise buildings in UK cities which have remained unoccupied because of their inappropriate location or local socio-economic conditions. She questions the idea of high density urban designs since some of the existing high density areas do not attract new residents because of their economic or social situations.

	Advantages	Disadvantages
Environmental sustainability	Reducing private car use	Increase in traffic in town centres
	Promoting use of public transport, walking and cycling	Heat island effect in highly dense urban areas
	Reducing the need for development on existing green fields	
	Reducing heat loss and energy consumption in buildings	
	Reducing carbon dioxide emission	
	Reducing energy consumption	
Social sustainability	Active and vibrant public spaces	Overcrowded neighbourhoods
	Developing a sense of community	Crime rate and safety issues in high density neighbourhoods
		Negative perception of high density urban areas
Economical sustainability	Improving social equity via reducing cost of transport and need for private cars	Threat of lacking appropriate facilities and services for the large population
	Potential for mixed use development	Increase of density without consideration for jobs and the housing market
	Viability of investment on public transport	
	Viability of new local jobs	

Table 1.1: Key potential advantages and disadvantages of intensification;
Adapted based on: Dennis and Urry (2009); Jenks et al (1996); Carmona (2010)

All these discussions show that questions remain about the appropriate level of intensification. There are still many gaps in understanding the real benefits and drawbacks of this approach. Moreover, these discussions show that, even if there are global benefits to the compact urban form, the concept should be analysed at the local scale. Many of the concerns about the feasibility of the high density urban form in the planning literature highlight the challenges at the local scale.

Generally, despite the fact that there has been many discussion and doubt about intensification, the demand for new housing remains high in cities like London. In order to respond to this demand, it is necessary to rapidly develop new housing in such cities. Clearly, both sprawl (in terms of the shape of urban extension) and intensification (in the shape of higher density urban infill) will happen in cities like London, but the question is this: which option will be used more widely in the near future in new housing schemes?

The Greater London Authority (GLA) (2003) assumes that high density urban intensification should be the first option in London. The main reason for this view is that, if new houses are developed with a density similar to the existing residential areas within the city, then a high proportion of the green spaces around London will need to be used for new developments (GLA, 2003). This challenge has resulted in the development of many high density schemes in London over the last two decades (GLA, 2015). Given that some of the policies and strategies in favour of high density schemes have become more relaxed in the last few years (Jenks, 2012), and local authorities have more control on the density target in their local plans, many high density schemes are still being developed in This City.

As discussed, the main benefit of high density urban forms is generally agreed to be in their contribution to global environmental sustainability by reducing car dependency and preventing excessive development on green land (Breheny, 1996). However, an important issue for this discussion are the local pros and cons of high density urban forms. The theoretical discussion which is set out in this chapter has attempted to provide the basis of a better understanding of the main reasons why high density forms are promoted. Knowing about the academic debate can help when considering the main issues of concern within the planning literature while studying the relationship of design and policy matters.

Another key issue is that, while looking at the planning literature which theoretically discusses the issue of density, the main qualities that are explored in this literature are usually different from the ones which are introduced in the urban design literature. This will be discussed in more depth in Chapter Three - Density and Urban Design Qualities - but it is important to recognise that the qualities which may be influenced by design can contribute in a limited way to sustainability as explained in this chapter. This is because urban design qualities often consist of qualities which relate to the form and design of the physical shape of the city; however, the theoretical discussion around sustainability and density in the field of urban planning covers a wider range of subjects. As discussed in the introduction chapter, it should be stressed that this study will mainly explore the design issues narrowed down to the range of building to neighbourhood scale. Therefore, some of the issues discussed in the planning theories in relation to density will have limited influence on this study. As this chapter is related specifically to the issue of density, it is necessary to have a more in depth exploration of this concept.

The next part of the chapter focuses on the meaning of urban density and the ways in which it is measured. The literature discusses high and low density city or urban forms; however, one significant problem in discussions about density is that there is no precise agreed definition for high and low density. Some of the literature has tried to give more precise definitions for low, medium and high density and to define the exact ranges for each (for example: Schoon, 2001). However, such definitions can vary from country to country and between different scholars. Therefore, the next step for this research is to provide a useful and precise definition of density and its measurement which are appropriate for the method and scale of investigation in this thesis.

1.6 Measuring density

This section sets out the different types of density measurement used in the literature. Understanding these measurements is helpful for understanding how to use them in each part of the analysis and is helpful for understanding the differences and limitations of each type of measurement.

Jenks (1996) and Edward NG (2010) contend that there is no consensus about the measurement of density. Different countries with different units of measurements such as hectares, acres or square metres; even within the UK there are different types of measurement. Due to the fact that this study is dealing with cases in the UK, the measurement styles which are more common in UK planning policy and literature will be more appropriate for this research. However, as mentioned earlier, UK researchers have used a variety of methods of measurement (for example: Hall, 2012; Jenks and Jones, 2012).

Based on the work of Ng (2010), overall, there are two main categories of density measurement: physical density and people density. People density has to do with the number of people who live in or use an area and physical density counts the number of dwellings or the amount of built environment space in an area. This research is focused on the issue of residential urban form; therefore, generally, physical density measurements are more likely to be useful for analysis. However physical and people density measurements have quite a direct relationship, especially for predominantly residential areas.

The census surveys show the average size of households on a national scale. For England, this number is 2.4 people per dwelling. It would also be possible to find the average size of household on a more local scale. This number can help to convert the measurements of physical density into people density. When the number of dwellings in a specific area has been counted, using the average household size from the census, the number of people who live in the area can be estimated with relative accuracy. Therefore, it can be claimed that, although the main focus of this research will be on physical density, it should be easy to use this measurement to also calculate the people density.

In the following section, different measurements of physical density will be explained in more detail. There are three main measurements for physical density:

- Net density
- Gross density
- Plot ratio

Each of these measurements show specific aspects of urban density and are also more likely to be used in particular scales of analysis.

1.6.1 Net Residential Density

Net density is the simplest measurement of urban density. It is easy to understand and therefore more likely to be used in the literature and discussions about density. This measure is common in the planning and urban design literature of the UK, especially within communities which are focused on the issue of density (ex: CABE, 2005; DETR, 1998)

In the context of the UK, the term ‘net residential density’ refers to land covered by residential developments in addition to gardens and other parts of the plot, and also includes a half width of the adjacent road (NG, 2010; TCPA, 2003). Typical measurements for net density are dwelling per hectare (dph) or habitable room per hectare (hrh).

There are slight differences in the use of these two measures. DETR (1998) state that dph is the most appropriate measure to use to understand land requirements for a development. When the net density is decided for a development, it shows exactly how much land should be allocated for a defined number of dwellings. On the other hand, habitable room per hectare (hrh) is a more accurate measurement because it shows how many more people can be accommodated in an area when the physical density increases. Although hrh is more accurate, dph is easier to apply and to understand as it is a simpler measurement.

Net density is commonly used for measurements at the neighbourhood scale and smaller. One of the main reasons for this is that the net density does not count supporting facilities such as schools, hospitals, large green spaces and other amenities which may serve more than one neighbourhood. However, this measurement can give an overall idea and interpretation of the shape and form of a neighbourhood based on the number of dwellings per hectare, although, as will be discussed that, net density cannot independently show the specific character of the urban form. One of the main reasons for this is that, in measurements of net density, the size of houses and also other local uses are not counted. The organization of dwellings within plots or blocks does not influence the net density. Such neglected variables in net density measurements can greatly change the characteristics of an urban area.

When discussing net density, increasing density simply means that the number of dwellings in a specific area has increased. This may have happened as a result of a proposed design scheme to develop a new residential area or because of interventions in an existing urban area. In either case, higher net density simply means more houses in that specific area.

1.6.2 Gross residential density

This measure is similar to net density, but it also brings other uses and areas into account such as schools, parks, public buildings like community centres and main roads. These are generally pieces of land which serve the local community. In some of the recent literature, developments which serve surrounding communities and also derelict or non-developed land may be included in this measurement, which makes it somewhat imprecise (Ng, 2010).

Based on the nature of the gross density measure, it is commonly used at the scale of neighbourhoods and larger (for example, the city as a whole) because it includes land and spaces which serve a large area such as a combination of neighbourhoods. For example, a park may be counted in gross density measurement which will completely change the result from that of the net density measure. Barton (2003) mentions that significant changes in net density may not seem extreme when counted in gross density measurements, simply because large areas of land such as large parks and other amenities do not influenced the net figure by increasing the number of dwellings.

This is a very important point when discussing urban density issues because increases in net density and increases in gross density depend on different factors. As previously explained, increasing net density means that more dwellings will be built in a specific area. On the other hand, increasing the number of dwellings has less influence on gross density. Focusing on design issues, which are the main focus of this thesis, show that the most important factor which influences gross density is the size of the amenities. For example, if the size of the land used for amenities such as schools, hospitals or large public parks becomes reduced in a design scheme and these areas are used for residential development, then the gross density may change significantly, while the net density would remain the same because it does not count these amenity spaces.

Overall, it can be stated that increasing the number of dwellings can increase not just the net density but also the gross density although to a lesser extent. Conversely, reducing the amount of land allocated for city-scale amenities can significantly increase the gross density, while it may not always affect the local net density.

Given that gross density may include derelict land, it may not fairly show the changes in urban morphology. For example, in an overall view of a city, when the vacant areas of the inner city are developed through the intensification process, the gross density of the city will change significantly. However, the net density at a local scale may not experience significant modifications if the morphological characteristics of the new development are similar to the existing local typologies. On the contrary, changes in net density may have a considerable influence on the local urban morphology.

1.6.3 Plot ratio

As Ng (2010: 5) explains, "Plot ratio is the ratio of the total gross floor area of development to its site area" (Figure 1.1). This measurement can support the net density measure to increase understanding of the possible characteristics of developing on a defined piece of land (DETR, 1998: 58).

Measuring density with dwellings per hectare (dph) or habitable rooms per hectare (hrh) may not show the exact amount of development because the size of the dwellings and rooms may vary in different cases. Therefore, plot ratio can be a better measurement. Generally, as the DETR (1998) acknowledges, net density is a simpler, more understandable and more useable measure for comparing development densities, but for more in-depth analysis of case studies, the plot ratio can also be extremely helpful.

The significant advantage of plot ratio measurements compared to net density is that the former measurement takes the size of the houses into account, while net density is solely influenced by the number of dwellings. This is a very useful advantage for this research because plot ratio relates to the size of the dwellings and obviously the size of dwellings can influence the overall form of an urban area.

The DETR (1998) suggested that using plot ratio in addition to other factors such as footprint or the height of buildings can establish the most accurate relationship between the density and possible characteristics of the urban form. The research of Delft University by Pont and Haupt (2010) demonstrated that a combination of plot ratio and site coverage can be used to define the possible formal typology of an urban area. In other words, by knowing the plot ratio, plus the height or footprint of the buildings, the characteristics of an urban area can be predicted. In this way, plot ratio is one of the most important measures for this study because it creates a more accurate understanding of the relationship between form and density.

However, the challenge of using plot ratio is that it does not exactly point to the number of dwellings or people which can be accommodated in a specific area, because it is simply a number which demonstrates the ratio of floor area to site area. However, net or gross density is exactly related to the number of dwellings or people which makes them more understandable and useful for discussion. This is one of the main reasons why all of these measurements are used for this research as each of them can be used to explain different aspects of intensification.

From the dimension of plot ratio measurement, an increase in density means an increase in floor space in an area. The increase in floor space may be the result of either increasing the number of houses or extending the size of the houses without changing the number. Therefore, sometimes changes in plot ratio as a measure of density do not mean that more people can be accommodated in an area. However, generally, a higher plot ratio is the result of developing or designing a higher number of dwellings. This is because the size of houses in an area normally falls within a certain range. Therefore, even when using the plot ratio measure, the influence of an increase in the number of dwellings is normally greater than that resulting from changing the size of the dwellings.

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Figure 1.2: Change in plot ratio from 1,0 to 2,0.
Adapted from: Ng (2010)

1.7 Density Measures and Intensification

Overall, increasing density means having more people living in a defined area. However, as discussed earlier, changing density may have different meanings when different measures are used. However, overall, all the different measures can be used as tools to understand how the number of dwellings or people in an area may be changed by design.

From the perspective of ‘net density’, intensification means an increase in the number of dwellings. Changes in gross density also depend on the increase in the number of dwellings; however, a reduction in the size of other city scale amenities can significantly influence the gross density measurement. Changes of plot ratio also depend on an increase in the number of dwellings; however, the size of dwellings has a noticeable impact on this density measure.

These are different ways of explaining changes in density and each of these explanations demonstrates different dimensions of the relationship between urban form and density. None of these measures used alone are sufficient to define the interrelationship of increasing density and changing urban form. Therefore, it is necessary to consider pros and cons of using each of these measures for the analysis in the next stages of this research.

Measure of density	Criteria	Meaning of increase in density based on this measure	Key pros and cons of the measure
Net density	Dwelling per hectare (dph)	Increase in number of dwellings	Easy to understand More common in the UK planning literature
Net density	Habitable room per hectare (hrh)	Increase in number of living spaces such as bedrooms or living rooms and even shops and non-residential spaces.	More useful in highly non-residential areas with less number of dwellings.
Plot ratio	Ratio	Increase in number of dwellings. Increase in size of dwellings. Increase in non-residential spaces.	The size of dwellings considered in this measure. Since it is just a numeric measure it is less understandable and imaginable for non-experts.
Gross density	Dwelling per hectare	Similar to net density	Better for large size areas such as city or regional scale.

Table 1.2: Key Measures of Urban Density. Source: Author

1.8 Relationship of density measures and urban form

In this section, an overview of the relationship between density and urban form will be provided. This is just a starting point to show that there is a need for a more in-depth method to analyse urban form, and this will be defined in the next chapter.

The literature in recent years has made numerous attempts to define the relationship between density and urban form (Moreno and Steadman, 2014; Pont and Haupt, 2010; Cheng, 2010; DETR, 1998; Alexander and Reed, 1988). In much of this literature, the types of measurements which have previously been explained in this chapter have been used. Sometimes there have been different names for these measurements, but mostly the same concept has been used. Pont and Haupt (2010) use plot ratio as the most convenient measure of density in order to explain the relationship between density and urban form. Their research, using a combination of plot ratio and site coverage, shows the different categories or characteristics of urban form with regards to their density quite accurately. Alexander and Reed's (1988) research also explored different options in terms of the design of urban areas considering different densities.

These studies reveal that there is an interrelationship between density and possible typologies of urban form. In other words, in different ranges of density, there are specific types of urban form which are more commonly designed or developed. Therefore, it is necessary for this research to define a method to explain the differences between these typologies as they relate to specific ranges of density. The way to measure and define density has been explored in this chapter and therefore, in the next stage, it is necessary to explore methods of studying and analysing urban form characteristics.

1.9 Conclusion

In this chapter, the term ‘urban density’ has been examined based on existing theories in the literature. The overall relationship between the concept of intensification and the idea of urban sustainability has been explored. Moreover, historical perceptions and preferences within the UK related to the idea of intensification have been explained. The concept of urban density was studied in more depth by explaining different ways of measuring density as well as what ‘increasing density’ means when using each of the different measurements which have been explained. Moreover, the chapter has offered an exploration of the different types of measurement of urban density based on the focus of the study on residential neighbourhoods.

The chapter reviewed the first dimension of the three which are discussed in the theoretical part of the thesis. Having a precise understanding of the notion of urban density, particularly in neighbourhood scale design, helps to develop a more precise definition and discussion for this concept in the next chapters of the thesis. Also, identifying the appropriate measures of density at this stage helps to develop a tool for comparing density in different neighbourhoods. While, in some cases, discussions about the compact city and densification have a vague form, such measures help to produce an accurate understanding about levels of densification and compactness in residential areas.

Based on the study so far, it has been mentioned that further investigations are necessary in this research to define an accurate method of analysing urban form. Therefore, the urban form issue is the main concern in the next chapter in order to generate a more in-depth understanding of how increasing density may affect the characteristics of the city.

Chapter Two

Urban Form

2.1 Introduction

This chapter explores the issues around the characteristics of urban form and understanding how it changes as a result of changes in urban density. It covers the variety of design options in different ranges of density and also reviews existing morphological approaches to develop a better understanding of urban form. By reviewing the literature on urban morphology and analytical methods, the main elements of urban form and different scales of morphological studies for this research are identified.

Finally, the chapter explores the general patterns of change in each of the physical elements of urban form while considering the changes in urban density. It develops an analytical understanding of the interrelationship between density and urban form which will be used in later chapters to produce a cohesive theoretical proposition related to the interrelationship of the three dimensions of density, form and urban design quality.

2.2 Density and urban form

Before starting to explore the relationship between density and form, it is worth considering the importance of design in discussions of urban form. It is clear that different ranges of density may dictate specific urban form typologies to designers; however, even in a specific range of density, there are still different design options. Alexander (1993: 184) posits that different physical layouts can have similar densities. The Urban Task Force (UTF, 1999) and English Partnerships (2007) also state that, in the same range of density, different typologies of urban form can be designed (Figure 2.1).

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Figure 2.1: Same density but different urban form typologies; Source: Urban Task Force, 1999

Very different physical layouts can have similar density measurements. Previous studies show that density measurements and other physical factors are independent of each other (Alexander 1993: 184). People often confuse density with building type and assume, for example, that detached houses are lower density than attached housing types. While this is generally true, it is not always the case. A high-rise tower block with large units set on a park-like site may be lower density than a set of detached houses on small lots (Forsyth, 2003: 4). Highly desirable Georgian and early Victorian terraces are often higher density than high rise tower blocks developed in the post war era (Denby, 1956; in: Carmona, 2010)

2.3 Understanding urban form

In this thesis, in order to understand the relationship between density and urban form, two approaches have been adopted. Firstly, the relevant literature has been reviewed which explores this issue of the relationship between density and urban form (Pont and Haupt, 2010, DETR, 1998, Alexander and Reed, 1988). This literature explores theoretically and via case studies the fact that density changes, in terms of increasing net or gross density or plot ratio, may influence the form of the city.

Secondly, the findings from the literature review have been validated by observing real life examples. Maps and photos have been used to explore different existing typologies of urban form and relevant reports and documents (ex: MLA, 2012) have been analysed to identify the density of these cases using different measurements. In addition, site observation has been carried out for some of the examples which are cited in the literature, specifically in relation to the cases of high density with various urban typologies in London (GLA, 2003).

The final results of these three stages of the research are presented in Chapter Four which proposes the main theoretical position of this thesis. However, the research has shown that, in order to explain and identify differences in urban typology, it is necessary to define methods and tools to reveal these changes of form. The aim of this chapter is to examine these methods for analysing changes of urban form.

These explorations of different methods have led to an overview of the possible urban forms and typologies and their relationship to density. However, these changes in the characteristics of urban form need to be defined and explained in a way which can be clearly predicted for other similar cases. In other words, a method has to be defined for this research to explain the main patterns of change in urban form with regards to changes of density. For this reason, the study has focused on the urban morphology literature which explores the characteristics and changes of urban form and methods for analysing these changes.

2.4 Urban morphology analysis

The three main European schools of thought in urban morphology have slightly different methods and focus points with regards to the notion of urban form (Levy, 1999; Moudon, 1997). These schools of urban morphology developed in France, Italy and Britain (Whitehand, 2001). The Italian School is based on the studies of Muratori in the 1940s. The focus of these studies is about the organic change of urban form as a result of political and economic influences (Gautiez, 2004; Pont and Haupt, 2010). The French school which is from the Versailles School of Architecture focuses on the architectural levels. The French school followed the Italian school studying the architectural typologies and town plans. The main focus of this school of morphology was the pattern of plots and their changes and relationship to the past (Gautiez, 2004). The British School of urban morphology was founded by Conzen focusing on the analysis of urban plans in different morphological scales. In the Conzen approach, maps are studied to identify the buildings, plots and urban blocks as the key morphological elements that shape the urban areas (Whitehand, 2001).

While this research is concerned with the relationship between density and urban form, some of the analytical methods of these schools of thought are more appropriate than others for this study. Reviewing some of the most recent literature about the relationship between form and density (Pont and Haupt, 2010) shows that much of this research refers to studies within the British school of urban morphology, which is based on work by Conzen (1960). As Moudon (1994) explains, Conzen developed theories and methodologies to analyse the physical urban form at different scales. His approach is slightly different from other morphological schools which are more focused on architecture (Italian school) or socio-cultural dimensions of the city form (French School) (Pont and Haupt, 2010).

2.5 Physical elements of urban form

An important tool which has emerged from the Conzenian studies of urban morphology is the use of physical elements in urban form to explain the main changes in the city as a whole. The main physical elements are buildings, plots and streets. Conzen also considers 'land use' as one of the elements in his analysis; however, in this thesis, this last element could not be used as a morphological element because changes of land use are not discussed as a physical element, but as one of the factors which influence design qualities in the next chapter. Also, Levy (1997) explains that all types of morphological analysis discuss these elements to some extent and the interrelationship between them. Levy also adds 'open spaces' as the fourth main element of urban morphology because this element may not be properly considered while using the three basic elements. This additional element will be useful for this study because the size and proportion of open spaces change significantly as a result of increasing density. Therefore, for this study, these four physical elements of urban form ought to be considered as the foundation for the analysis. By choosing these physical elements it will be easier to explain the main changes in urban form which have been identified via the literature review, modelling and brief case study analysis.

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Block/Street

Plot

Building

Figure 2.2: Physical elements of urban form; Source: Conzen, 1960

The other concept which can be introduced parallel to the physical elements of urban form is the notion of urban grain. The notion of urban grain is used in this study to refer to general changes in the morphological elements. Precisely, the change in grain size means that generally all of these physical elements are changing in size; for example, an increase in grain size means an increase in the footprint of the buildings and plot sizes. Such changes may also occur in the street pattern by increasing the width of the streets and in the size of the urban blocks. While the urban grain relates to the matter of urban form, this concept is introduced at this stage of the study for further discussion in the following chapters.

2.6 Scale of study for morphological analysis

The other issue which needs to be considered for this research is the scale of the analysis. For this research, the scale of the analysis may vary from the small scale of individual buildings to the larger scale of a neighbourhood. Clearly, there are different ranges of analysis for urban morphology from smaller parts which are more likely to relate to the field of architecture and larger scale analysis which may relate to the field of city or regional planning. However, as this study has focused on urban design issues, a limited range of urban scales have been examined in more depth. Urban design studies, as will be discussed in the next chapter, focus on the interrelationship between public and private space, or, in another dimension, the relationship of buildings and open spaces.

Even within this particular scale of the urban area, different scales for analysis can be defined; for example: building, block, a complex of blocks and the whole neighbourhood. These different scales become more important when the study of form relates to the issue of density. As an example, the differences between net and gross density become more significant when the scale of the analysis exceeds the level of building and block and reaches the neighbourhood scale. Other uses and different sizes of open space can be considered in neighbourhood scale density measurement; however, at the smaller scale, such elements of the city are not considered for analysis.

Field of study	Morphological scale
City and regional planning	Region
	City
	Urban District
Urban design	Neighbourhood
	Street pattern and urban blocks
	Plot
	Building
Architecture	Components and details

Table 2.1: Focus of the study on urban design scale;
Although there are some overlaps between these fields, the table shows the general focus of each field of study.
Adapted based on: Evans, 1998; Watson, 2004; Barton, 2010;

2.7 The impact of density changes on morphological elements

Now that urban morphology and the physical elements of the urban form have been introduced, it is appropriate to review the relationship between density and form, although this is a brief explanation which is intended to support the final chapter of the conceptual framework which discusses the main patterns of change in the urban form as a result of intensification. In this way, this overview is intended to bridge the previous discussion to the final one which will be the conclusion of the theoretical chapters (Chapter Four).

Specifying the elements of urban form can help to develop a more in depth approach to explain the changes in urban form which occur as a result of densification. Some of the literature which has been reviewed in the current and previous chapters has explored the impact of changing density on urban form. Defining the morphological elements is necessary to understand these changes.

One of the main issues that is mentioned in the literature (for example: Panerai *et al*, 2004) is the typology of blocks. Martin and March (1972) introduce three main types of urban structure; these are pavilion (pointed shape), street (linear shape) and court (perimeter block shape). One of the main patterns which they describe is that, when density increases, the possibility of designing and developing pavilion or linear blocks is reduced and consequently the perimeter block shape is more common in higher densities. This is similar to the findings of Pont and Haupt (2010) showing that higher density urban blocks in the Netherlands are more likely to have the shape of perimeter blocks.

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Figure 2.3: Martin and March’s studies show that in buildings with a higher number of floors – and consequently in higher density areas – the potential of developing perimeter blocks is higher than that of developing linear or pointed blocks. Source: Martin and March, 1972

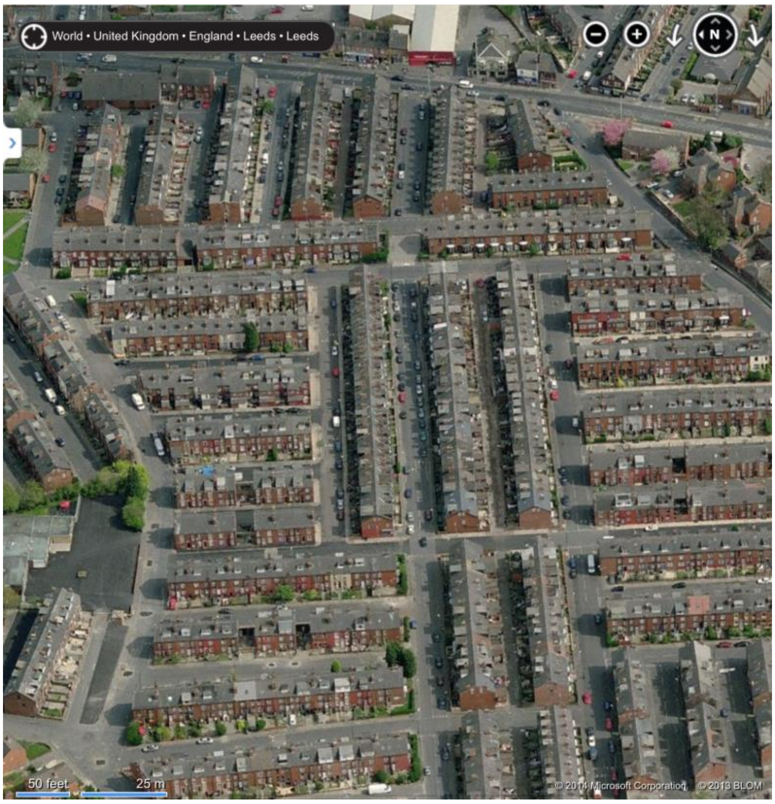


Figure 2.4:
Leeds, terrace houses without any private open spaces used as front or back garden and using a minimum plot size. This urban form shows the maximum capability of increasing density with terraced houses.
Source: Bing Map

In terms of buildings, there also appears to be patterns of change as a result of designing at higher density. Alexander and Reed (1988) provide evidence that some types of dwellings can only be designed in a limited range of density. For example, detached and semi-detached houses are generally developed in densities lower than 30dph. In addition, the typology of row housing, which is similar to terraced houses in the UK, is commonly built in a density range of 32dph to 148dph. Clearly, flats are the most common typology of building. In high density designs, the way to increase density using flat typology is to increase the height of the buildings and number of floors. However, with other building types, such as detached or terraced housing, there is a limit to the number of storeys that can be built.

With regards to plots, if the size of plot is reduced, then more houses can be designed together (figure 2.5). However, when the typology of the building completely changes, for example from terraced housing to flats, then plot size can become much larger even though the density can greatly increase in a high rise tower block of flats. So when density increases, changes in plot size do not follow a linear pattern. The pattern may completely transform when the typology of the building changes.

The street typology can change slightly while density increases. The width of a street may be reduced and front gardens may not be allocated for buildings. However, these patterns of change are linked together; for example, a very high density area may have a wide street pattern and the changes resulting from intensification may appear in other physical elements, such as the height of buildings.

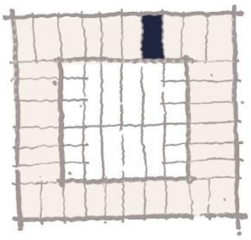
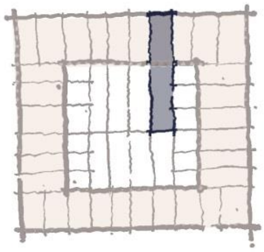
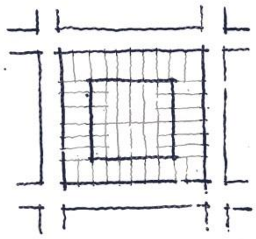
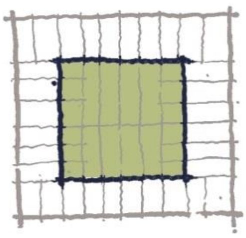
Figure 2.5: In the Same amount of land, density is increased by:
- Reducing the size of plots (middle)
- Shifting the building type to high rise flats (right)

Source: Author

These are some of the common possible changes in patterns of physical elements as a result of densification suggested by the recent literature. However, what may be more important than these separate analyses of physical elements is the patterns of change when a combination of these physical elements is studied. As discussed, it is possible that some elements may change by increasing density, while some others may not change, or the changes in some elements may vary in different ranges of density. Depending on the scale of the analysis - from building or block to a whole neighbourhood - the patterns of change in the physical elements may be different.

Based on this, it can be assumed that there is a need to understand the larger pattern of change in urban form. In this case, there is a need to define the main patterns of urban form, or some common typologies of urban form and then to realise how increasing the density may influence the physical elements of form within each of these typologies. In other words: what are the common typologies of urban form and what are the main patterns of change in the physical elements for each typology? This question will be answered in the final chapter of the theoretical framework (Chapter Four). The following table (2.1) briefly explains the changes which have been identified in each of the physical elements as a result of increasing density.

Table 2.1: Possible changes of urban form elements as a result of increasing density. Source: Author

Urban Form Elements	Changes as a result of increasing density
Building 	• Detached typologies can only be designed in a limited range of low densities. • Width of terraced houses is reduced • Depth and height of blocks of flats or towers increase.
Plot 	• In detached and terraced housing, the width of the plot reduces in higher density designs. • In specific ranges of net density, the likelihood of designing terraced houses becomes very low. Instead, flats with a larger size of plot are more likely to be designed. • In very high density schemes, it is common for plots to completely disappear and for block based designs to become the dominant urban typology.
Street network 	• Due to an increase in the height of the buildings and a probable reduction in the width of the streets, the enclosure of the streets will increase.
Open spaces 	• It is more likely that the size of open spaces will be reduced in higher density schemes; however, this depends on the typology and design decisions. • Nevertheless, increasing density results in pressure on and intensity in the use of open spaces.

2.8 Conclusion

In this chapter, the second key dimension of the study has been reviewed; the relationship between density and urban form has been investigated with a particular focus on urban form. The previous chapter covered the concept of density and ways of measuring it in neighbourhoods. Similar to the previous chapter, the concept of urban form and its meaning and physical aspect is narrowed down to the neighbourhood scale for more focused study. At this stage, the study aimed to develop a standard way of comparing the urban form of neighbourhoods. This comparison has been carried out by identifying key elements of urban form and explaining the changes in these elements as a result of changing the residential density of neighbourhoods.

The common methods and approaches to urban form analysis have been introduced. These approaches are commonly used in urban morphology literature. Based on this literature review, the main elements of urban form have been defined for this research. Moreover, different scales of analysis of urban form have been described and the appropriate scale of analysis has been defined for this research. Following this, the main patterns of change in urban form as a result of densification have been explored. Finally, the link between this chapter to Chapters Three and Four has been explained. Therefore, the findings of this chapter will be used to support the discussions in the next two chapters in order to generate the primary theoretical propositions of the thesis.

Chapter Three

Urban Design Qualities

3.1 Introduction

The previous two chapters discussed the two dimensions of density and urban form. In this chapter, the third main dimension, urban design qualities, is discussed. This chapter is an additional part of the first objective of the thesis which is to define the three main concepts and to explain the interrelationship between them with a focus on the third concept.

The aim of this chapter is to identify the urban design qualities which are of concern for this study. It refers to the qualities which are generally agreed in the urban design literature (ex: Bentley, 1985; English Partnership, 2007; Carmona, 2010) which influence the quality of life in the city through design. These are the qualities that can be improved or compromised as a result of change in the physical form of the city. The study focuses on the qualities which may be affected by changing the residential density of a neighbourhood. These impacts may either involve compromises in the delivery of particular design qualities or, in some other cases, may enhance them.

In this chapter, urban design as part of the built environment field of study will be defined and the role of this field within other professions in the built environment is identified. Moreover, the way in which the field of urban design contributes to the overall sustainability of the city will be explored. Based on this, the main qualities which urban designers influence, with regards to improving the sustainability of urban areas, will be identified. Each of these qualities is explored in more detail and their main relationship to the issues of density and urban form is discussed. Overall, the chapter is intended to lead to a more precise understanding of the urban design qualities which are the focus of this research, so that these qualities can be discussed and analysed in the next chapters of the thesis.

3.2 Urban design as a part of the built environment subject

Bennett (1984, p12: from Cooper, 2000, p 73) provides the following definition of urban design:

> *"Urban design is the generally accepted name for the process of giving physical design direction to urban growth, conservation and change. It is understood to include landscape as well as buildings, both preservation and new construction and rural areas as well as cities."*

From this definition it can be understood that urban design can be defined as an attempt to intervene and produce the physical shape of the city. Based on existing definitions of urban design within the literature, Cooper (2000, p 73) concludes that urban design "aims for functional efficiency, aesthetic value that it is comprehensive and applies to rural as well as urban environment."

On the other hand, a review of the literature on urban design (English Partnership, 2007; Barton, 2010; Bentley et al, 1985) reveals that the majority of the studies and recommendations in this field concerns specific morphological scales of the built environment. These ranges of scale are commonly focused on public spaces and the relationship between buildings and space, from the range of a complex of buildings to the whole neighbourhood. Obviously the issues covered in such literature may occasionally extend from these morphological ranges and goes further, to architectural and detail scale, or to the larger scale such as an entire city. However, the main discussion in this research remains to this specific range of morphological levels which already introduced in Chapter 2 (see CH2: Table 2.1, p53).

Urban design therefore covers bodies of theories and design concepts which overlap with other built environment fields such as planning, architecture and landscape design. Urban design literature in general is concerned with specific concepts of the built environment which may not be focused on in depth by other professionals; these are mostly about the relationship between the public and private realm or the interaction of buildings and spaces within an urban area.

Some of the main qualities and concerns of urban designers are not generally discussed in detail by other experts in the field of built environment. As an example, specifically in relation to the notions of density and compactness, differences between the planning and architecture literature and urban design discussion are observable. For instance, when Jenks et al (2000, 2010) or Berheny (2000) discuss the compact city form, their language and concerns are different from those of the urban design literature such as Gehl (2010), Barton (2010) and English Partnership (2007). The main concern of planning academics is sustainability on a relatively large geographical scale such as national, regional or whole city scale. However, the urban design literature generally discusses the effect of density on the street level experience of users. On the other hand, architectural studies about the compact city (ex: Pedersen, 2011) focus on individual building form, and do not cover the possible impacts of architectural form on the surrounding public space. Hence, it appears that there are certain qualities which are commonly discussed in the urban design literature, which are not significantly covered by other areas of expertise by built environment academics.

On the other hand, commonly, texts dealing with urban design have quite a brief discussion about the notions of density and compactness. For example, Barton (2010) and English Partnerships (2007) point out the importance of reaching a certain neighbourhood density in order to sustain the viability of services such as public transport or medical centres. However, whilst some suggestions about design, form and density are made, there is still a lack of a comprehensive evaluation of the impact of density on form and design. A positive contribution is made by Gehl (2010) who briefly discusses the benefits of higher density neighbourhoods and also covers some design considerations and suggestions related to high density urban forms. However, despite prescriptive suggestions in such urban design studies, there remains a lack of in depth analytical and evaluative research about the concept of intensification within the urban design body of theory and the relationship between density and urban quality.

This situation shows that, so far, the concept of the compact city is more likely to be the concern of planning studies rather than urban design. One of the reasons for this is that, even theoretically, the success of the concept of the compact city and intensification is being questioned (Berheny, 2000). While this is the case, urban design studies, which cover design issues at a more practical level and on a smaller scale, have not scrutinised these concepts in any great depth, compared with planning theory.

Generally, it can be assumed that the main body of urban design literature uses a more prescriptive language and tries to suggest design principles which improve urban life quality. Academic literature in this field is less evaluative and more prescriptive. This is clear in some of the main literature of urban design such as Barton (2010), English Partnerships (2007), DETR (2000) and Bentley (1985). The evaluative methods in the field of urban design is commonly produced based on accepting design principles and qualities which are discussed in such a prescriptive body of theories; For example, the general position in the studies of Evans (1998) Butina Watson et al (2004), Medcalf (2005) and CABE (2006) is an acceptance of the general design qualities which have been produced in the above mentioned literature. In other words, there is a general consensus about acceptable design qualities within the urban design literature; in many cases, the evaluative methods in urban design studies start by finding ways to measure such design qualities.

Therefore, in order to go further in this research and to make an analytical method to understand the relationship between density and urban design, it is necessary to first define the key design principles and qualities and to hypothesis the overall impact of intensification on each of these qualities.

3.3 Urban Design Qualities

As Carmona (2010) explains, many academics have attempted to define good urban design by developing a series of design principles. These principles have been produced to deliver specific qualities in urban spaces. Despite the variety of the language used to describe them, which exists between suggested qualities, many studies (ex: Sangsihanat, 2012; Carmona, 2010) have identified that there is a consensus about some specific urban design qualities. These generally accepted qualities are introduced in table 3.1.

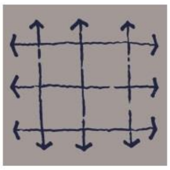
Comparing planning literature to urban design studies on the subject of density, it appears that there are primarily two different types of qualities which are discussed and evaluated by the two groups. The main concerns of planning analysis of compact urban form relates to the three main categories of the environmental, social and economic sustainability of the city (see: Jenks, 2010; Williams et al, 2000). Moreover, as explored in Chapter One (Section 1.4), the sub qualities and indicators for these analytical studies cover quite a wide range of subjects. On the other hand, since the field of urban design is concentrating on design and the physical form of the city, the focus of the urban design studies narrows down to the specific aspects of urban sustainability. Reviewing urban design literature, these studies are more likely to be focused on the qualities mentioned in table 3.1. Hence the focus of this study in the field of urban design is also narrowed down to these specific qualities related to design and the physical form of the city.

Table 3.1: Urban design qualities and principles within urban design literature
Based on Cooper, 2000; Carmona, 2010; Sangsihanat, 2012

Jacobs (1961)	Lynch (1976)	Bentley et al (1985)	Tibbald (1988)	Bentley (1990)	Commission of the European Community (1990)	Rogers (1997)	European Union Working Group of Urban Design for Sustainability (2004)	Clarke (2009)
Permeability, Short Blocks	Accessibility	Permeability	Permeability	Permeability		A city of easy contact	Connected streets	Permeable block structure
Mixed use, age and rent concentration, activity richness		Variety	Encourage mixed use	Variety	Mixed Community	A diverse city	Vibrant mixed use streets	Mixed use high street, Housing Mix, social street
			Respect history		Regional identity		Distinctive identity, sense of pride, respect for heritage	
	Clarity of perception	Legibility	Legibility	Legibility		A beautiful city		
Concentration of people			Vitality	Vitality	Compact Development	A Compact Polycentric city	Compactness, density to support public transport	Polycentric Urban Structure, Density Gradient, Reduce Parking
					Open space	An ecological city	Integrated landscape, biodiversity, green structure	
Robust space	Adaptability	Robustness	Robustness and Adaptability	Resilience			Adaptable Built Form	Long Term Maintenance
				Energy Efficiency	Reducing travel/ Energy reduction		Land Reuse, Resource conservation, public transport efficiency	Orientation for Solar Energy, Public Transport
			Pollution reduction		Pollution reduction via planting			
				Cleanliness				

3.4 Urban design qualities and their overall relationship to the issue of densification

In the following section, each of the urban design qualities which are of concern in this study is explained. In addition, the main ways of delivering these qualities in design schemes, as deduced from the literature, are discussed. The general influences of increasing density on these qualities are individually explored, again as suggested in the theory. This exploration of urban design qualities is based on reviewing the key literature related to field of urban design and the question of urban density.



3.4.1 Permeability

Permeability is often argued to be a key quality in urban design. It is, as Bentley et al (1985, p12) explain, the degree to which "an environment allows people a choice of access through it, from place to place". It is the quality that enables individual users to have more choices in how they travel from one point to another.

Increasing the degree of permeability can be achieved via a more connected street layout. As is recommended in the literature (Bentley et al, 1985; English Partnership, 2007; Barton, 2010), keeping urban blocks to an optimum size and having connected streets, avoiding cul-de sacs and dead ends in the street patterns, is the key to delivering acceptable levels of permeability in urban design schemes. The main purpose of this quality is to improve the choice of movement in urban areas. A permeable urban layout results in better traffic flow because of the variety of choices for movement. Hence, facilities and other places are also more reachable in this way. A more connected street pattern can even provide clearer choices and finding one's way around becomes much easier.

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Figure 3.1: Large urban blocks reduce connectivity of street patterns and hence the overall permeability of neighbourhood.
Source: Bentley et al, 1985

Permeability and increases of density

According to the literature, in some cases, increases in density may be associated with a reduction in permeability and the connectivity of streets. A common characteristic in higher density development is the tendency to have larger sized blocks. This is because the increase in the height and size of the buildings in higher density areas results in overshadowing and therefore, through the design process, larger spaces may be allocated for high rise buildings. In fact, observing the high density urban forms in London shows that, in many cases, high density urban forms are located next to rivers or railways. In this way, designers have more opportunity to increase the size of the blocks and reduce the connectivity because these are at the 'dead end' of the street network and so an increase in the size of the blocks may not seriously harm the overall connectivity of the streets in the neighbourhood. However, the literature points out the risk of high density urban forms in making less permeable urban forms. This may even result in gated communities which may in turn result in urban polarization and large grain urban forms which would not give the same degree of choice of movement to residents (for the concept of Urban Grain see: CH2: 2.5). Therefore, one of the main considerations for assessing high density urban forms is to evaluate the permeability and connectivity of the street pattern.

3.4.2 Accessibility

Lynch (1981) defines this quality as the ability to reach facilities, resources and places within an urban area. In some of the literature (Bentley, 1985; Urban Task Force, 1997), permeability and accessibility are discussed in the same category. Generally, a more permeable urban area also has better accessibility. The focus of the quality of accessibility is more about faster and easier access to services and resources within a neighbourhood. Keeping short and walkable distances to services within a neighbourhood can reduce car dependency and hence increase environmental sustainability. Moreover, lower dependency on driving to reach the necessary local services results in more social equity in the built environment (Burton, 2005).

The quality of accessibility can be influenced through design by considering the walkable distance between dwellings and the major services within a neighbourhood. As suggested by literature such as English Partnerships (2007), the majority of houses in a neighbourhood should be designed to be within walking distance from public transport which will give residents access to all other resources. Barton (2010)) recommends a maximum of 800m from all dwellings to public transport and services, which is the distance that can normally be walked in ten minutes (figure 3.2). Also, due to the need to consider walkability, it is recommended to keep a walkable sized neighbourhood, with all necessary facilities within easy reach on foot and providing all necessary services within each neighbourhood so that access to them can be easier for the residents (Barton, 2010).

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Figure 3.2: Accessibility to services in neighbourhood, district and city scale
Source: Barton, 2010

Accessibility and increase of density

Accessibility, in other words and for this study, is about people living close to local resources and amenities. One of the potential advantages of densification is to bring people closer to facilities and to reduce the need for car use. Providing a higher number of dwellings and residents within a neighbourhood, with existing facilities located locally, means that more people can live within a walking distance to facilities which mean less car dependency. Based on this, the issue of location of densification becomes very important. If a higher density area is located according to its proximity to public transport and other services, then a greater number of people will be within a walkable distance to these facilities, therefore, the overall accessibility of the neighbourhood will be increased. However, if the higher density area is located at a considerable distance from the neighbourhood centre and public transport, then, conversely, the increase in density may reduce the overall degree of accessibility within the neighbourhood.

3.4.3 Diversity

Diversity is the quality of delivering a variety of choices and experiences in the built environment. As Bentley et al (1985) state, variety can be achieved in form, use and meanings. In this study, diversity is studied in relation to the two subjects of function and visual experiences. As Bentley et al (1985) state, a variety of usage can open up other levels of diversity. This is because diversity of uses brings variety in shape, form and visual experience as well as more activities and more people into public space for different reasons and purposes. Therefore, one of the main goals with regard to this quality is to avoid separation of residential and non-residential areas uses in a built environment to encourage a mix of uses within a neighbourhood (figure 3.3).

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Figure 3.3: Diversity of use. Bentley et al (1985) suggest to avoid separating the city to residential and non-residential zones (above) and to have mixed use neighbourhoods (down). Source: Bentley et al, 1985

Other than providing a range of choices and experiences, diversity has other benefits for an urban area. Allocating more non-residential spaces in the design of a neighbourhood, results in more local job opportunities. In this way services such as shops, educational and recreational facilities are also placed closer to residents. Diversity can therefore reduce the use of cars and keep the proximity of residential and non-residential uses within a neighbourhood and within walking distance. A greater variety of uses can also bring more activities into the streets and at different times during the day and night, which increases the overall vitality and safety of the neighbourhood.

In order to achieve the quality of diversity in a design scheme, it is necessary to provide non-residential uses within a neighbourhood, and make a mixed use design. In other words, it is better to avoid zoning and reserving different areas of the city for specific uses; instead, each residential neighbourhood should include all other uses necessary for local residents. In addition, allocating non-residential uses to the ground floor can bring more activity and visual diversity to a neighbourhood, particularly those uses which have interaction with public spaces such as shops.

Visual diversity is also related to the design of buildings on the ground floor and their relationship to the street. Other than having a variety of activities on the ground floor, one important issue is the size of the grain of urban form. Having small plots and buildings results in vertical divisions in the façade of the buildings and provides more opportunity for diverse visual experiences in the streetscape. Another feature which improves visual diversity is the hierarchy between public to private space. This hierarchy can take place in spaces such as front gardens, stairs or gaps between the street and the entrance of the buildings. These spaces bring opportunities for personalisation and planting of semi-public spaces and can improve the visual experience. Many social interactions between neighbours take place in such intermediate spaces, between the public and private which also improves the vitality and liveliness of an urban area (Gehl, 2010).

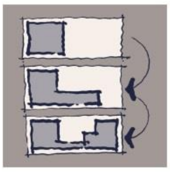
Diversity and increases in density

An increase in density is commonly associated with more activity and more diversity in the built environment (Jenks, 1996). Having a higher number of residents means more new jobs and services are viable in an urban area. An increase in density can create more potential for diversity because of the presents of more local demands as a result of an increase in population. However, in the same way, adding new non-residential spaces to a design scheme with an already high density target may rapidly and significantly change the morphology of the scheme. It appears that such an increase in mixed use spaces in high density built form may result in a tendency for the separation and zoning of uses within the city. This is the case in large cities such as London, where even mixed highly dense area contain some districts which are completely non-residential. However, in predominantly residential neighbourhoods, creating a balance of residential and non-residential space in higher density areas is a challenge which is further explored through this research via inquiry by design method in part two and three of the thesis.

While diversity is about bringing a variety of choices to residents, the issue of diversity in the type and size of houses is also an important dimension of this quality. This means that the neighbourhood and built environment can give a variety of options to residents for their living spaces. This is another important aspect of the issue of density. As CABE (2005a) states, one of the issues which should be considered in higher density developments is the need to retain a variety of dwelling sizes and types. It is possible that in order to increase the density and number of houses, the size of the houses would be reduced in a design scheme. It is a very important matter to keep the variety in dwelling sizes so that the neighbourhood can offer appropriate housing choices to different types of households, from single people to large families. Neglecting this aspect of diversity means that some groups of residents may not be able to find appropriate houses, and the neighbourhood may lose the range of different ages and family sizes. As residents may change from singles to families over time, not having a range of house sizes in the neighbourhood can force residents to leave the community. Based on this, one of the key qualities which should be delivered in high density schemes is a range of house types and sizes for residents.

Figure 3.4: Visual diversity via small plots and building;
Up: Broad Street, Oxford. (Small plots)
Down: Central Street, Islington, London. (Large plots)
Source: Up: Author,
Down: Google Map Street view

Another significant issue here is that increases in density are associated with larger grain urban fabrics. This means that buildings and plots are designed in a combined way, even as a whole block. This is not just happening in post war high rise tower blocks, but also some recent high density developments have such large grain morphology. Such large grain urban form can reduce the visual diversity of the neighbourhood and harm the human scale of the buildings, facades and even components of its public spaces (figure 3.4).



3.4.4 Adaptability

Adaptability is the quality that reflects degree to which the urban form is capable of accommodating different choices of activities and uses over time. It is also about the flexibility of the built environment for possible changes in function or form in the long term. Since the lifestyle of residents and the function of buildings commonly changes over time, it is necessary to consider the capacity of the urban form to adapt to the new needs of the users.

At the morphological level of buildings, the size of the dwellings has a direct impact on their ability to adapt the living spaces for different functions. Habitable rooms should be sufficiently large to accommodate a variety of uses and lifestyles. Appropriate sizes are generally recommended in urban policies and guidelines (for example: GLA, 2010) and are discussed in further detail throughout the following chapters. Also, it is not recommended for the depth of the buildings to exceed a certain size. English Partnerships (2007) recommends a minimum of a 12- metre depth for residential buildings so that habitable rooms can be designed with a variety of forms and sizes adaptable for different functions. In addition, it is recommended not to exceed 16 metres in depth; otherwise the central part of the building will not receive natural light or ventilation (English Partnerships, 2007; Bentley, et al, 1985). Access to and the distance of spaces to the street and public realm is another matter related to adaptability. It has been argued (Bentley et al, 1985) that a greater distance of the interior spaces of the buildings from the street can reduce the accessibility and make them less adaptable for a variety of uses (figure 3.5); This happens by increasing the size and height of the buildings which therefore means that access to most of the interior

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Figure 3.5: Urban form can be more adaptable (robust) by designing:
- “Shallow in plan
- Many point of access
- Limited height “

Source: Bentley (1985; p57)

spaces should be provided by stairs, elevators and corridors. Therefore, overall, increasing the size and height of buildings results in a reduction of adaptability.

Another aspect of adaptability is the potential of the urban form for gradual change over time. Alexander (1987) suggests that the built environment should be developed in a piecemeal or step by step way. Rowe and Koetter (1987, in: Carmona, 2010) also state that the development of a city is more like a collage of buildings instead of a complete, one off design. Such gradual development and regeneration of a city is not possible unless the built form has flexibility for small interventions and alterations. In such a case, the size of grain the urban morphology has a great influence on this capacity for adaptation. An urban morphology with tight grain, particularly via designing small plots, provides more possibilities for gradual intervention in the urban form via altering individual plots. Tarbatt (2012) also emphasizes the role of small plots, not just for their flexibility, but also because they provide other qualities such as diversity in form and use. With small plots, the ownership and control of spaces in the built environment is distributed to individuals or a few users and they have more ability and can make more allowance for changes based on their personal needs. Therefore, a more plot based type of design instead of block based (Carmona, 2010) can help retain the qualities of adaptability and flexibility to allow for gradual changes in urban form (figure 3.6).

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Figure 3.6:
Plot based and Block based typology.
Source: Carmona, 2010

Observation of contemporary urban places indicates that, in general, high density schemes are more likely to be developed with a large grain urban fabric. Large grain layouts are designed via block based or very large plots. This tendency towards large plots or block based forms is because larger and fewer plots in a scheme reduces the amount of space used for stairs and other circulation spaces. Therefore, more space can be allocated for habitable rooms (Figure 3.7). Noticeably, this is also associated with a greater depth and height of buildings to accommodate more dwellings and a higher number of residents. All these factors can reduce the potential for adaptability of the urban form. This is both at building scale and potential changes in use and function of living spaces and also, at a larger scale, it relates to alterations and interventions in the urban form of the whole block or urban fabric. One of the challenges with high density forms is to maintain the adaptability potential of the urban form while increasing its density.

Plots

Vertical circulation space (stairs and lifts)

Figure 3.7: Shifting from small to large plots:
In high density large sizes of plots become more common because less space should be spent for circulation. However, such shift has negative effect on overall adaptability of the urban form.
Source: Author

3.4.5 Biodiversity

Biodiversity is about bringing greenery into the built environment for its health benefits for residents both physically and mentally for its own sake. The goal here is to increase the amount and improve the quality of green spaces within the built environment, and also to provide residents with greater experience of nature. Green spaces not only deliver the benefit of connecting people with nature, but they can also be spaces for recreation and interaction with others. Therefore, this is another key quality discussed in much of the urban design literature.

The quality of biodiversity is mostly achieved via the allocation of green spaces throughout a given design scheme. The size and distribution of green spaces in urban areas is a key factor in improving biodiversity. The connection of green spaces together and to the wider green areas outside of the city can contribute to the natural variety within the city. While the main benefit of green spaces is for local residents, it is also important to place green spaces in accessible locations and possibly within walking distance from the majority of dwellings.

Different recreational activities can be brought inside the green spaces so that the use and connection of people to these spaces can benefit. In this way, the quality of biodiversity can contribute to the overall wellbeing of citizens.

Biodiversity and increase of density

Increases in density generally results in more pressure being put on green spaces in urban areas (Pont and Haupt, 2010). According to the conclusions from the previous chapter, a higher plot ratio results in increases in either the footprint or the height of the buildings. Increases in the footprints of buildings can mean less space for greenery. Increases in height also can reduce the sunlight and hence the quality of the green spaces.

While in high density urban areas, different methods for improving biodiversity have been tried, in general, this quality is more likely to be reduced by the densification process. Green spaces may be distributed in smaller sizes and even vertically through the façades of buildings. However, such solutions have their own drawbacks. In some cases, it appears that greenery on the façade and within a building may also result in health problems, but further studies are required to explore this issue (Roaf, 2010). As Jenks (2012) states, the size of the green space plays a major role in the quality of biodiversity. Small separate green spaces, which are more feasible in high density schemes, do not contribute as much to the biodiversity of urban areas compared to a large park. Overall, the quality of green spaces and their contribution to the biodiversity and wellbeing of residents can be reduced through densification and it can be assumed that one of the major challenges of densification is the potential significant reduction in the quality of biodiversity.

3.4.6 Environmental Comfort

Environmental comfort is that quality related to the way spaces are made more comfortable for use. Bentley et al (1985) put this quality and adaptability within the wider notion of robustness. Others, such as Gehl (2010) and English Partnerships (2007), discuss this quality separately. The main concern in high density development is the challenge of overshadowing as a result of increases in height and the reduction in the distance between the buildings. CABE (2005a) also point out that this is a key concern for local residents when high density development is discussed with them, because of the loss of sunlight. The problem of overshadowing can influence the design and compromise the delivery of other qualities such as biodiversity of green spaces and adaptability of public spaces for variety and time of use.

3.4.7 Energy Efficiency

Energy efficiency, or reducing the consumption of energy, can be delivered by design in certain ways. First, designs can reduce dependency on cars and encourage residents to walk, cycle and use public transport. The second aspect is about the reduction of energy use inside buildings, mostly for heating. Finally, from a wider perspective, a reduction in energy use through design can reduce the carbon footprint of urban areas and contribute to environmental sustainability, not just for the neighbourhood, but for the entire city and at larger morphological levels.

Energy Efficiency and increase of density

Overall, one of the main contributions of densification or compact city form to the built environment is to this quality of resource efficiency. It is assumed that well designed high density urban areas with proximity and accessibility to public transport can reduce car use. Moreover, while higher density urban forms have more attached buildings with a lower amount of exposed surface, less heating energy is lost from the external façade of buildings (Moos et al, 2006). Central heating can be a more viable option in a compact complex of dwellings and therefore residents can make more efficient use of energy at a lower price.

3.4.8 Legibility

Legibility is the quality which reflects to what extent an urban form is understandable and memorable for users. Bentley et al (1985; p10) state that a legibility of a place means that “how easily people can understand its layout.” An urban layout which is understandable is one where people can imagine the layout and finding their way becomes easier. As a result, people can also have a better understanding of the choices and services which are delivered in the neighbourhood or city (Bentley et al, 1985). Lynch (1960) suggests five key physical elements or urban features which improve the legibility of urban layouts. It is argued that the existence of these elements or use of them in a design scheme with a distinctive form can improve the legibility of the whole urban area. They are:

1. Nodes (such as junctions and squares)

2. Edges (such as railways or rivers)

3. Paths (streets and their character)

4. Districts (the distinctive character of an urban area)

5. Landmarks (iconic buildings and monuments)

In some cases, an increase in density can contribute to the legibility of a neighbourhood. This can be via changes in form and urban layout and by influencing some of the above mentioned physical elements. An increase in density may be achieved by allocating significantly high rise buildings which can become landmarks, and cannot just enhance the legibility of a neighbourhood, but also the whole city. Moreover, focusing the increase in density on particular streets and junctions can create a distinctive pattern of paths and nodes. A whole urban area or neighbourhood with significant differences in density and morphological character can contribute positively to the legibility of a larger area and can also contribute to positively to the identity of the surrounding neighbourhoods.

3.4.9 Character and distinctiveness

This quality is about respecting the existing physical character of the built environment through design, suggesting that new urban development have a positive relationship to the existing local character. In this way, the distinctive shape and form of the neighbourhood will be saved. This distinctive character will give a sense of belonging and identity to the area and also to its residents. “By Design” (2000) explains this quality as the way of “responding to and reinforcing locally distinctive patterns of development, landscape and culture”.

One of the key issues with regard to the matter of character for this study is to respect the existing morphology within a local neighbourhood while increasing density. In other words, an increase of density should be considered in relation to the existing patterns of form, specifically in terms of the size of plots, height and width of buildings, street patterns and size and form of urban blocks (figure 3.8).

An increase in density may create certain conflicts with the qualities of character and local distinctiveness. CABE (2005a) suggests that loss of character is one of people's main concerns when discussing increases in urban density. As was explored in the previous chapter, increases in density are often associated with particular changes in elements of the urban form. The most common change is enlargement in size of grain which appears in the height of the buildings and the size of the plots and blocks. Therefore, in many cases, new higher density form may damage the existing character of a neighbourhood. It should be mentioned that these conflicts are most significant at the neighbourhood and urban design scale which is the focus of this research. However, at a smaller scale and at the level of architectural design such as the components of buildings or materials, the new high density form may be capable of retaining the existing local patterns and reinforce the local distinctiveness.

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Figure 3.8: Respecting the existing urban form in terms of size of grain and skyline of the neighborhood.
Source: CABE, 2000

3.4.10 Safety

Safety is another quality which is discussed in the urban design literature. This quality is commonly cited in various categories and as a consequence of other qualities. For example, increase of activities in the street via improving quality of diversity can make urban areas safer. Due to the fact that safety is a serious concern, particularly in high density developments (Lawson, 2012) it is discussed here as an individual quality. The main point about safety via design is to distinct public from private spaces and also to provide surveillance on all public spaces which will result in a reduction in the crime rate in urban areas (Frey, 1999; Clarke, 2009).

The quality of safety is directly related to the design of the urban layout. It is often argued that a design which separates public and private spaces in a clear way and has buildings with windows overlooking the streets is the key to increasing the sense of security in the neighbourhood. Based on this, particular typologies such as the perimeter blocks can deliver greater safety than point or linear types. This is because a perimeter block provides a clear distinction between public and private space, and allows passive surveillance on all the surrounding streets (figure 3.9). Moreover, other qualities such as diversity can contribute to safety because of the increase in the activities and time of use of public spaces. In other words, bringing more people and traffic flow to public spaces can reduce the possibility of crime and hence improve safety.

Safety and increase of density

An increase in density can be both an opportunity and also a threat for the safety of people living in the built environment. Increasing the number of residents can bring more activities to the public realm and naturally more surveillance on the streets. There is greater potential to design block shaped urban layouts in higher density areas, as discussed in the previous chapter, which can also enhance surveillance on the streets. However, as discussed in the section on diversity, it is possible that some parts of the city or neighbourhood have a mono function, such as business hubs, which may not be active during the whole day, and which may reduce the safety aspect at particular hours of the day or night. Particularly in high rise buildings, shared spaces such as stairs and corridors become vulnerable spaces for crime. This is because of the number of residents who use these spaces, which makes them more like public spaces, but without proper surveillance. This is one of the problems with post-war high rise estate blocks which are commonly considered to be areas with a high crime rate (Lawson, 2012).

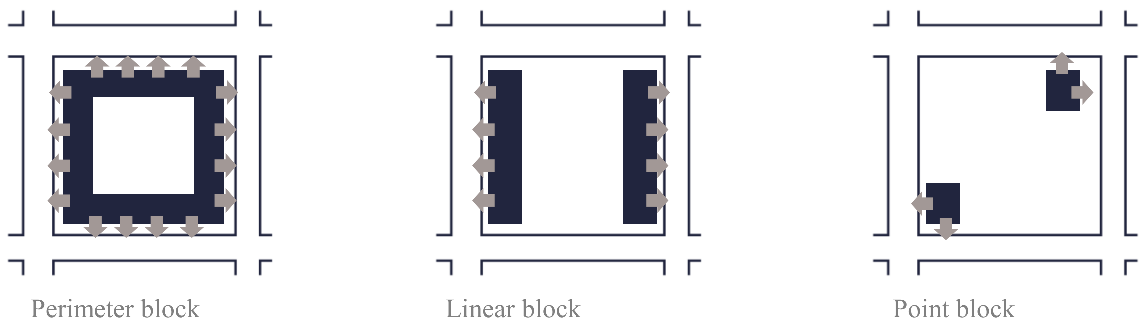


Figure 3.9: Surveillance on streets in three forms of urban block (also see figure 2.3)
Source: Author

3.4.11 Privacy

The urban design literature does not commonly discuss privacy as an independent quality, but is typically considered while delivering other qualities. However, while this quality is discussed as one of the concerns of users in high density developments (CABE, 2005a, 2005b), in this study it is regarded as an individual design quality. The main privacy issue for urban design is that of keeping an adequate distance between the buildings so that the interior of a building is not visible from other dwellings. Moreover, the degree of overlooking on private open spaces can influence how much these spaces are used by residents.

Privacy and increase of density

Studies such as that by Lindsay et al (2010) and MRC (2003) show that, generally, higher density is associated with a lower sense of privacy. While part of this has to do with noise pollution from neighbours and therefore should be dealt with architecturally and by the choice of building materials, some other aspects of privacy still remain a major concern at the neighbourhood and urban design scale. While the footprint of buildings may be increased in high density schemes, this change may result in a reduced back to back distance between buildings. Bentley (1985) and Alexander (1988) recommend a minimum of 22 metres of back to back distance between buildings to preserve the privacy. This is the distance which makes the interior of houses less visible to a large extent. However, through densification, there is a threat that this distance may not be allocated due to lack of space.

Another major obstacle with regards to privacy is that, at higher densities, private open spaces are mostly overlooked by neighbouring buildings and, inevitably, the level of privacy in such private spaces becomes compromised. Based on this, private open spaces may be used less often due to the high level of overlooking. This is one of the reasons that communal gardens are becoming more common in new high density developments than the previously favoured private gardens.

3.6 Conclusion

This chapter has developed the third concept of this study which is that of urban design quality. At the end of this chapter, the three key dimensions of density, form and design quality are defined based on the scale and focus of this research. This chapter has particularly focused on qualities which are of concern to urban designers. The study in this chapter showed that some aspects of these qualities which are influenced by changes in density have been identified. Such design aspects have become the focus of the study and have narrowed down the discussions about urban design qualities in this research.

As a summary this chapter have first discussed the fact that urban design qualities are the main issues which designers can influence in order to contribute to the overall sustainability of a neighbourhood. Then the main design qualities were explored based on reviewing the urban design literature. Moreover, the relationship of these qualities to density and urban form, discussed in the previous chapter, were explained at a theoretical level. At the end of these chapters, all three concepts of density, form and design quality have been defined. The review of the design qualities in this chapter shows that different qualities experience modification when density changes. Even within each quality, there are also different aspects of the quality which may be influenced in different ways by changes in density. The improvement of a specific quality may result in compromising another one. Therefore, overall, while there is a trade-off between density, the number of dwellings in a design scheme, and the delivery of particular qualities in the scheme, there is also a trade-off between the qualities by themselves within the scheme.

The question of density and its relationship to particular qualities has been covered in these three chapters through a review of the relevant literature. However, the approach that can help designers to make decisions in regards to density and design is to see all these design qualities together and evaluate the consequences of changing one quality in relation to the others. The literature review shows that previous studies have focused on individual qualities and their relationship to density, but, in the end, in a design scheme all these different aspects need to be understood together. Having discussed each of these concepts in depth in the previous three chapters, the next chapter sets out a conceptual framework for the thesis. In this, all these three concepts are brought together to provide a cohesive theoretical view about how the three concepts are interrelated. This theoretical framework posits the overall impact of changes to the three concepts together and explains the major trade-offs and impacts of them on each other, allow for the proposition of a set of hypothesis to be tested for deduction and induction.

Chapter Four

Conceptual Framework

4.1 Introduction

In the three previous chapters, the main dimensions of density, form and design quality were discussed separately. The aim of this chapter is to bring all these three concepts together and develop a cohesive way to understand the interrelationship between them. In this way, a theoretical framework for the study is produced. The proposition is that this framework can be used by designers to understand the potential consequences of changes in density and design for residential densification schemes in different localities.

In this chapter, the three concepts are reviewed and the author presents a way of explaining the interrelationship between them according to the focus of this research and bringing them all together. Based on this, the main significant changes in each of these dimensions become a major focus of the study. The major changes in the ranges of density are identified and become the basis of further analysis throughout the thesis. In particular, the key patterns of change in urban form are discussed and, accordingly, the urban types related to these changes are identified. Based on this, the changes in design qualities also becomes clearer and trade-offs between qualities can be observed.

Having this more focused view of the issue of design and density, the study then takes the issue of locality into account. How the physical urban form and attitude of local residents may influence the process of densification and how it is necessary to take such matters into account within the densification scheme is discussed. Therefore, the chapter starts by narrowing down the concepts of design and density so that, by the end, the theoretical part of the thesis can be applied to densification schemes in different residential neighbourhoods with their own physical and social characteristics.

4.2 The three concepts combined

This chapter brings together all three concepts of density, urban form and urban design qualities. The previous chapters explored the concepts individually with the overall possibility that each of these concepts can influence the others. However, here, the purpose is to bring all these interrelationships together and to develop a structured way of explaining the most significant changes and influence of these concepts on each other. Overall, the relationship of these three concepts can be assumed to be linear relationship, meaning that an increase in density directly influences the urban form. It is assumed that these changes in urban form result in the delivery or compromise of certain design qualities.

The literature review for this study showed that existing theory mostly focuses on just one of these concepts or the interrelationship between two concepts. For example, Benrheny (1996) explores the theories, opportunities and threats of densification, while Jenks et al (1996) explores concepts such as the compact city about high density cities without particular exploration of the two other concepts. Pont and Haupt (2010) and Moreno and Steadman (2014) also explore the relationship between density and urban form without further exploration of the consequences on quality of design on public spaces. In addition, studies such as work of Masnavi (2000), Jenks (2012) and Lindsay et al (2010) focus on specific qualities. Although all these studies contribute significantly to the body of knowledge on matters of urban densification, the lack of a method for seeing all these three concepts together makes it difficult to predict the final consequence of densification on an urban area. More importantly, these separate studies do not give a clear suggestion as to how designers attempts for increasing density may affect the quality of a design scheme at the neighbourhood level.

This study tries to propose a tool or method to investigate all these three dimensions together. Mostly, the existing body of literature focuses on a specific parts of the relationship between the three concepts. So, at the end, these studies do not provide a tool to help designers choose the correct density range for their design scheme, nor can they particularly help designers to understand the consequences of choosing particular ranges of density in terms of the delivery of urban design qualities. One of the main reasons for this is that, as explored in the previous chapters, each of these main concepts is measured in various ways and bringing all of the concepts together requires a simplification of the issues, using common measures and focusing just on the significant changes in each of the three main concepts. This is the main purpose of this study: not to have detailed mathematical calculations of the changes in each of these three dimensions, but to provide a tool for designers to use to identify the key changes in density, form and design quality all at the same time. This tool or method can then be applied and used in different localities and contexts.

4.3 Major changes in the three concepts

In order to identify the key interrelationships between these main concepts and create a tool to identify this interrelationship, the research explores the most significant changes in each of these concepts. In this way, the study can explore and identify the major influences of these concepts on each other and prevent the over complication which has occurred in other studies on urban density (Dovey and Pafka, 2014).

The final purpose of the study is to develop a tool for designers to predict the consequences of density change on the design quality of the final development scheme. The process of design always involves trade-offs between design qualities. The hypothesis of this research is that explaining the major changes in these three concepts and pointing out their relationship in a simplified but robust way should improve designers' ability to identify and understand the trade-offs between qualities. They will then make better decisions with regards to increasing density in urban design schemes. Therefore, one of the main purposes of the conceptual framework of the study is to narrow down the discussion about the interrelationship between these concepts by exploring significant changes in each of these three concepts that are given priority in the literature.

In the previous chapters, each of these concepts was introduced. For each of the concepts, possible ways of measuring or describing changes were explored. Here, based on the exploration in previous chapters, the elements of measurement which can help us to identify significant changes will be highlighted so that, from this stage, the study has clearer and more focused discussions about each of the three concepts. The following section discusses each of the concepts of density, urban form and design quality in relation to their simplification and the structured measures for this study. The simplification in this case does not mean simplicity or ignoring some aspects of these relationships; it means focusing the study on the major patterns of change in each of these three dimensions.

4.3.1 Density change: clarified measures and specified ranges of density.

As discussed in chapter one, many different measures are used for urban density. For this study, the measure of dwelling per hectare (dph) is the one which will be used (figure 4.1).

This is because dph is the most common type of measurement, particularly in the UK planning and urban design literature (ex: DETR, 1998). Moreover, it is more understandable than other measures, such as plot ratio, because it includes the number of dwellings (not just a number such as plot ratio) which is clearer. Furthermore, since the study tries to involve locality in the choice of density and design, using an understandable and imaginable measure is more convenient for discussion with local users and non-experts. However, as indicated, plot ratio can give us a more accurate measure for the amount of space required in any density. Therefore, plot ratio is also calculated as a secondary and backup measure for more detailed aspects of design. It is also preferred to use the dwelling per hectare measure instead of people per hectare, because the study is about adding to the number of dwellings not to the density of people. This is because density of people relates to many social and cultural aspects which would change the focus of the study. The focus of this study is purely on densification, meaning that it is about an increase in the number of houses and the consequences of this on urban form and design qualities, which urban designers can influence by their design decisions. By the way, as explained in the first chapter, all these qualities are convertible to each other and using mostly dwelling per hectare as the key measure for this study is for convenience and communality of this measure in UK urban planning literature.

It was also decided to choose specific ranges of density and focus the study on these specific ranges. This decision was taken to both narrow down focus of the study as well as to show significant changes instead of detailed minor alterations in density and consequently insignificant changes in form and design quality. In this way, the major changes can easily be highlighted and delivery and compromise in design qualities can be clearly pointed out.

The main ranges of density used in this study are 200dph and 400dph at the neighbourhood scale, and 200dph, 400dph and 600dph in the urban block scale. This is because the highest acceptable density in UK planning policies is 400dph (MLA, 2012) and two other ranges of density were also added so that major changes in form and design qualities could be investigated. 600dph is just used in the urban block scale because even for a maximum target density of 400dph it is necessary to have a mixture of urban block with different ranges of density. A more detailed explanation of these ranges of density and their use will be illustrated in the next chapter during the inquiry by design process. In addition, ranges lower than 200dph have not been reviewed in this study because they are more common in the low to middle range of existing urban forms of cities in Britain and these are discussed in the urban form chapter.

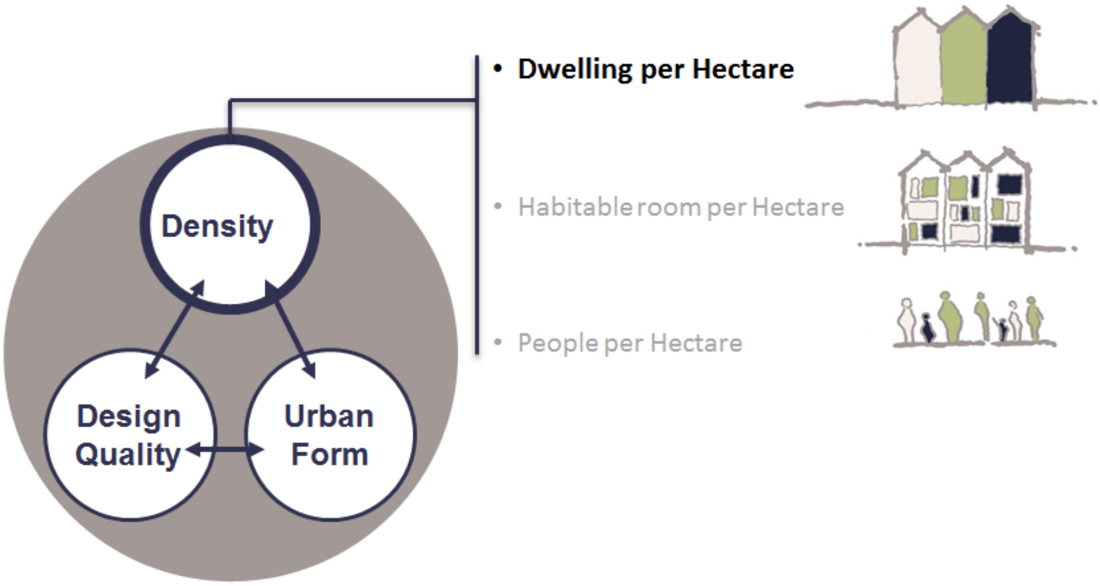


Figure 4.1: Dwelling per hectare (dph) is used as the key measurement for the study
Source: Author

4.3.2 Urban form. Patterns of changes and urban form types

In Chapter Two the literature about the relationship between form and density was reviewed and physical elements of urban form were introduced (figure 4.2). In the next part of this chapter (section 4.4), the urban form changes which can be hypothesised that result from increases in density will also be clarified in order to allow a more structured analysis in this research.

Reviewing the literature and existing examples of residential developments within the UK with different ranges of density via observation and secondary data (ex: French, 2006; Costa Duran, 2009; MLA, 2012), it has been realised that, at different ranges of density, certain patterns of urban form are more commonly repeated. In other words, each range of density gives specific common characteristics of urban form pattern which can be identified and categorised. This results in certain patterns of change in urban form while increasing density.

Focusing on these major patterns of change, it is then easier for the study to explain the urban form changes within different ranges of density. In addition, it will be more convenient to show the major changes in urban design qualities as a result of major changes in urban form patterns. This is again because the significant changes which are pointed out in the process and analysis of significant changes can lead to more accurate findings. Using the idea of change in urban form patterns can potentially help designers to understand more easily the major consequences of density change on the form of their design, and to predict the morphological characteristics of a neighbourhood or a design proposal just by knowing the estimated density target.

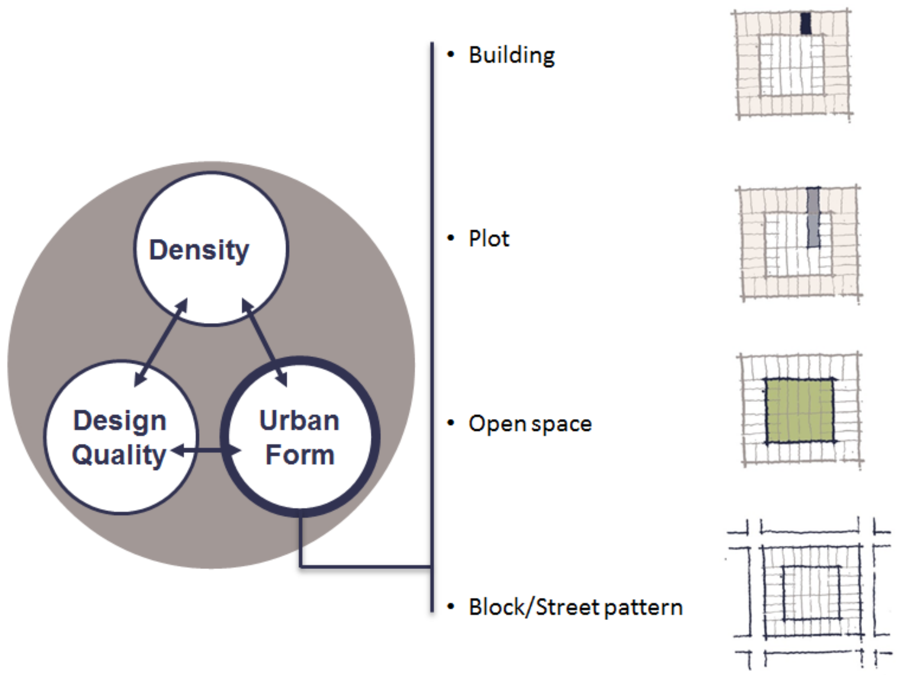


Figure 4.2: Four main physical element of urban form used for the study. Source: Author

The urban form patterns were identified for each of the main morphological elements and presented in Chapter Two. The following is an explanation of the main patterns of change for each of these elements:

The changes in urban form which emerge as a result of density changes can be described in two main ways.

First, part of the changes in form as a result of increasing density is gradual and incremental. These changes are mostly related to the specific morphological elements of the buildings. Normally, increases in density result in increases in the footprint of buildings or their height. This is also admitted by Pont and Haupt (2010) as explained in Chapter Two, where the two aspects of the footprint and height of buildings have a correlation with the plot ratio. In other words, changes in height or footprint are the only way that the amount of living space can be increased on a fixed amount of land.

Such changes in buildings happen gradually as density increases. This means that slight changes of density results in slight changes in the height or footprint of buildings. Therefore, while studying major changes of density ranges for this study, the changes in the height of buildings or the footprint of the urban layout are more obvious.

However, some other morphological elements experience different types of changes as a result of increases in density. For example, for elements such as plots and open spaces, while gradual changes related to small increases of density are identifiable, there are some major shifts or jumps in the characteristics of these elements when there are extreme changes of density.

With regards to the morphological element of plot, as discussed in Chapter Two, increases in density may result in smaller division of plots so that a higher number of houses can be accommodated in an urban block. However, while looking at major shifts in density ranges, then the changes in plots are significantly different. While in densities such as 100dph it is common to have narrow plots, when shifting to densities such as 300 to 400dph, the urban form commonly has very large plots. This means that the pattern of changes does not occur in the same gradual way, but there is a significant change in the characteristic of plots. Even jumping to a higher density such as 600dph, the notion of plot may disappear, and only block based typologies or individual tower blocks may be designed, without any plot divisions.

Figure 4.3: from left to right: Jericho, Oxford/ Greenwich Millennium Village, London/ East Village, London
Source: Author
In higher density the plots may be designed bigger and then completely to an extent which notion of plot does not apply to the urban form and the block works as one unified building.

On the other hand, shifts in open space patterns are also identifiable. While even in high density urban forms in London it is common to set individual private gardens for each plot, more commonly in new high density developments the open spaces in the centre of blocks change to one cohesive communal garden. In other words, instead of small changes in the division or size of open spaces, their characteristics and use changes completely in areas of higher density. Even at densities such as 600dph, which are the concern of this study, the communal garden may disappear and all open spaces may be allocated for public use and part of the street and public space network.

This major shift in the characteristics of morphological elements shows the importance of focusing on and observation of the significant changes of density. Only by studying major density changes can such shifts in character be identified. Then, it is also possible to explain the nonlinear changes in urban design qualities because of the complete shifts in the urban form element.

4.3.3 Urban design qualities: explaining significant changes

In the previous sections, the two notions of density and urban form were simplified to show the major changes in each of these dimensions. Based on this process, the measurement and explanation of changes in urban form also becomes clear in the study. Since the study is focused on the most significant changes, the alteration in urban design qualities becomes more significant and visible. This means by focusing on design schemes or case study examples with significant differences in density and consequently urban form patterns, the changes of urban design qualities can more easily be identified.

This is a crucial point about this research that the study focuses on significant changes in delivery of design qualities (figure 4.4). This is because focusing on major changes means that all the changes in wide range of design qualities can be seen together in the study. In other words, the major gains and losses of qualities become more visible, and the interrelationship between these qualities is explainable and identifiable. The process of design is about trade-offs between qualities and decision making by the designer, and about improving or sacrificing particular qualities through their design scheme. Therefore, this process of showing notable changes of design qualities may allow for a toolkit for designers that can be used to predict the possible consequences of their density choice and major design decisions for high density design projects.

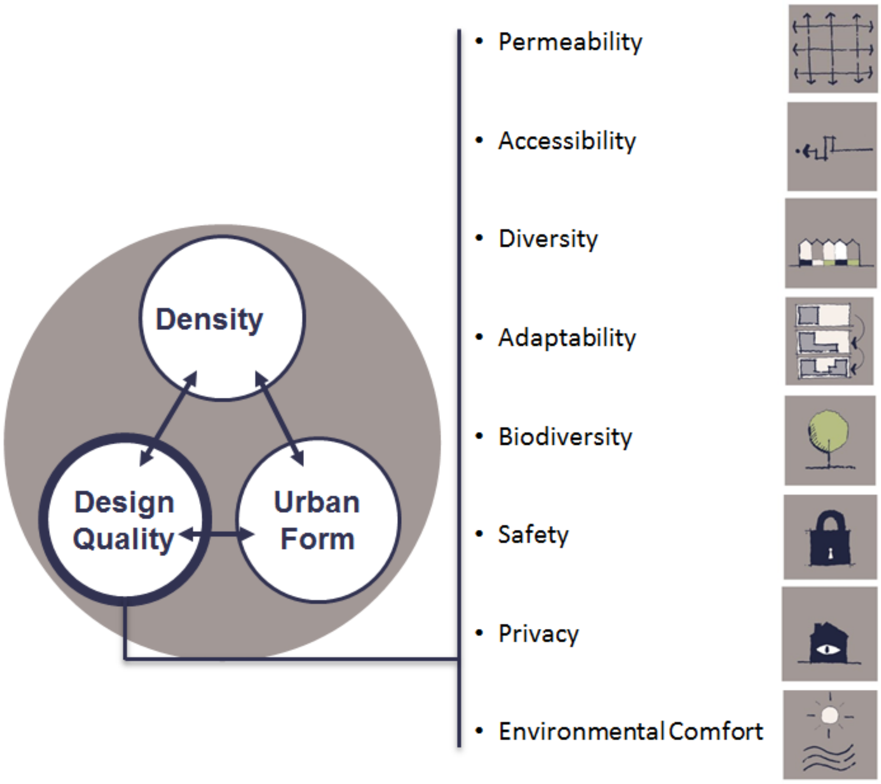


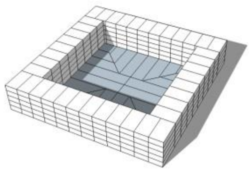
Figure 4.4: Design qualities identified for the study which are influenced by increase of density. Source: Author

Figure 4.5: Bringing three concepts together.
Increase of density (with specific target ranges) result in:
Specific common changes in urban form patterns and consequently result in:
Improvement or compromise in each of the identified design qualities
(Increase or reduction of colours shows the improvement compromise in the design qualities according to the discussions in Chapter Three.)
Source: Author

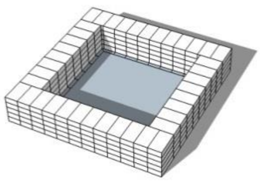
4.4 Identifying 'urban form types' as a method of explaining significant changes

For the convenience of studying change in urban form patterns, this study identifies and introduces particular types of urban form for residential developments (figure 4.6). As mentioned in the discussions above, urban form is the major factor which changes in a nonlinear and regular way through the process of densification. While there may be patterns of change in the urban form, these are not always gradual changes and, in many cases, there is a jump and shift from one pattern to a totally new one. Based on this scenario, in order to present a clearer explanation of changes in urban form, this study introduces specific types of urban form that categorise the major changes in morphological elements discussed in Chapter Two. In other words, the use of urban types here is a way to explain and identify the major shifts in urban form patterns.

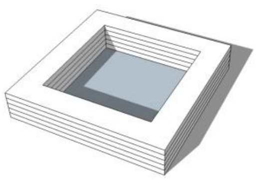
Urban form types are generally the result of combinations of specific patterns of urban form which are repeated in many examples and cases of residential development. These urban types can be identified based on observation of real examples of residential urban forms. In this chapter and through the testing part of the thesis some of these real examples are illustrated. Each urban type has specific characteristics with regard to its morphological elements. Figure 4.6 shows the residential urban types identified in this study.



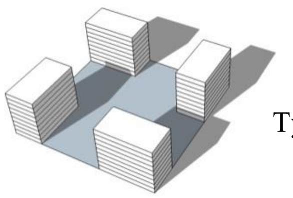
Type 1: plot based flats with private gardens



Type 2: plot based flats with communal gardens



Type 3: block based with communal gardens



Type 4: tower blocks surrounded by public spaces

Figure 4.6: Residential urban form types. Source: Author

Through the process of the research, many different urban types were identified based on observing changes of morphological elements in a variety of real examples, however, the study is primarily focused on the four types for further investigation. This is because the study is looking for the ideal typologies of urban form, so that the final recommendations and design principles produced based on the study can be applicable and transferable to other cases. For these reasons, the two aspects of density range and urban design qualities have initially been considered in order to choose these residential types.

The residential types chosen are those which are commonly acceptable based on studies in the urban design literature. As Barton (2010) and English Partnership (2007) recommend, one of the most practical urban forms which can deliver a variety of design qualities takes the form of the perimeter blocks with a depth between 12 to 16 metres for the periphery buildings and around 100 metres for each side of the block. With this urban form, it is argued the potential for the delivery of many qualities such as permeability, safety, diversity and biodiversity can remain high. Most of the urban forms which have been selected for this study were based on these criteria (figure 4.7).

The change of density has also influenced the choice of residential urban form for this study. The observation of urban forms with different ranges of density through the primary data (site observations in London) and secondary data (ex: Costa Duran, 2006; French, 2006) shows that particular types can be designed in the range of densities which is of concern in this study. For example, terraced housing was initially one identified residential urban type, but this typology was eventually dropt because of its inability to reach the minimum target density of 200dph for this study when including terraced housing. Finally, these four urban types were selected for further investigation and are used throughout the inquiry by design method in the next sections of the thesis.

The following sections are provided overall explanation of the character of each of these four urban types.

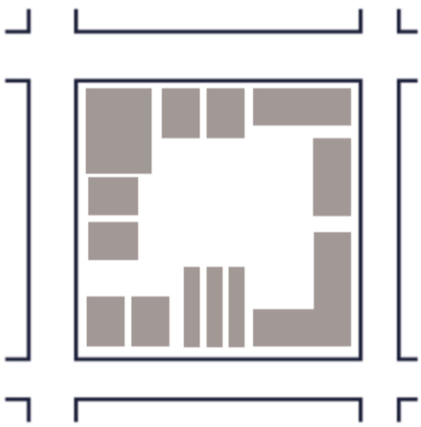
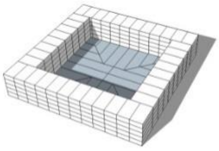


Figure 4.7: Perimeter block urban layout. Buildings are located in periphery of the urban block. Such layout can make clear separation of public and private spaces and better surveillance and enclosure on the streets.
Source: Author



Type 1: plot based flats with private gardens

There are similarities between the layout of this type to the layout of terraced housing because of their small and narrow plots. However, the main difference is that each building contains multiple flats and dwellings on different storeys, while in terrace housing, each building in individual plots is allocated to just one house. For this reason, the density of this urban type can far exceeds terrace housing by increasing the height of the buildings (figure 4.8).

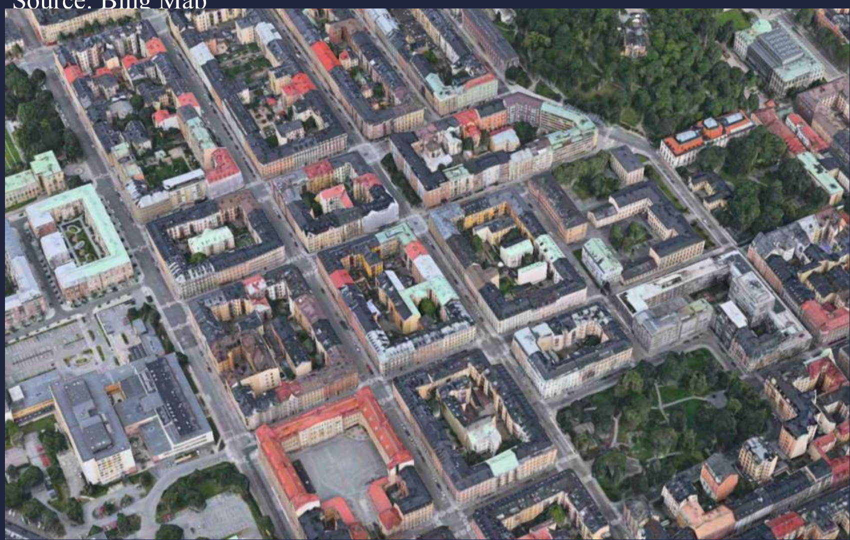
The key morphological characteristics associated with this type of urban form are the small grains of the buildings, plots and open spaces. Such a small grain provides the opportunity for gradual and "organic" changes in this urban form. This is why many high density historical cities in Europe such as Barcelona, Rome and Turin commonly have this character. The small grain helps to give flexibility for further changes and alterations in individual buildings and open spaces, and give more control to local users for such changes (for the concept of Urban Grain see: CH2: 2.5).

So as density increases in urban Type 1, some drawbacks and inefficiency appear in this form. Examples of this type are commonly designed with buildings of around 4 to 6 floors. However, in higher densities and where buildings are higher than this, it is less common to see such a typology. One of the reasons here is that private gardens become less private, due to being overlooked by other buildings and hence they are less often used. Also, a number of dwellings in each building, in higher densities, means a larger circulation space, including elevators, allocated for each building. Therefore, the small size of the plots and buildings results in a large amount of space used just for circulation within buildings, which reduces the amount of living space and the economic viability of the designed typology. Given such drawbacks, despite the high density examples of type 1, eventually design preferences shift to other typologies.

Due to copyright reasons, the image has been removed in the online version of thesis.

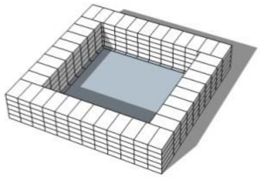
MVRDV design scheme with characteristic of plot base flats.

Rome, plot base urban form can gradually change through long time. Source: Bing Map



Stockholm urban fabric. Individual Plots can have building with different footprints and sizes. Source: Bing Map

Figure 4.8: Examples for Urban Form Type 1.



Type 2: plot based flats with communal gardens

This type of urban form has become more common for high density residential areas in recent developments in European cities. Examples of this residential urban form can be seen in Copenhagen, Freiburg and also in parts of the Greenwich Millennium Village in London (figure 4.9). The main difference between this type and urban form Type 1 is that due to the fact that private gardens are less usable in high density forms, all the open spaces within blocks are combined to make a communal garden in the centre of the block. In this way, the open spaces can be used equally by all residents and more social activities, such as playing and meeting the neighbours, can take place in these spaces. Moreover, the large communal space gives more opportunity for designers to allocate parking spaces beneath the open spaces in the central part of the block.

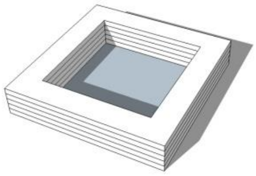
Type 2 retain the small grain characteristics of Type 1 in its buildings and plots. In this way, residents still have a good degree of control over making alterations and regenerating individual buildings. Although there is less flexibility for change to the footprint of the buildings and the urban layout due to communal ownership and use of open spaces, overall, the open spaces are more usable, particularly in high density and high rise types of urban form. Again, the problem of the amount of circulation space needed in high density areas is a drawback of this urban form type for similar reasons as discussed in the previous type. For this reason, there is a tendency to have for larger sizes of plots and buildings in high density schemes. In other words, in urban forms with buildings of more than 5 to 6 floors, small plots commonly change to larger plots and even the notion of plots disappears and block based types of form become the dominant morphological character. In this way, there is another shift of urban type from Type 2 to Type 3.

Recent development in Copenhagen, plot base with communal garden.
Source: Bing Map

Due to copyright reasons, the image has been removed in the online version of thesis.

Diagram of plot base block with small back garden and a large communal garden. Source: Tarbat, 2012

Figure 4.9: Examples for Urban Form Type 2



Type 3: block based with communal gardens

The main characteristic of this type is its large grain. While the two previous types mostly exhibit a small grain, the remaining two (types 3 and 4) have a large grain morphology. In this type, the plot sizes are so large that each side of the urban blocks may just have two or three large buildings of 20 to 30 metre width; or the plot may even disappear (as in Adelaide Wharf, East London: figure 4.10) and the block works as a whole unified unit. In this type, less space needs to be allocated for circulation; in particular, vertical access can be combined for a large number of dwellings. Long corridors may also be used to provide horizontal access to communal elevators and staircases.

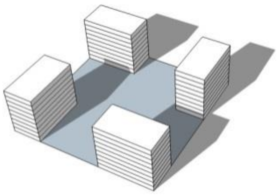
Shifting from small grain to large grain urban form has specific consequences on some of urban design qualities in this type of urban form. As discussed in chapter 3 (section 3.4.4) large grain urban form is less capable for changes in form and use of buildings. One of the key consequences of shifting to this type is that, due to the large grain in this type, the quality of adaptability for further changes in the buildings and urban form will significantly reduce. Moreover, the number of buildings is reduced so the number of entrances and access from the street to the buildings is reduced. In addition, the vertical division of the street facade is less than in the previous types. In this way, generally, the potential for functional and visual diversity in the streetscape reduces.

Olympic village (East village), London. Just two or three large plots made one side of the block and attached via balconies. Source: Author

Adelaide Wharf, East London. Communal garden of the urban block. Source: Author

Adelaide Wharf, East London. The whole block contains only three large plots.
Source: Digimap

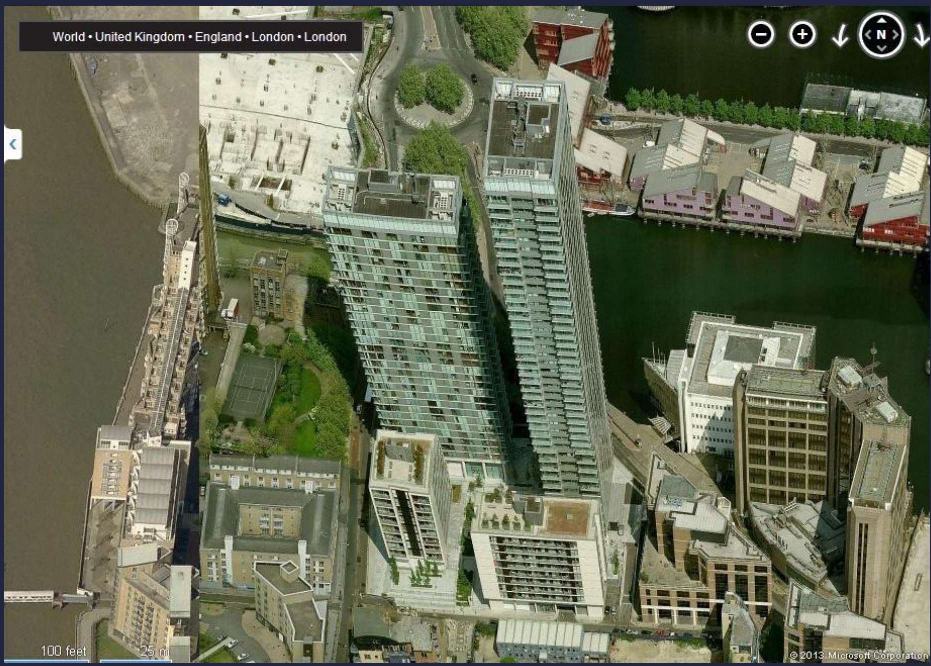
Figure 4.10: Examples for Urban Form Type 3



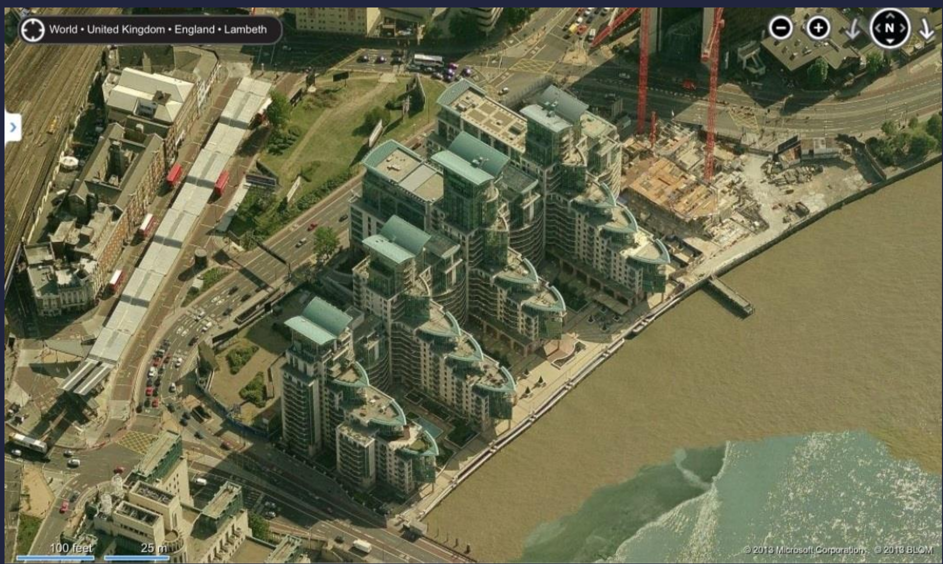
Type 4: tower blocks surrounded by public spaces

This urban type is common in very high density areas and is more likely to be used in the highest density target range introduced for this study (600dph). The significant change from the previous type is that all open spaces shift to completely public open spaces. The number of residents has reached such a high level in this type that it may make little difference whether the open spaces are restricted only to the residents of a particular block or are completely public (figure 4.11). Based on such conditions, the urban blocks can also have more variety in form. It is more likely in this type that the urban form does not have the perimeter block character. As explained in figure 4.7 (p92) the key feature of perimeter block is that the public spaces outside of the block are separated from private open spaces inside the block. While there is no private open space in this type, there is no need for allocating building in the periphery of the block and separating the public and private spaces in this type, and all open spaces are allocated for public access. As the figure and examples show, this urban type is also common in some recent high density developments in London. While not necessarily exhibiting a perimeter block layout in this type, the buildings may be designed separately and in the shape of very high rise towers to accommodate the target number of residents.

Again, particular changes happen in the delivery of design qualities as a result of shifting to this urban form type. This type is significantly less adaptable for gradual changes because of the large grain urban form in the shape of individual or in combination of residential tower blocks. On the other hand, there is more potential for functional diversity and mixed use. This is because of the greater potential for active edges, because of the public spaces allocated within the block. As an example, in the Vauxhall Bridge development (figure 4.11), many different uses are located inside the urban block and are not just adjacent to the street. Due to the highly public character of the open spaces, it is also common and necessary to allocate a variety of uses within the buildings and particularly on the ground floor so that the public space will be active and overlooked during the day and night. In other words, the safety of the public spaces becomes very important in this type. On this issue, it is also helpful to have a high level of traffic flow in public spaces. Based on this, it is better to allocate this type of urban form close to public places such as tube stations and main transport hubs which have a naturally high number of commuters.



London Docklands, an urban block containing four separate towers with complete public open spaces inside the block.
Source: Bing Map



London, near Vauxhall Bridge. Large size block with complex footprint of towers. All open spaces inside the block are publicly accessible.
Source: Bing Map

Figure 4.11: Examples for Urban Form Type 4

4.5 Designers choices and trade-offs between qualities

In the previous sections, the fact that urban form patterns change as a result of increasing density was discussed, and the fact that these changes are not always linear, but that major shifts in types of form happen when major changes in density take place. There is no exact density boundary that separates the type of form which can be used in specific ranges of density. In other words, while some types are more common in very high density areas and some others in very low density areas, in some ranges of density, a variety of urban type options exists for designers. Other than the question of density, it follows that the choices that a designer makes which are related to the appropriate patterns of urban form and choices of urban type can influence a design scheme and the delivery of design qualities. Through decision making about urban form patterns designers make trade-offs between design qualities, and improve particular qualities and may also sacrifice some others.

This research illustrates these trade-offs so that designers can have a better understanding not just of how to change density, but also the choices and design decisions throughout the densification process which may consequently influence the design quality in a final scheme. While designers have the opportunity to make such choices, and decisions throughout the densification process, the most fundamental issue which influences these decisions is the existing conditions of the neighbourhood in which the increase of density occurs. The next section, therefore introduces particular issues in the local contexts which may influence the process of increasing density in the design process.

4.6 The influence of context on density and design

In this section, the three concepts are discussed in relation to locality. Any densification project will be targeted to increase the density of a specific site and to bring a larger number of dwellings into a particular neighbourhood. In section 4.4, the study has shown the possibility of specifying the major changes to these three concepts, but it is important to discuss the topic in relation to real neighbourhoods with the potential for densification. The densification process happens at actual sites in the city and will influence the existing character, form and design quality of a neighbourhood. Despite the theoretical validity of the previous discussions about the interrelationship of density, form and design quality, it is not practically helpful to devise a research method which lead to design recommendations at the end without considering the influence of locality on a design scheme.

This influence of locality in relation to design and density needs to be explained in more detail. As already mentioned, an increase in density to a certain range can result in particular changes in urban form pattern within a neighbourhood. The designer also has a specific range of choices available with regards to the patterns of urban form which can be used in certain ranges of density. Consequently, particular design qualities within a neighbourhood may be improved or compromised. However, despite all these established relationships, the existing locality and the surrounding urban form will and should influence the decision making on choices of urban form pattern, and on delivery of certain qualities for a neighbourhood. This means that, not only does density influence urban form patterns, but also that the locality influences the designer's decisions to choose certain urban form patterns.

The influence of locality on a densification project can take the following two forms which is discussed in next section:

1. issues related to place (local physical form)
2. issues related to people (local users)

4.6.1 Issues related to place

Densification projects commonly take place within an existing neighbourhood or brownfield site surrounded by or at the edge of existing buildings and public spaces. The local site within which densification happens normally has existing morphologic characteristics in terms of buildings, plots and street patterns. Some positive design qualities may already exist or they may need to be improved. Any new development within a neighbourhood should better not be just targeted at increasing density, but should also aim to improve the existing quality of the neighbourhood. The existing condition of an area can therefore help prescribe what design qualities should be the greatest focus for the new development. Hence, the existing physical form of the neighbourhood influences the choice of urban form patterns which the designer may choose for the scheme. Overall, the existing morphological conditions of an area will influence decisions and trade-offs in the design process.

4.6.2 Issues related to people

On the other hand, the existing residents and users of a neighbourhood also influence the decisions taken in relation to a densification scheme. The question of people's attitude towards high density neighbourhoods in UK context were discussed in chapter One (Section 1.4). This is an important issue which, if neglected, may result in an unsuccessful densification project. Here, the acceptability of the design project by local people is the main concern of the research. If a design scheme is not generally acceptable to the locals, then they will not want to live in the newly provided houses and the existing local residents may even leave the neighbourhood and the whole demographic characteristics of the area may radically change. Roaf (2010) points out this issue as there are high density developments in the UK, which have remained empty because of their low quality and lack of acceptability by local users. In this way, density is not actually increased because the target of densification (which is to respond to demands for new housing in the neighbourhood) is not actually achieved.

Based on this, it is important to consider the local community's viewpoint in any densification process. Local users have their own preferences and concerns regarding new developments within a neighbourhood. These local concerns should also be considered in a design scheme to produce a place which is locally acceptable.

4.7 The three dimensions combined in different localities

Given the discussion above, it is important to take local issues into account in densification projects in terms of the existing characteristics and qualities of the neighbourhood (place), and the preferences and concerns of local users (people). The relationship between the three main concepts of density, form and design qualities also therefore needs to be understood in terms of the influence of local conditions on them (figure 4.12).

Trade-offs between different qualities are inevitable in a design project. This is particularly the case in densification schemes. In many cases, local concerns may relate to losing some of the existing positive qualities within a neighbourhood as a result of increasing density. While this is a valid concern, the process of densification involves compromising on certain qualities in order to improve others. For example, increases in density may reduce privacy or bring overshadowing problems, but, it can also bring more activities and new local jobs to a neighbourhood. Some benefits may also lie in the bigger picture and relate to the whole city (such as responding to the major need for new housing) with slight compromises on local design qualities. Educating local people about such trade-offs will also help to make the design scheme more acceptable and help reach a mutual solution between the professional designers and local residents.

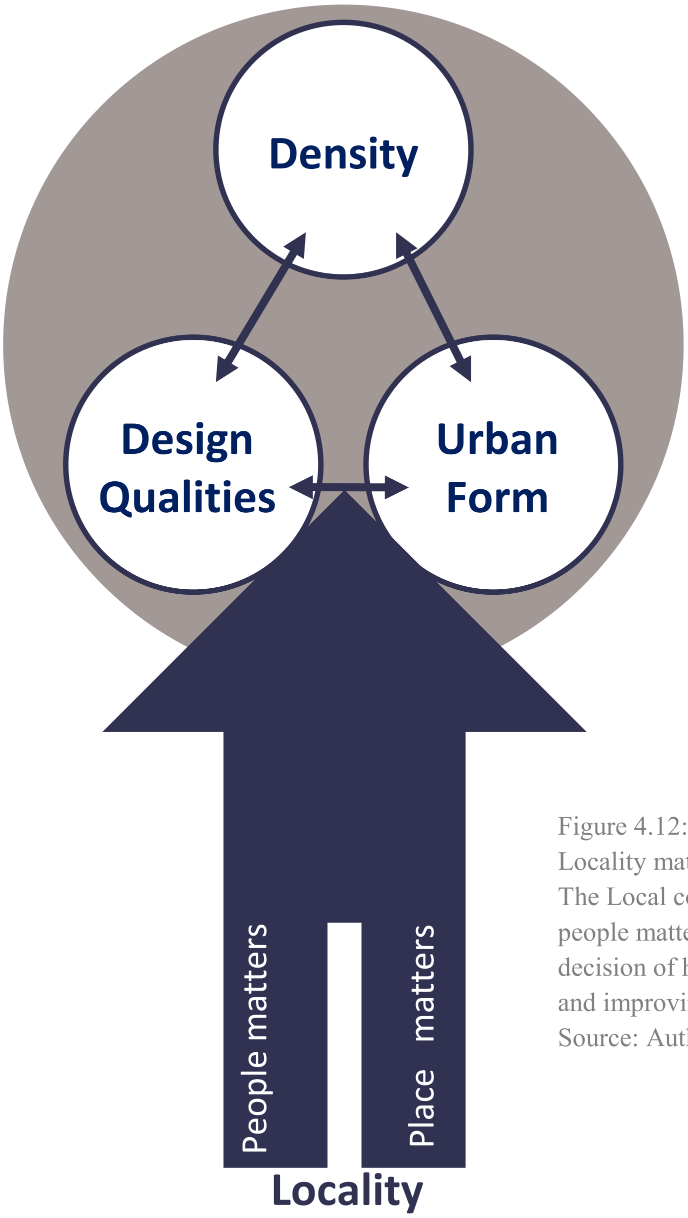


Figure 4.12:
Locality matters:
The Local condition in terms of place and people matters can have impact on the decision of having specific urban form type and improving certain qualities
Source: Author

Regarding the matter of trade-offs, finding an approach to identify the concern of local users about design and densification issues can be very helpful. Therefore, the hypothesis which is explained in this conceptual framework is about clarifying and simplifying matters related to the three dimensions of density, form and design quality, which can be useful for this. When the main changes in density and design qualities are identified and introduced in a simpler way, it is possible to propose these changes into a locality, and easier to gather opinions about the acceptable and favourable ways of changing the design of a local area. The whole process of identification of major changes not only creates a tool for designers, but also provides a tool for receiving feedback from the local community about their preferred densification methods.

4.8 Testing the hypothesis in different localities: an inquiry by design method

Up to this point, the study has suggested a conceptual framework related to the relationship between the three concepts of density, urban form and design quality. The framework explains one model that can be used to observe and analyse major changes in these three concepts and how to measure and explain them. Moreover, local specifications and the ways in which local conditions may affect this relationship have also been explored. The research proposes a process to simplify and explain how changes in density can influence design qualities. This hypothesis has resulted from reflection on the literature review, and deduction from examples of existing urban forms via primary and secondary data.

These theoretical assumptions are further validated through the testing stage of the research in the following chapters. The theoretical section shows how the process can be conducted to understand exactly how density changes may affect urban form and design quality. However, in the next step, the process will be realised through an inquiry by design process so that the validity of the theoretical assumptions can be validated.

The validation of the hypothesis will be completed by observing existing examples of urban developments with different ranges of density and checking how the urban form patterns and design qualities have changed. However, in this way, it is not possible to fully understand to what extent it is possible to deliver certain qualities in an ideal way. In other words, just reviewing examples cannot properly show the maximum potential of delivering design qualities at different ranges of density, although it can show to what extent each project has delivered urban qualities. Such analysis of existing sites cannot show all the potential which exists for higher density urban forms because all developments have been influenced by many factors dictated by their locality in terms of physical form limitations (place matters) and local residents' demands (people matters). In order to identify the ideal or optimum urban form which can be delivered in each range of density and to understand the maximum potential of delivering urban design qualities, this study tries to use an inquiry by design method instead of analysing existing high density developments.

Using an inquiry by design method, the trade-offs between design qualities and choices of urban form patterns can be scrutinised more deeply. Each step of the decision making process can be rationalised and made explicit so that the final design is more justifiable. In this way, the research tries to identify possible options and obstacles with regards to maximising design qualities while increasing density. Since this study has developed a structured way of changing urban form patterns based on existing examples, and since precise design qualities and factors have been introduced related to the matter of design and density, then the inquiry by design process should be capable of being conducted in a more convincing way to show the potential of high density residential neighbourhoods.

4.9 Conclusions

In this chapter, a conceptual framework has been explained for the theoretical part of the thesis. While, in the previous chapter, the issues of density, form and design qualities were discussed separately, here, all these three concepts have been brought together. As shown in previous chapters, defining the interrelationship between these three concepts can be a challenge. The hypothesis of this research is that it is possible to explain the interrelationship between these three dimensions in a more comprehensive and clear way in order to develop more feasible and practical findings and recommendations for designers.

Hence the author aimed to make a simplified, but clearer and more usable framework to explain the interrelationship between these three concepts. Therefore, the main focus and view of this research about each of these concepts was redefined in a more focused way. The main focus was to bring together all the theoretical discussions based on the literature review in earlier chapters into a transferable method for explaining the relationship between design and density. The framework should then be more easily understood and used by designers to understand the consequences of changing residential density through urban design schemes. After this section, the different choices of urban form related to changes of density were discussed. Finally, the main influences of localities on the designer’s choices were explored. These are related to local specifications with regards to their unique physical form and attitude and the preferences of local residents regarding the notion of densification.

While the final result of this study is a method to understand the relationship between the main three concepts and based on this, to recommend urban design principles appropriate for high density development, making such recommendations for designers depends on seeing all these three concepts together and understanding the trade-offs between qualities as density increases. Based on this, the study focuses on extreme changes in residential density and significant patterns of change in urban form. In this way, the major influence on design qualities is consequently much more visible for evaluation.

This study argues that, particularly with regards to urban form, changes are not linear and gradual, but certain shifts in the characteristics of morphological elements take place as a result of significant changes in density. Based on these changes of form, it is preferable to define certain urban form types which represent significant changes in residential morphology. It is then much easier to evaluate changes in design qualities. Using such urban form types in this study is intended to provide a clearer explanation of changes for designers and local users so that the method can be used in a practical way in densification design schemes. In other ways, the study can show the consequences of designers' choices in relation to different target densities and urban form characteristics.

Based on this theoretical framework, the study will be focused in the next chapter on testing these hypotheses using an inquiry by design method. The test section contains two main parts. In the first part, the focus is mostly on how density changes may influence the choices made by designers when selecting different residential types and the consequences on urban design qualities. Then, in the second test, the study is focused on the influence of locality on choices of urban form and design qualities. In other words, from this stage of thesis, the purpose is to check the validity and practicality of these hypotheses through a series of inquiry by design processes which will be explained in Chapter Five.

Chapter 5

Methodology

5.1 Introduction

In the four previous chapters the study proposed a theoretical structure offering a simplified view of the relationship between density and design, particularly for urban designers. The study posits a way to see all three concepts of density, form and design quality together and a method to identify significant changes and the influence that these concepts have on each other in the context of residential neighbourhoods. In this chapter, the research goes further to suggest a means of testing these hypotheses. The aim of this chapter is to introduce the analytical method and framework of the research. This chapter should be seen as a transition between the theory (Part One) and the practical testing (Parts Two and Three).

The chapter sets out a base for all of the testing parts of the research. It shows the overall testing method that is applied in both Parts Two and Three which employs an inquiry by design method. The inquiry by design method for each part is explained here. This covers the generic modelling process in Part Two and the local design in Part Three of the thesis.

The chapter also introduces the framework used to analyse the models and design proposals developed in both testing parts. This analytical framework is a method to help ensuring a unified process of analysis for all the design outcomes of the research and to be able to compare the results of different stages. This analytical framework incorporates the precise indicators of the design qualities and the criteria used to evaluate and explain the changes in the quality of design in the models and design proposals.

While the detailed process of modelling and design is explained separately in parts 2 and 3 of the thesis, this chapter shows the unified aspects of the design process and analysis which were carried out through the testing. In this way, the chapter gives an overview of the whole inquiry by design process before going into the detailed process in the subsequent chapters.

5.2 Main research approach

This study is based on a design-led research approach. However, in keeping with the objectives of the research, different research methods and data collection techniques were used in this study. However, it is worth emphasizing that the main research method in this thesis is based on the design and analysis of the design proposal. Other qualitative and quantitative methods which were used can be seen as supportive methods used to validate and rationalize the design process and the following analysis. Figure 5.1 and table 5.1 demonstrate how different methods and techniques were used in the research process to support the main design-based inquiry of the thesis.

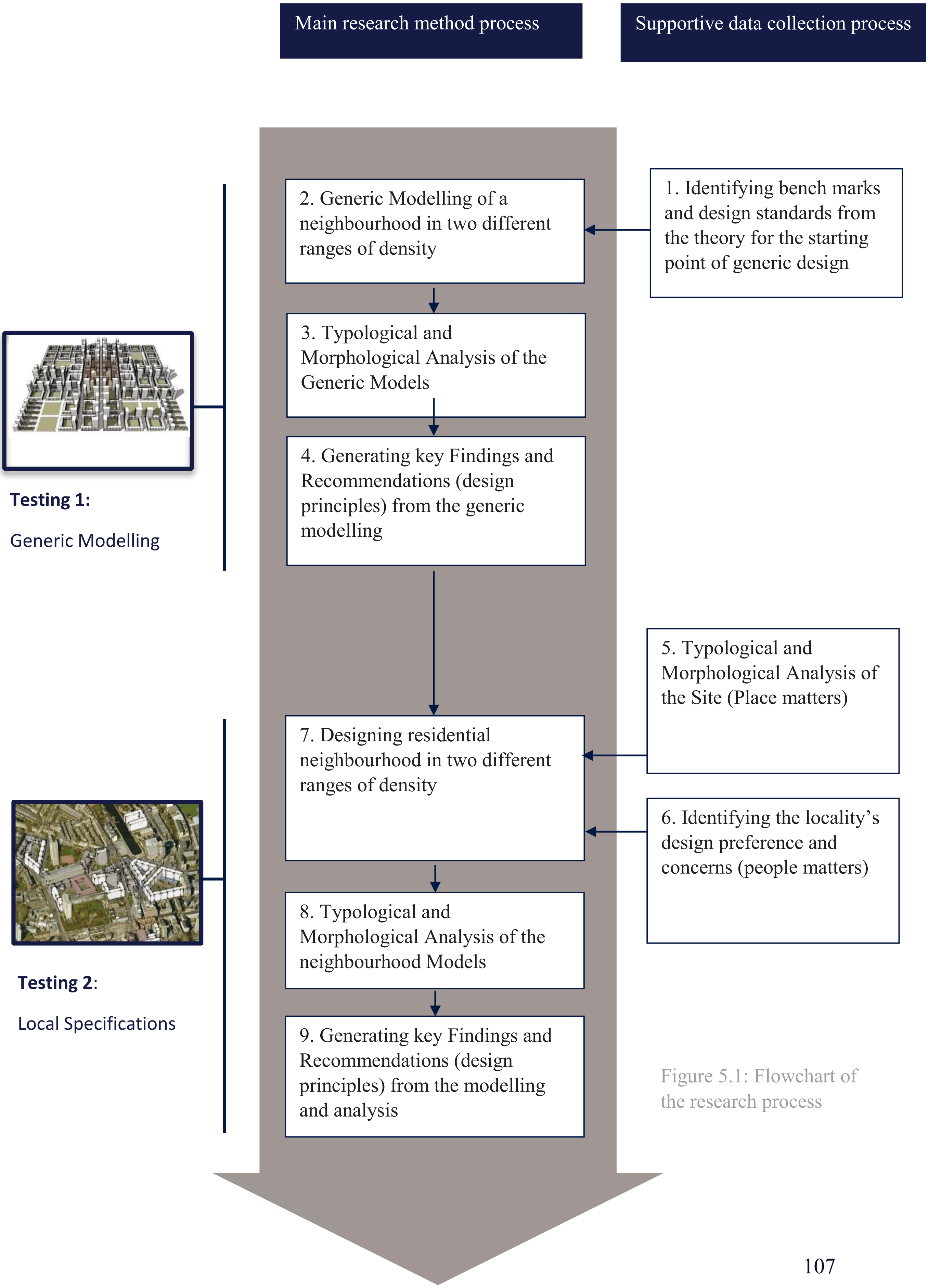


Figure 5.1: Flowchart of the research process

	Urban design literature review	Urban design guideline review	Housing standards of the UK and London	Secondary sources of case study and typological analysis	Councils' Local plans for new development	Local Council urban design guidelines	semi structured interview (based on Q method)	Focus group discussion (based on Q method)	Email survey (based on Q method)	Design principles and findings derived for first stage of inquiry by design	Design principles and findings derived from comparison of two inquiries by design stages	Site observation	Morphological and Typological analysis based on analytical table of the research	Qualitative analysis: content analysis of interviews and focus group discussion	Quantitative analysis: q method analysis of the sorting tables gathered in interviews
	Data collection techniques and resources												Analysis methods		
1. Benchmarks and standards															
2. Generic Design															
3. Model Analysis															
4. Findings															
5. Site analysis															
6. Locality preferences															
7. Design proposal															
8. Model analysis															
9. Findings and recommendations															

Table 5.1: Research methods and data collection techniques based on research process flowchart in figure 5.1

5.3 Inquiry by design method

Overall, the method which was used for testing the theoretical assumptions of this research is inquiry by design (Zeisel, 2006). The reason for using this method was set out in the research approach section in Introduction Chapter (section 0.8). The relationship of density, form and design, which was explained in previous chapters, was tested using design and examining the impact of changing density and form on the design qualities as discussed in conceptual framework.
The process of design can show us the variety of physical forms which may appear as a result of changing density; hence, the limitations and opportunities which arise for higher density design can be identified, and finally it can be stated which design qualities may be compromised or improved as a result of designing at different ranges of density. The inquiry by design process here was delivered via using the urban types introduced in Chapter 4 (section 4.4) and choosing specific ranges of density and producing design schemes in these ranges of density.

In this study, the inquiry by design process is divided into two parts (figure 5.2):

1. Generic Modelling
2. Local Design

The first part, which is explored in Chapters Six and Seven, is about generic modelling of density in a more abstract manner, without taking account of local design context issues. The second part applies the design recommendations and findings to an actual local neighbourhood in London. This local design and analysis is contained in chapters Eight to Ten.

The main reason for two stages of inquiry by design is that the inquiry by design process is complicated by many different variables in density, form and design. Therefore, a research method for testing the assumptions of this research was developed which starts with simple modelling and progresses to a more complex design.

To summarise this process, firstly, design is at the scale of urban blocks, then at neighbourhood scale (Testing Part One). After that, the design ideas is applied in a local area and the opportunities and limitations of the local context is considered in the design scheme (Testing Part Two). After each design step, an evaluation is carried out to examine the changes in density, form and design qualities. Finally, the findings of the design and analysis are tested via two focus group discussions in the local context to have final validation. In this way, a process of design and analysis covering simple to complicated conditions is developed for this research.

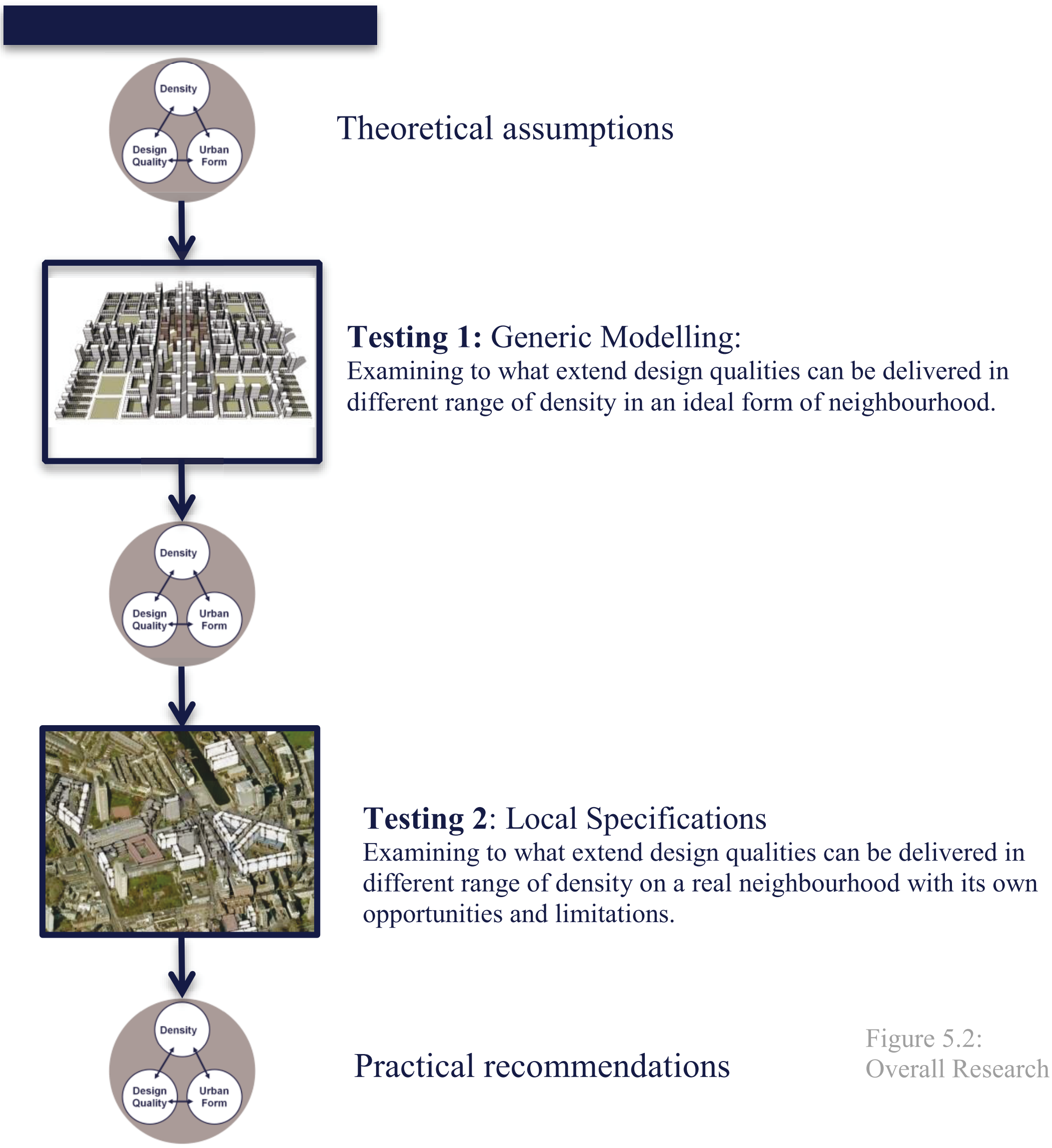


Figure 5.2:
Overall Research Process

5.3.1 Part one: Generic Modelling

The first part of this thesis, which is called Generic Modelling, is about proposing an abstract design. No specific site in the real world was allocated for this modelling. The second part, which is the local design, sets out a design proposal based on a real location in one neighbourhood of London, with the potential for high density development in the near future.

The main reason for having two parts of inquiry by design is to simplify the process. In this way, step by step, more aspects of design will be added to the proposal. It is not necessary to deal with many different design aspects and particularly design qualities which are closely related to local site conditions. Moreover, the simpler abstract design in the generic modelling enables designers and researchers to create design proposals based on an ideal scenario. As a result, the potential for different urban form types should be revealed. Therefore, all possible urban form options and choices during the design process can be identified regardless of the limitations which may be dictated in a real site.

Generic modelling as an inquiry by design method

The first testing part of the thesis which is explored in more depth in the next chapter is about generic design. The main benefit of using a generic modelling process for this research is to start with a simple design regardless of the local contexts and make it more complex in second stage of testing. If the modelling process starts here by making urban design schemes for a local area in London, then the study can be led in a way which the maximum potentials of design in different ranges of density may not reveal. This is because the local context can dictate specific design considerations to the design scheme. For example, existing characteristics of the local area may dictate specific types of design for the area in terms of the heights of the buildings, grain size, specific type of uses, size of block or street patterns in order to respect the local context (see Chapter Three, section 3.5.9 about quality of character and distinctiveness). However, if we first have a more generic design we can understand the maximum potential of the different urban forms in different ranges of density. Then, in the local design context, the limitations and local considerations can be added to the scheme. In this way, we can understand the potential of different design decisions, and also understand whether the increase in density is the main reason for choosing a specific urban form or if the local context dictates a specific type of design.

Generic modelling is also used in other studies as part of an inquiry by design method. Particularly in studies related to the issue of urban density, generic modelling is a helpful tool for introducing and presenting ideas. In the study of Dovey and Pafka (2013) generic models are used to show the difference in variables and measurements of density and form (figure 5.3). In some cases, such as Urban Task Force studies (1999), (figure 5.4) different urban layouts with the same density are shown by generic modelling. These studies show how much using generic models can help to simplify the concepts related to density and urban form and to identify different options of change in form.

Due to copyright reasons, the image has been removed in the online version of thesis.

Figure 5.3: Studies about different forms and density by Dovey and Pafka (2013),

Source: http://www.bartlett.ucl.ac.uk/events/density-intensity-assemblage-kim-dovey

Due to copyright reasons, the image has been removed in the online version of thesis.

Figure 5.4: Showing different possibilities of urban form with the same density,

Source: Urban Task Force, 1999

Generic modelling is also used in some studies as a tool for showing all possible potential changes in form and additionally to analyse the consequences of these changes on different factors and variables. As an example, studies by Pedersen (2011) about density on the scale of urban blocks should be mentioned. In this study, after identifying different forms, each generic model is analysed using the same method based on the variables identified for their study. Alexander et al's (1988) studies also use the same approach of generic design of different potential urban forms, but overall the range of densities which are used are mostly less than 150dph which is quite low compared to the context of the UK (figure 5.4). Also, studies by London Development Agency (LDA, 2009) on the intensification of eight town centres in London starts by showing generic types of design and applying these types to different contexts (figure 5.6).

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Figure 5.5: Studying different forms of urban block and their relationship to density.

Right: Pedersen (2011)

Left: Alexander, Reed and Murphy (1988)

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Figure 5.6: LDA Urban Design (2009); Identifying and using general types of urban form for intensification studies.

As these studies show, generic modelling is a research approach which can help to simplify design ideas and to better categorise changes in physical form. For this research, generic modelling is used at both block and neighbourhood scale because some of the design qualities which are of concern for urban designers can be investigated in more depth at the block scale and some at the neighbourhood scale. Secondly, understanding the interrelationship of these different morphological scales can help us to find the most appropriate design solution in order to deliver design qualities which are of concern in this research. Thirdly, the difference between the generic modelling in this research compared with the previously mentioned studies is that this research focuses on design qualities which can commonly be achieved on the scale of urban design schemes such as neighbourhood design. In this way, this research tries to show the trade-offs between design qualities while choosing different densities and different types of urban form.

Figure 5.7 shows the process of inquiry by design carried out in the generic modelling part. The process starts by establishing benchmarks and standards for modelling generic urban form. These standards were developed based on reviewing the urban design literature related to neighbourhood design (ex: CABE, 2000; Department for Transport (DT), 2007) and also studies about density and housing standards in the UK context (ex: GLA, 2010). Then, using such benchmarks, generic models of a neighbourhood with different densities were simulated. The target was to maximise the delivery of all identified urban design qualities in these neighbourhood models. Also, the urban form types which were used in these models are compared and referred to real examples of housing so that the generic models can be more practical and applicable to real sites. Then, the generic models with different densities were evaluated using the analytical table which is introduced later in this chapter (section 5.5). Finally, the result of evaluation was used to establish the initial findings and urban design recommendations for this study. These findings were then used in the second part of the testing on a real neighbourhood design.

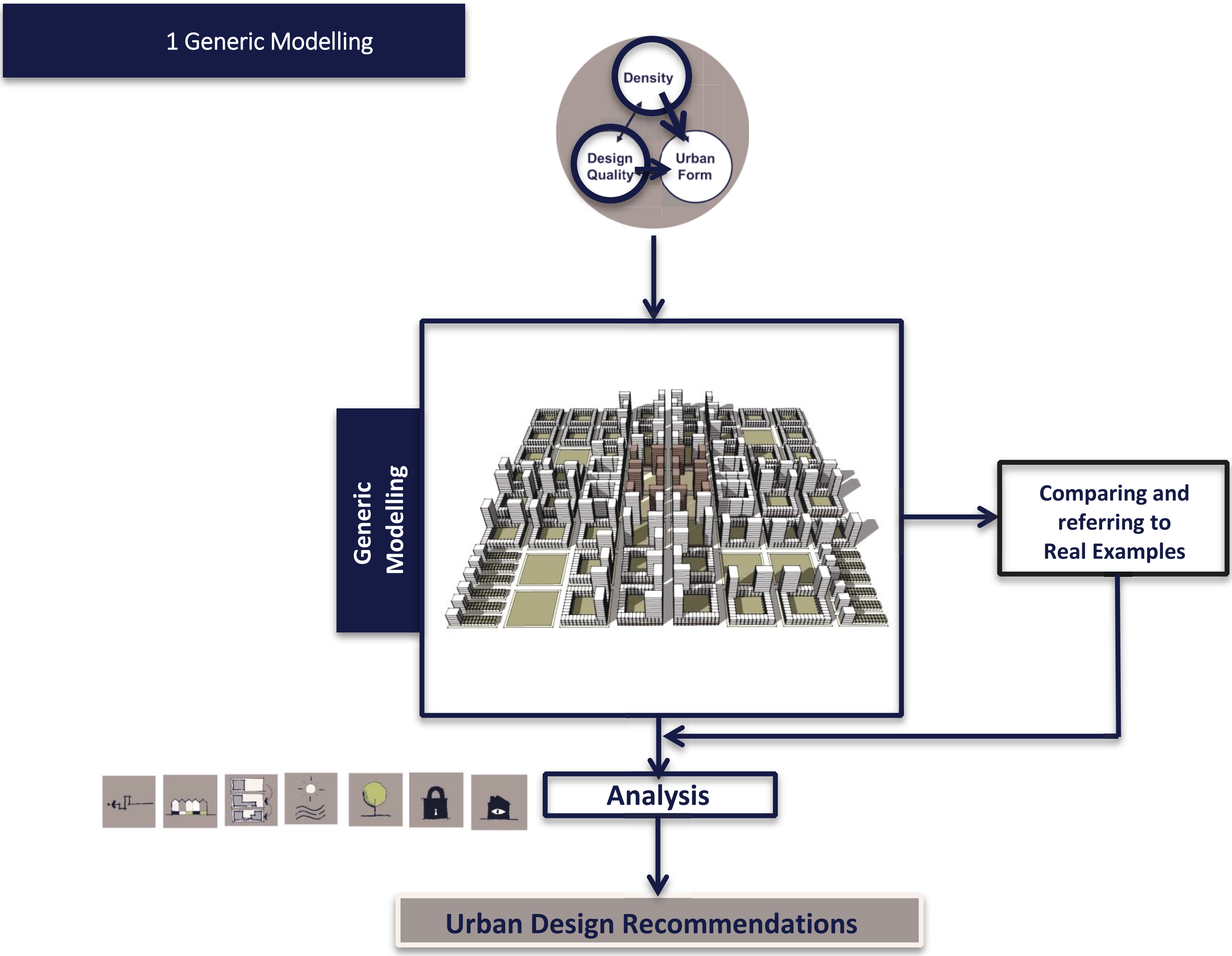


Figure 5.7: Design and analysis process in the 1st testing part: Generic modelling.

5.3.2 Part two: Local Design

The second part of the inquiry by design process took place on an actual site. The findings from the simpler design process in the generic modelling were added to the second part and necessary alterations and further revisions specifically for the chosen area were applied to the design scheme. In this part of the testing, two major issues, as discussed in the conceptual framework in Chapter Four, were considered which have not been taken into account in the generic modelling. The main issues in local design are:

1. Place matters
2. People matters

'Place matters' are related to the existing physical condition of the site. Issues such as the existing characteristics of the area, the street patterns and the size of the blocks related to the urban form patterns of the scheme were investigated. Overall, the urban design qualities which may need to be improved or those which may need to remain at their existing appropriate level in the neighbourhood were discussed. Analysis of the existing site can reveal to what extent the ideal form and design principles developed from the generic modelling may be delivered, or how far they may need to be compromised in the local design scheme.

'People matters' relate mostly to the attitudes and preferences of local residents. The study investigated the main concerns of the locality with regards to changes in urban form and increases in density within the area. The result of this investigation also influenced the design principles and the final scheme for densification in the area.

Finally, based on these place and people considerations, design schemes were produced for analysis. Figure 5.8 shows the overall process of inquiry by design in Part Two of testing in the thesis. In sections 5.4 and 5.5 of this chapter, the main design and the analysis process are explained. After the analysis process final design recommendation for high density residential neighbourhoods were made. Moreover, the theoretical framework of the study (chapter Four) was again reviewed to develop a more accurate understanding of the relationship of the three main dimensions of density, form and design quality.

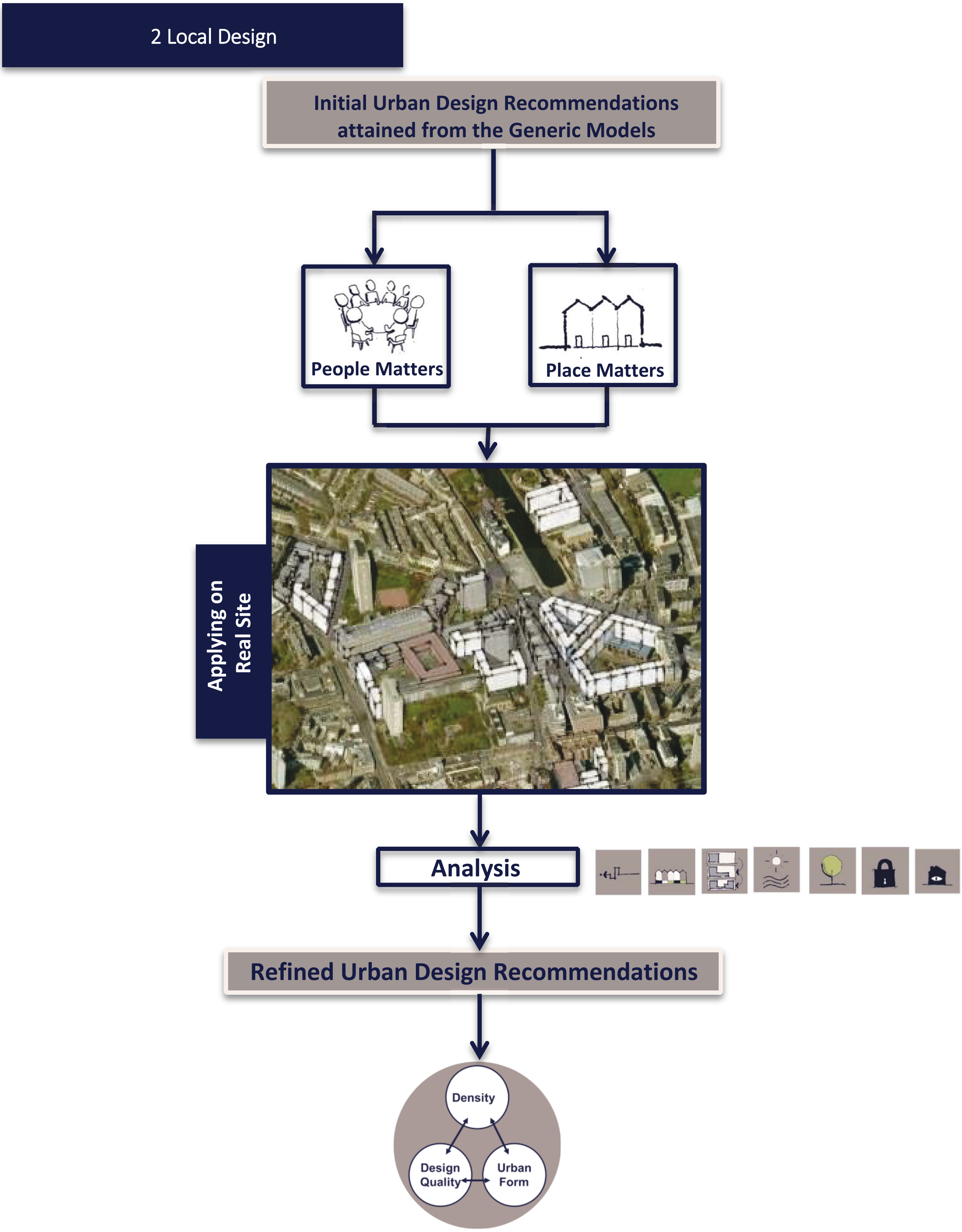


Figure 5.8: Design and analysis process in the 2nd testing part on a real site.

Single case study approach

As explained in the research method, a single case study was used in this thesis. Using a single case study provides the opportunity to conduct an in depth study of a particular case instead of a more superficial analysis of many cases. Moreover, since there are a large number of qualities to be evaluated in the study and given that a complete design process in different ranges of density and with different alternatives (CH10), should be carried out for each case, using a single case can help to provide more detailed investigation.

The use of a single case study has become more common and more accepted in research, particularly in fields close to social science (Flyvbjerg, 2006, Ragin and Becker, 1992, Giddens, 1984, Geertz, 1995). This is based on the argument that, (Flyvbjerg, 2006) although there are limitations in terms of generalization, a single case study can be seen as a tool for verification of a hypothesis. This study developed a theoretical hypothesis in the first part of the thesis and findings were also developed from the generic and abstract modelling in the second part of the thesis. The case study in the third stage was used to verify these theories and generic findings. The result of such testing within a single case study cannot be generalized to other cases, but the thesis can demonstrate the overall research method which can be used in other contexts and cases.

Using the Q methodology for the people matters

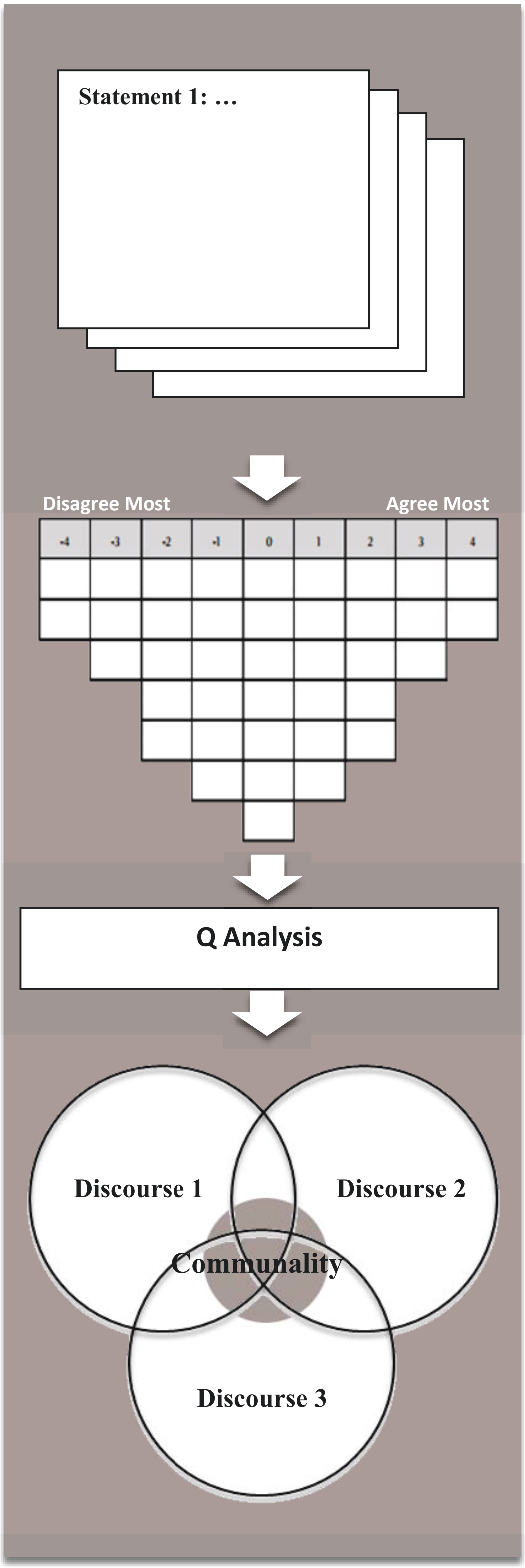
Instead of the conventional qualitative or quantitative method such as survey or semi-structured interviews, in this study, Q Methodology is used to gather the perceptions and viewpoints of locals. Q methodology is a method used to explore subjectivity or individual perspectives about a subject. It can reveal the main discourses and ways of thinking among people around specific topics.

The method was developed by psychologist William Stephenson in the 1930s. The common use of this method is in social and political science as well as psychology (Barry and Proops, 1999). This method has gradually become more commonly accepted in other fields such as health and also in the built environment (ex: Jones, 2012; Van Exel et al, 2004).

Q methodology involves developing statements about a topic and asking participants to rank the statements based on their level of agreement with them. The researcher usually develops the statements based on their existing knowledge of the topic. Then these statements are presented on separate cards (Q cards: figure 5.9, stage 1). The participants in the study are asked to sort these cards on a table based on the degree to which they agree or favour the statements (figure 5.9: Stage 2). Hence, each of the sorting tables from individual participants can show a distinctive point of view about the topic of study. In the next step, the results from the sorting tables are analysed using specialised factor analysis software named PQSoftware (figure 5.9: Stage 3).

Instead of measuring viewpoints across a population, the main purpose of this method is to identify the main discourses or shared views about a subject (figure 5.9: Stage 4). Each individual can then be investigated to see the degree of his/her convergence or divergence to the main discourses. For this study, the discourses can show the major viewpoints and also common attitudes with regards to the matter of densification and new residential developments within the area. Then the designer can arrive at a better understanding of what type of design strategy may be more acceptable for the specific locality.

In this chapter just a general explanation of the q methodology is given in order to establish the overall methodology of the study. The detail operational process of using Q methodology for this study is explained in Chapter Nine related to the People Matters.



1. Developing Statements and Q cards

2. Sorting Q cards on the table by the participant in the study

3. Analysis of the sorting tables via specialised factor analysis software

4. Demonstrating the main discourses about the subject of the study and identifying the communality between discourses

Figure 5.9: The general Q methodology process.
(Also see Appendix Two and Three for specific Q Cards and Table developed for this study.

Rationale of using the Q method

One of the main advantages of this method is that ideas or statements are compared to each other by the interviewee instead of their making comments about individual statements in isolation. This is key for this study as the subject relates to trade-offs between design qualities. While in a semi-structured interview, the participant can comment about each design idea or theme, using this method provides the opportunity for the interviewee to prioritise a group of ideas and compare them. The method also allows the participants to choose only two or three statements (Q cards) to put as the most and least agreeable cards in the table (figure 5.9: table in stage 2). In this way the participant is restricted to choose and prioritise the most important issues with regard to the subject of the study.

This comparison and prioritisation is normally carried out by urban designers in design schemes. Hence this method can put local users in a position to make the same comparisons and express their preferences. Also, this method is a good tool for making stakeholders and users familiar with the challenges related to the process of design.

Another advantage of this method is that the discussion at the end of the interview (after sorting the cards) can be of higher quality, because the interviewee now has a better understanding of the possible opportunities and challenges related to neighbourhood design. In other words, as happened in the fieldwork, the interviewee warms up about the subject and can give better comments at the end of the interview.

5.4 Main design proposals

In the conceptual framework (CH4), it was explained that for the sake of simplification and in order to understand the major changes, this study focuses on specific density targets. The goal of the design process for both the generic and local part of the study is to develop design schemes using these target densities. The target densities, as previously explained, are 200dph and 400dph. These are the final target densities for all of the design schemes, meaning that, in the generic modelling, a 200dph and a 400dph scheme were produced. Then, similarly, the local design schemes applied those density ranges.

The density targets used for the design schemes were meant to be achieved for the whole allocated area of the densification within the neighbourhood. Obviously at the smaller scale, through urban fabric units and residential blocks within the neighbourhood, urban form patterns with higher and lower ranges of density may also be used. This is because the design process aims to be used as a method or tool to identify all the potential combinations of design and urban form patterns to achieve a certain density. Each urban form type which was used in this process can deliver certain qualities to the whole scheme. Therefore, the final target density of 200dph and 400dph were for the whole scheme.

By producing two design schemes, it was possible in each testing stage to identify which design qualities were improved and which were compromised as result of increasing density. These schemes showed the practical options to achieve optimum urban form, considering all the design qualities together as well as the specifications of the local site in terms of physical form and local perceptions. Therefore, comparing these two schemes can show to what extent form and design qualities are likely to change as result of increasing residential density.

In each stage, two schemes were analysed, based on the analytical framework, which is explained in this chapter, and the differences in morphological elements, form and delivery of design qualities were evaluated and compared between the two schemes. The findings from first testing part (generic modelling) were also compared with the findings from the second testing on the real site (local design). These findings result in identifying the three main subjects:

1. The accuracy of the findings of generic modelling for this type of inquiry by design method
2. The limitations of the generic design compared to the real site design
3. Identifying the main improvements and compromises of design qualities at a local scale

The aim of using such a step by step inquiry by design method was to give a better understanding and examination of the whole design process. Through this design process, the major design decisions and selection of urban form patterns was rationalised. The overall design process and the analysis which follows can then be used as a method which can be applied in other places. This means that having a rationale for each step, altering particular steps in the design process for different localities is feasible and therefore the method can be applied in different places.

5.5 Cohesive Analysis Method

In each part of the testing, based on the above explanation, two design schemes with different densities were produced. These schemes were analysed using the analytical framework explained in next section. The analytical framework helps to identify the main changes in urban design qualities in terms of improvement and compromises in delivery of these qualities. While there are different parts to the design and different design schemes in this study, all the final schemes were analysed with the same cohesive analytical method (figure 5.10). In this way, any changes in urban form patterns and design qualities can be compared across the schemes and particularly between the two main target densities.

Through the analytical method, the urban form patterns which were used within the schemes were identified and the major reason for choosing such patterns were explored. Having identified the urban form patterns, the delivery of the urban design qualities for each design scheme can be analysed. In this way, the reason for changes in the delivery of the design qualities should be clearly understandable at the end of the analysis process.

5.6 The analytical table of the research

The urban design qualities were analysed in these schemes using relevant indicators for each. As table 5.1 shows each design quality has a number of indicators. The purpose of the analysis is to identify the major changes in the indicators of each design quality. While measurement of these changes can be carried out in a detailed mathematical and quantitative way, for this research it is preferred to use a more descriptive explanation of the changes. This is because this study tries to point out the major changes and see all these design qualities and their indicators together and explain the trade-offs between them. In this case, identifying major changes in the design qualities by examining their indicators can more conveniently show such changes. This is also because the study focuses on major changes in density ranges and the effects of these significant changes on the quality of urban areas. Such a form of analysis should help designers to predict possible changes in urban design qualities and urban form in middle density ranges which are not precisely covered in this study. The study is intended to help designers to see the changes which result from a combination of design qualities together instead of focusing on detailed changes in individual indicators. As a result, this method can offer a tool which quickly shows the consequences of design decisions.

The process of analysis used here for urban design qualities is to identify particular criteria for each design quality. These criteria are descriptive and explanatory as they explain the major changes in the indicators of each design quality. Therefore, the changes in design qualities are mostly explained by pointing out significant changes in indicators of the design quality.

In order to analyse the changes in the design qualities of the models, an analytical table was developed (table 5.1). This analytical table was used to check and compare, in detail, the changes in the design qualities between the models and to associate these changes with particular choices of urban types and alterations in morphological elements.

The main purpose of the analytical table is to help to identify the main changes in design qualities. In this case, through the table for each design quality, particular indicators were identified. These indicators were derived from the literature review of urban design (see design qualities in Chapter Three) and the methods used to assess the quality of the physical form of a neighbourhood (ex: CABE, 2006 and LEED, 2012). Reviewing the indicators and methods for measuring design qualities from different literature sources, indicators were selected which may be influenced significantly by increased density and hence are discussed through the theoretical framework of the thesis. In this way, the analytical framework should be more specific for the evaluation of design qualities with regards to changes of residential density.

For each indicator, criteria for measuring and assessing the changes were introduced. These criteria were essentially descriptions of different levels of delivery of the indicator. It was attempted to categorise the criteria for most indicators into three levels of low, medium and high showing the degree to which the indicator and the related design quality were delivered in the design scheme. This is an accepted way of structuring the analytical framework for assessing neighbourhood design schemes used in other assessment methods such as USGBC (LEED) (2016), CABE (2006) and BREEAM (2012) for reaching certain criteria. The idea of having unified criteria from low to high has a particular advantage for this study. While the analytical table were developed for each of the designed schemes, the unified form of the table can help the reader to see the change in qualities all together and to compare the analytical tables of different models. In this way, the trade-offs in the delivery of different qualities were more clearly shown all together.

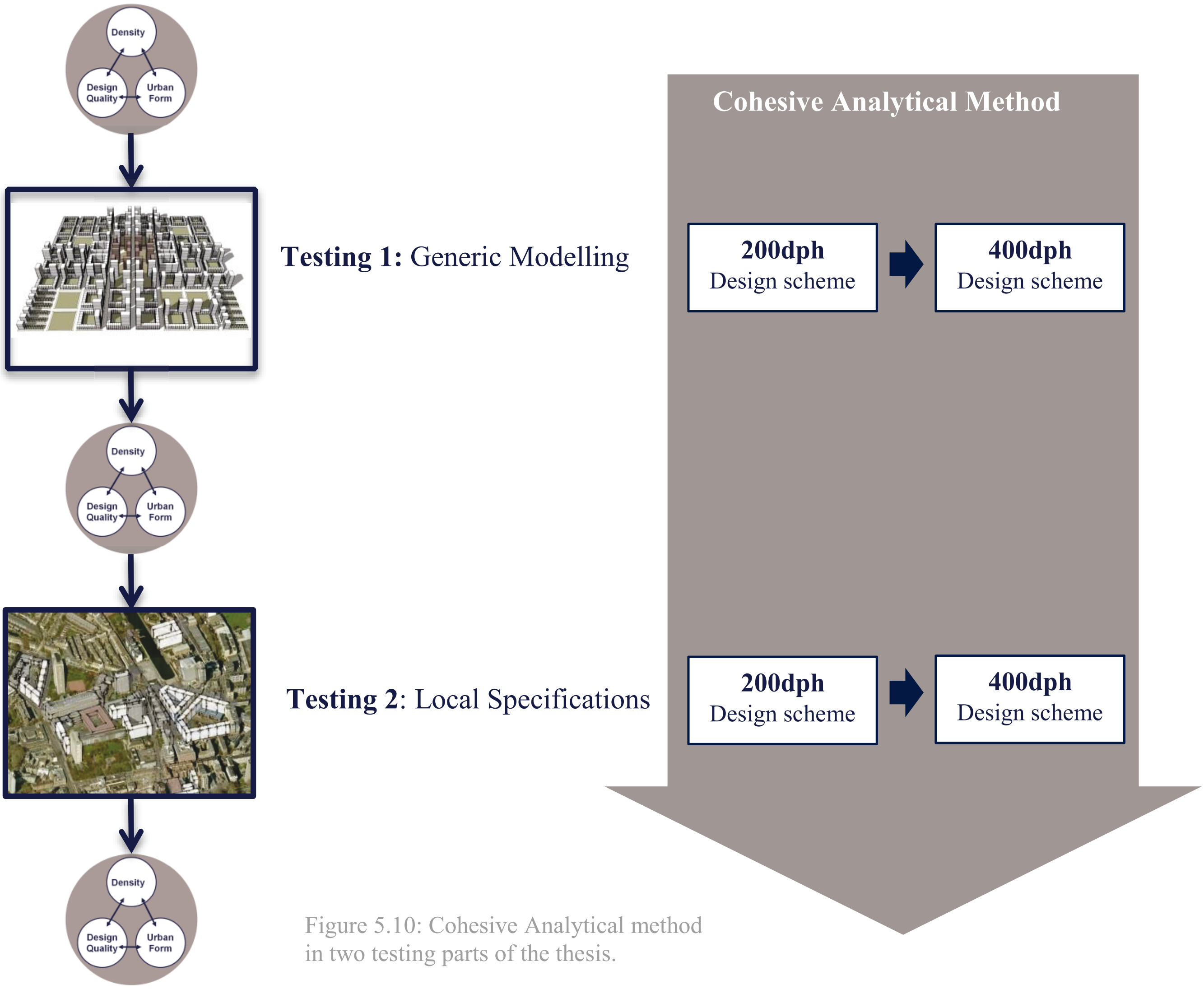


Figure 5.10: Cohesive Analytical method
in two testing parts of the thesis.

Table 5.2: Analytical table of the research

Urban Design Qualities	Indicator	Criteria			Related Morphological Element				
		Low	Medium	High	Building	Plot	Street network	Open spaces	Whole Neighbourhood
Permeability	Average length of block	more than 200m each side of urban blocks	Between 100 to 200m each side of urban blocks	Less than 100m each side of urban blocks			X		
	Existence of cul-de-sacs and dead ends	Approximately one within each bock	Existence of cul-de-sacs but rarely	No cul-de-sacs			X		
Accessibility	Density gradient designed according to main transport and business nodes	Completely in opposite of location of local resources and public transport	No relation to location of local resources and public transport	Directly according to location of local resources and public transport					X
	Walkable distance to services	Most dwellings are further than 800m radius	Some dwellings are in walkable distance and some are further than 800m radius	Most dwellings are less than 800m radius					X
Diversity	Allocation of non-residential uses	Almost no non-residential uses considered within the neighbourhood	A few Non-residential uses exist but not on appropriate for the target	Large number of Non- residential uses exist with the rate appropriate for target density	X				
	Proximity to main non-residential uses: Primary school	Dwellings are not in walking distance (less than 800m)	Average number of dwellings are in walking distance	All dwellings are located in walking distance	X				X
	Proximity to main non-residential uses: secondary school	Dwellings are not in walking distance (less than 800m)	Average number of dwellings are in walking distance	All dwellings are located in walking distance	X				X
	Proximity to main non-residential uses: medical Centre	Dwellings are not in walking distance (less than 800m)	Average number of dwellings are in walking distance	All dwellings are located in walking distance	X				X
	Proximity to non-residential uses: main shopping area	Dwellings are not in walking distance (less than 800m)	Average number of dwellings are in walking distance	All dwellings are located in walking distance	X				X
	active edges produced and distribution of non-residential uses	Rarely active edges within neighbourhood streets	Active edges exist on ground floors but not aligned with location of neighbourhood Centre	Majority of Active edges are distributed in alignment with location of main street and neighbourhood Centre	X				
	Diversity in dwelling size	Just on typical size of dwelling considered in the scheme	Variety of dwelling size is considered but not according to the local household sizes	Variety of dwelling size is considered according to the local household sizes					
Visual variety	Opportunity for personalization at the ground floor of buildings	No front garden or personal space between street and the buildings	In some of the residential streets front gardens allocated for personalisation of ground level	All ground floors in residential streets have front gardens for personalisation	X	X		X	
	Opportunity for vertical division of façade to improve diversity in visual experience	Only Large buildings and plots (more than 8-10m) with repetitive and monotone facade	Mix of large and small plots and buildings	Mostly small plots and buildings that can provide opportunity for vertical division and visual variety of streets cape	X	X		X	
Adaptability	Potentials for change of use in dwellings via making quick access from building to public space.	average distance dwellings from public street is more than 6 floors and more likely via elevators	average distance dwellings from public street is between 4 to 6 floors	average distance dwellings from public street is less than 4 floors and commonly via just stairs	X				
	Potentials for gradual change of urban form	Very low, potentials due to large buildings and plots (such as 20 – 30 meters width) or completely block base urban form of the neighbourhood	Medium range, because of existence of large grains in shape of large tower blocks or block base typologies in some parts of the neighbourhood.	Very high, due to small grain of the urban form and use of plot base typologies with around 8 to 10 meter width of plots in the neighbourhood.	X	X			
	Opportunity for communal activities in semi open spaces in centre of the blocks	no communal space is allocated within the urban area	Communal space are allocated within some of the urban blocks large enough for allocation of meeting and resting space and greenery	Communal spaces are allocated for all residential urban blocks and spaces are allocated for activities such as meeting, playing, planting and social gatherings.				X	
	Possibility for extension in buildings	No space is allocated for further extension of the building in future.	In some urban blocks front and back gardens are allocated for potential extension of the buildings.	In all urban blocks front and back gardens are allocated (even small back ages next to communal gardens) for possibility of further extension of buildings.	X	X			
Biodiversity	Total Public green space per person	Sqm/pp						X	
	Total Communal green space per person	Sqm/pp						X	
	Connectivity of green spaces	Lack of connectivity between green spaces	Some green spaces are connected via green corridors such as tree lines and front gardens	All green sizes are connected to each other's and surrounding green areas via green corridors			X	X	
	Accessibility to green space (within walking distance of dwellings	Most dwellings are further than 800m radius to any green public space	Some dwellings are in walkable distance and some are further than 800m radius	Most dwellings are less than 800m radius to public green space				X	X

	Possibility for Variety of activities and character in green space	Green spaces have visual quality without opportunity of any activities	Green space can be used for walk, meet and rest	Green space has enough space for recreational activities allocating playground and sport field				X	
	Opportunity for use of greenery on exposed surface of buildings	Lack of any space for greenery within the buildings exposed surface	Some space are allocated for greenery such as green roofs	Most of the buildings ae used for allocation of green roofs and also roof gardens on large buildings	X				
	Opportunity for local food production (allotments)	Lack of any allotment within the neighbourhood	Existence of allotment but not in short walking distance (200m) to all dwellings	Existence of allotment in short walking distance (200m) to all dwellings				X	
Environmental comfort	Receiving sunlight for all dwellings during the day	More than 50 percent of dwellings do not receive any direct sunlight during low angled sunlight in winter	Majority of dwellings receive few hours of direct sunlight during low angled sunlight in winter	Almost all dwellings receive direct sunlight for long hours during low angled sunlight in winter	X			X	
	Receiving sunlight for all green open spaces during the day	More than 50 percent of green open space on ground level do not receive any direct sunlight during low angled sunlight in winter	Majority of green open space receive few hours of direct sunlight during low angled sunlight in winter	Almost all green open spaces receive direct sunlight for long hours during low angled sunlight in winter	X			X	
Resource efficiency	Average exposed surface of dwellings (for loss of energy)	Sqm per dwelling			X				
Legibility	legibility of public space network	No use of legibility elements such as distinctive form or character for public space. No visual permeability of street network and common use of dead ends in design of street pattern	Use of some distinctive character for nodes and edges of neighbourhood. Street network is visually permeable but dead end streets exist.	Use of distinctive character for nodes and edges of neighbourhood. Distinction of main roads is noticeable. Street network in visually permeable.				X	
	Legibility through use of landmark buildings	No specific land mark designed within the area.	Some use of distinctive buildings through the neighbourhood.	Distinctive and memorable buildings are improve the legibility of the whole city and are visible from long distances.	X				
	Change of character of buildings and open spaces from centre to edge of neighbourhood	No difference of character is considered from centre to the edge in terms of size and height of buildings	Variety of character is partially visible in some morphological elements but do not represent the distinction between edge and centre of neighbourhood.	Variety of character from edge to Centre of neighbourhood in terms of height and width of buildings, plot size and activities in public spaces, representing busy to quiet area in the neighbourhood	X	X			X
	Varity of public spaces character within neighbourhood in terms of form, use and activities	All public spaces have relatively similar size and form and similar type and shape and use in surrounding buildings	Moderate differences exist between public spaces in terms of shape and form of surrounding buildings.	Variety in character of all public spaces from active central areas to completely residential streets in all terms of form, use and activity	X		X	X	X
Character & Distinctiveness	Similarity of form and grain size in the urban layout to surrounding built environment	Completely different form in terms of size of buildings and plots from the surrounding.	Generally the design of buildings and plot sizes respect the existing context but not in all areas.	All new design layouts have similar character in terms of size of buildings and plots.	X	X			
	Respecting the existing height of buildings within the area	New buildings have totally different range of height from the existing form	New buildings have moderately similar height to the existing form but not in all areas	New buildings have completely similar height to the existing form in all areas	X				
	Distinctive characteristic of neighbourhood from surrounding areas	No significant difference in character from surrounding areas.	Differences in character exist moderately in some of the morphological elements but may not make distinctive boundaries between neighbourhood and the surrounding built form	Significant differences of character in terms of building height or open space size and form					
Safety	Overall length of Active edges at ground level of streets	Less than 30% of the streets have active edges in either sides	Between 30% to 60% of the streets have active edges in either sides	All streets have active edges in either sides			X	X	
	Clarity of public, communal and private space	The urban layout has mix of private and public open spaces together with no significant barriers.	In some of the design blocks the urban layout makes clear distinction and separation of public and private spaces and prevents from public access to private or communal open spaces.	In all blocks the design of urban layout has made separation of public space and private gardens. Also in front side entrance of buildings there is a hierarchy from public to private space on the.			X	X	
Privacy	Keeping appropriate back to back distance of dwellings	Majority of dwellings within blocks have less than 22 meter back to back distance.	In some of the residential blocks dwellings have less than 22 meter back to back distance.	All residential blocks are designed with consideration of more than 22 meters back to back distance of the dwellings.	X			X	
	View from street to the house in ground floor	Private spaces of the ground floor dwellings are visible from public street.	Front gardens and change of height is considered in some of the streets to reduce the visibility of private spaces in the ground floor from the street.	Front gardens and change of height is considered in all residential streets to reduce the visibility of private spaces in the ground floor from the street.			X		
	View on private gardens from other dwellings	All private gardens and open spaces are overlooked by large number of adjacent dwellings due to height of the surrounding buildings	Some of the private gardens are overlooked by the surrounding buildings.	No private garden is overlooked by the surrounding buildings.	X			X	

5.7 Chapters structure for analysis part

As explained, the testing stage of the thesis which starts after this chapter is in two main parts: generic modelling and local design. While a similar analytical method was used for the final design schemes in both parts, the design process had significant differences. This is because, in the generic modelling, particular design issues were discussed and then, in the local design section, different topics were taken into account. Hence, there were major differences in the discussion and explanation of the design process for these two parts. Also, the basic design process which is established in the generic modelling is also used as a bench-mark for new designs applied to a local basis, and the discussions were mostly focused on matters which were specifically related to local conditions. Therefore, these two parts are separated and shape the main organisation of the chapters in the next part of the thesis.

Moreover, the data collection methods for these two parts of the inquiry by design were significantly different.

The generic modelling involved using secondary data to establish standards and bases for the design process having a validated rationale for the abstract design schemes. Mostly existing standards and housing design targets from the general urban design literature, local plans and national policies were used to develop the design scheme. The local design, on the other hand, involved more gathering of primary data to address both place and people matters in the chosen locality. Therefore, a detailed explanation of the data gathering method and analysis of the data was provided. In addition, the results of the generic modelling influence the main design issues which were explored through the data gathering for the second testing part of the research (design for a real site). Given this, it was decided to include an overall methodology chapter to explain the major procedures, as well as explaining the detail parts of the research method separately in each testing section.

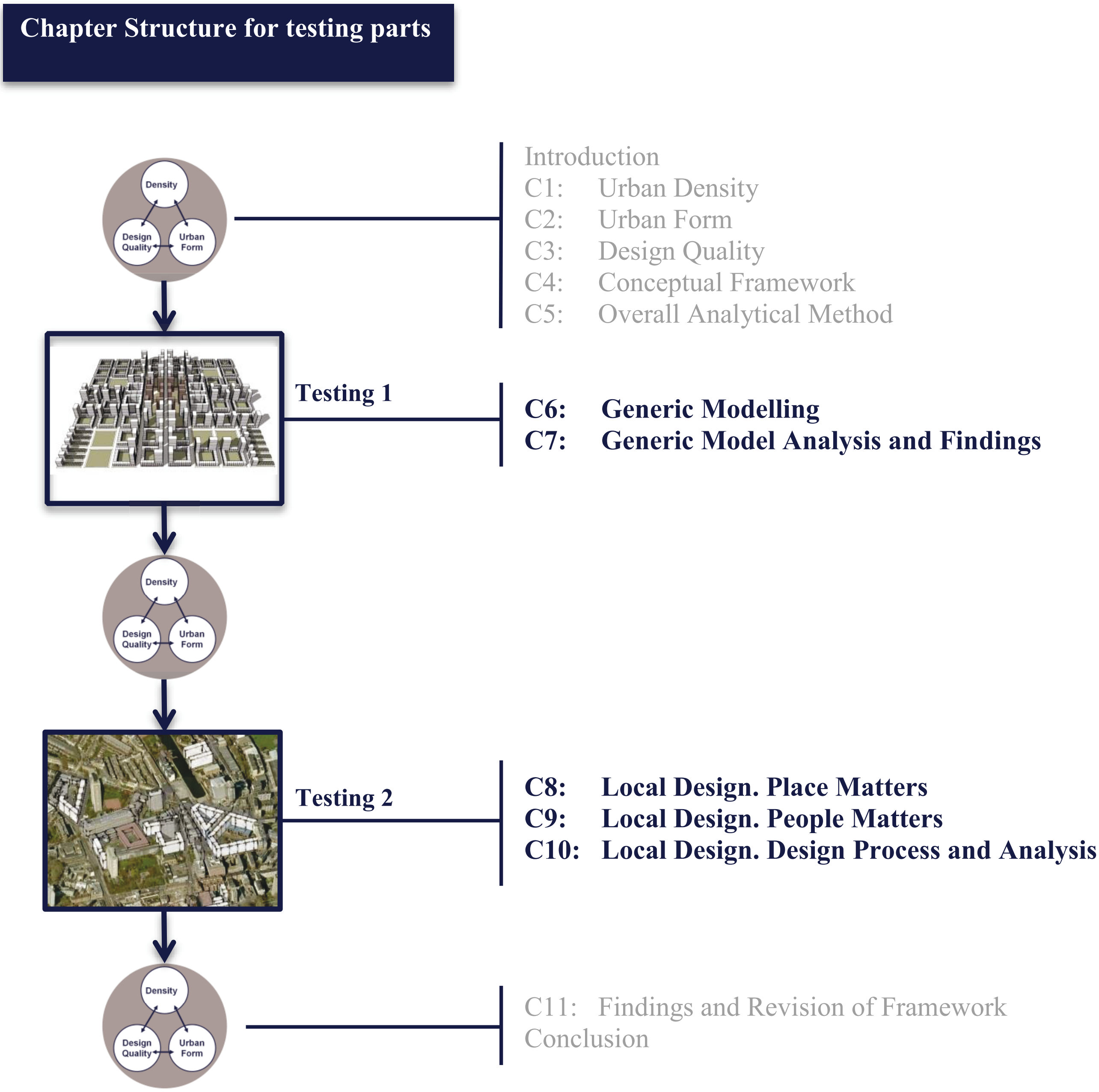


Figure 5.11: Chapter structure regard to the two testing parts of the research. More details about the structure of the chapters are already explained in Introduction Chapter: Section 0.9

5.8 Proposing practical design principles

Finally, at the end of the analysis, the main findings of the research were produced. Having completed the analysis of design schemes of different density ranges, the study concluded with the key findings about the influence of changes in density on the design quality of the public realms. The result of the analysis was developed in two main categories. The first contained the key findings and facts about the improvements in and compromises made between design qualities as a result of the densification process. The second contained recommendations as to the design principles which are intended to help designers make better decisions throughout the design process and maximise the delivery of each design quality as much as possible through the densification process.

Finally, after detailing the analytical process and recommendations, the study went back at the end to review the theoretical assumptions about the relationship between the three main concepts and also the method which were used for testing these assumptions. This means at the end it can be understood to what extent the conceptual framework and methodology were capable of showing the relationship between the three concepts and to produce practical recommendations to improve the delivery of urban design qualities through densification schemes.

5.9 Conclusion

This chapter has explained the overall inquiry by design method and the method for testing the research theory. In order to test the theoretical propositions of the research from Chapter Four, an inquiry by design method containing two stages of testing has been developed. The testing has been undertaken via a process of design and evaluation and comparison of neighbourhood models. The testing starts from a more general and ideal type of design at the first stage and then focuses on a specific neighbourhood for more practical testing at the second stage. In addition, a cohesive method of evaluation for design schemes has been developed so that, at the end, the developed schemes can be compared with each other.

The chapter explored the two main test sections, including the generic modelling and local design. At each stage, models of the neighbourhood with two specific ranges of density were produced. In the generic modelling part, a more abstract type of neighbourhood has been designed. Then, in the local design section, the design process becomes more specific and for a particular real neighbourhood. The chapter also introduced an analytical framework which is used to analyse all the design proposals with different densities. This analytical framework provides a unified process for the evaluation of the design schemes through the whole thesis.

A key part of the explanation in this chapter related to the indicators for the design qualities included in the analytical framework of the thesis. These indicators were used to identify and explain changes in different aspects of the design scheme, and to show how the qualities of a neighbourhood are changed as a consequence of the design and densification process. This goal was achieved by applying precise criteria and a descriptive explanation of the changes in indicators. These changes were organised in categories from low to high, showing the degree to which each design quality is delivered. The main benefit of these indicators is that they can help designers and researchers see all the changes together. In this way, the evaluation method is useful for designers to understand the main gains and losses of the design qualities, while changing the density target of the scheme. Such a framework also helps to provide a simple and easy way to show and explain these changes of qualities. Then, designers have more opportunity to make alterations to the design scheme by having a quick process of design, evaluation and change in their design proposals.

From the next chapter onwards, the detailed process of testing is explained and carried out. The first testing part is the generic modelling. The analytical method introduced in this chapter will be used during the testing process to evaluate to what extent design qualities are delivered in the design schemes produced in the next chapter.

Chapter Six
Generic Modelling

6.1 Introduction

This chapter is the starting point of the testing part of the research. The testing process is explained in chapters six and seven of the research. The aim of this chapter is to explain the process of the generic modelling and establish the benchmarks and rationale for the design process. At the end of this process, the chapter introduces the final generic models of a neighbourhood with different target densities for further evaluation in the next chapter. Based on this, the chapter also completes the third objective of the thesis:

Objective 3: To produce generic models of a neighbourhood with different ranges of density as the primary part of the inquiry by design process

The chapter explains in detail the method which is used for generic modelling. In Chapter Four the relationship between the three main concepts of density, form and urban design qualities was explained. It was seen that there are specific patterns of change in urban form as a result of increases in density. Putting these patterns together, the study identified five major urban typologies. These typologies represent specific patterns and characteristics for each element of urban form. For example, urban type 2, flats with private gardens, represents urban types which have small plots containing flats with divided open spaces at the centre of the block.

It was also explained that some of these typologies are more likely to be developed at higher densities and some of them at lower densities. In other words, some patterns and characteristics of urban form are more common in higher density and others in lower density areas.

In this chapter, a method is proposed to test these changes of urban form and to understand to what extent each of these different types of urban forms can deliver good design qualities. Finally, Findings about the most appropriate patterns of urban form in different ranges of density and to develop recommendations and principles to achieve optimum design in each range of density are presented. Here optimum design means the design which can offer the highest standard of delivery of the qualities discussed in previous chapters.

6.2 Generic modelling for this study

In this chapter, four steps in the process of generic modelling are explained. This section shows why these steps have been chosen and how these steps help to improve the generic modelling in order to deliver the design qualities which are of concern in this study.

Overall, this process moves from simple and smaller scale to more complicated design. At the first stage, the design and study remains at the scale of urban blocks, but, at the next step, the design is at neighbourhood scale.

Generally, step by step improvement in design schemes, requires a brief analysis and examination of the extent to which target qualities are achieved in the design, and what should be done in terms of changes in urban form to reach a better delivery of these qualities. In this case, the process of design cannot be completely separated from the analysis. Hence, in some parts of this modelling some brief analysis based on the analytical framework is carried out in order to produce a better design for the next step. Overall, the author has tried to separate the design process in this chapter from the main analysis in the next chapter, but still in this chapter, in order to reach the optimum design solution, it is necessary to briefly evaluate the design scheme at the end of each step.

Modelling at different ranges of density has been conducted, so that in the final model we can compare the optimum designed models with different densities. In this way, we can see to what extent each model may achieve specific qualities from the analytical framework, and may be less likely to achieve others.

Looking at the London Plan (GLA, 2015) the maximum residential density target for London is 400 dwellings per hectare (dph) which is for central areas with highest public transport accessibility. Hence, residential density of 400dph is chosen to be one of the density targets for modelling so that we can see the maximum acceptable residential density in London, initially, regardless of the local context.

Then, 200 and 600dph net density have been chosen to show higher and lower target densities. This ensures there are significant differences between the chosen densities. Also, the design starts from block modelling and then goes to neighbourhood scale. Hence, 200, 400 and 600dph density targets can help put different blocks together and achieve the specific density targets. This process is further explained in the stages of generic modelling (section 6.4).

On the other hand, although dwelling per hectare net density has been chosen as the basic measure of density for this stage, during the design process, other measurements will also be shown, particularly plot ratio which is the most accurate density measure in relation to urban form. However, because of the common use of the dwelling per hectare measure in the UK planning literature and the simplicity of explaining and communicating the density ideas for professionals and users in the next stages of the research, it was decided to use this specific measure and to convert it to other measures whenever it is helpful.

6.3 Bases and Standards for Generic Modelling

In this section, the bases and standards for the generic modelling are established. While the modelling is abstract, these bases are used as the starting point of the modelling. Here, some standards for residential urban form are introduced so that the design decisions for the generic models have a rationale based on the existing body of literature. Different aspects of urban form such as the size of dwellings, street patterns and neighbourhood sizes are explored and the reasons for choosing specific sizes and measures are explained referring to the literature of urban design or the housing guidelines for the context of the UK.

Depth of buildings:

English Partnerships (2007) suggest 9 to 13 meters as the ideal depth of residential buildings for good ventilation and natural sunlight. They also suggest that up to 16 metres is the maximum acceptable depth if the secondary spaces, such as toilets and corridors, are located in the centre of the building. Bentley et al (1985) also suggest a similar range of 12 to 16 metres depth for residential buildings. Based on this, for this study in lower densities such as 200dph, a depth of 12 metres has been selected for the buildings and for higher densities, a depth of 16 metres has been chosen.

Size of dwellings:
The size of dwellings is established based on the minimum space recommendations from London Plan (GLA, 2015; p78):

1 bedroom: 45 sqm (square metres)
2 bedrooms: 65 sqm
3 bedrooms: 85 sqm
4 bedrooms: 95 sqm

While the sizes represent the minimum space needed for dwellings, additional space should be considered for stairs, elevators and circulation between flats. Each floor has around 15 m^2 for a staircase, an elevator and a corridor. So if this space is used to access two average size flats (say 75 sqm), then around 10% space should be added to the overall floor plan for modelling. Therefore, this 10% space will be accounted for in the modelling. Although this amount may vary in different cases and different architectural designs, adding it to the total amount of space for dwellings can make a more accurate calculation for the total floor space in the modelling.

Variety of house size
This would be different according to local needs, but as we are making a generic model, the overall recommendation for the whole of London is used for this study.

- 1 bedroom: 32%
- 2/3 bedroom: 38% (can be 19% 2 bedrooms and 19% 3 bedrooms for this study)
- 4 bedrooms: 30%

Based on: London plan density matrix review (2006: 50) and SPG housing (GLA, 2005: p33)

Table 6.1: Space requirements for urban blocks in each range of density

200 dph Block reqi

Type of House	Size of flat (sqm)	Percentage of Total Housing	Number of Houses	Total required space (sqm)
1 Bedroom	45	32%	64	2880
2 Bedroom	65	19%	38	2470
3 Bedroom	85	19%	38	3230
4 Bedroom	95	30%	60	5700
		100%	200	14280

14280 Sqm	Total net required space
Adding 10% circulation space	
15708 sqm	Total required space
1.5	Plot ratio
4.8 Storeys	Number of storeys based on 3264 sqm footprint of buildings

400 dph Block reqi

Type of House	Size of flat (sqm)	Percentage of Total Housing	Number of Houses	Total required space (sqm)
1 Bedroom	45	32%	128	5760
2 Bedroom	65	19%	76	4940
3 Bedroom	85	19%	76	6460
4 Bedroom	95	30%	120	11400
		100%	400	28560

28560 Sqm	Total net required space
Adding 10% circulation space	
31416 sqm	Total required space
3.14	Plot ratio
9.6 Storeys	Number of storeys based on 3264 sqm footprint of buildings

600 dph Block reqi

Type of House	Size of flat (sqm)	Percentage of Total Housing	Number of Houses	Total required space (sqm)
1 Bedroom	45	32%	192	8640
2 Bedroom	65	19%	114	7410
3 Bedroom	85	19%	114	9690
4 Bedroom	95	30%	180	17100
		100%	600	42840

42840 Sqm	Total net required space
Adding 10% circulation space	
47124 sqm	Total required space
4.71	Plot ratio
14.4 Storeys	Number of storeys based on 3264 sqm footprint of buildings

Street pattern and urban blocks

In order to keep the permeability to a reasonable level, urban blocks are designed to be around 100 metres by 100 metres in size. This is also based on suggestions made by Bentley (1985) and English Partnerships (2007) with regard to the ideal size of a block. Barton (2010) also suggests the same optimum range of block size and recommends avoiding block sizes larger than 200m depth. Having such a block size would mean that the distance of the street junctions would remain less than 100 metres within the whole neighbourhood. Hence, such a design decision is likely to results in a good connectivity of street patterns and a good flow of traffic within the neighbourhood.

Street width:

- For fewer than 5 floors: 20m
- For more than 5 floors: 27-30m

Based on: By Design (2000, page 22)

Neighbourhood size

Size of neighbourhood: 800m width, 800m length

This neighbourhood size ensures that all dwellings lie within a 10-minute walking distance from all local facilities. Studies such as that by Barton, (2007, p 115) indicate that within 800m, 60% of trips would be on foot. Besides this, in this neighbourhood size, the maximum length of trip is around 800m (ten minute on foot), but most services will be in the centre which will be less than 400m distance (five minutes on foot).

Also, the ideal recommended school catchment radius is 800m, but 1000m is also still acceptable (Barton, 2010:132), so this size of neighbourhood also fits the criteria for school catchment area.

Non-residential uses:

An area of 800 by 800 metres is allocated for all dwellings; non-residential uses also count in net density measurement. Other large land-consuming uses stay outside of this boundary such as hospitals and recreational usage.

The initial approach for this research was to calculate the total dwelling space of the neighbourhood and add a certain percentage of this amount (say 15% to 30%) for other uses. However, it was not possible to consider a few hectares for separate out non-residential use and to put residential buildings in other places because the point of this modelling is to combine residential and non-residential floor space together in the central part of the neighbourhood. A study was carried out by Greater London Authority (GLA, 2012) to test non-residential density using the same approach as was used by the author of this study, by adding 22% floor space for non-residential uses. Since this approach by the GLA (2012) was similar to the calculation used in this study and was carried out for the same local context in the UK, this percentage has been used as a benchmark for calculating and adding the amount of non-residential space to the generic models.

Open spaces

For allotments, it is recommended by Barton (2010: 138) to have a 200m distance from each dwelling.

Pocket parks should be at a 400m distance from all dwellings. Barton, 2010: 139

Playgrounds should be at a 400m distance from all dwellings. Barton, 2010: 139

A 0.2 hectare kick-about area for the neighbourhood is also recommended. Barton, 2010: 139

Based on these standards, it has been decided to provide a 1 to 2 hectare open space within each 400 by 400 meters quarter of the block allocated for the above uses (figure 6.1). Therefore, all dwellings will have around 200m distance from these open spaces which are a combination of pocket parks, allotments and playing areas. These are all counted in the net density of the model (within the 800x800m boundary)

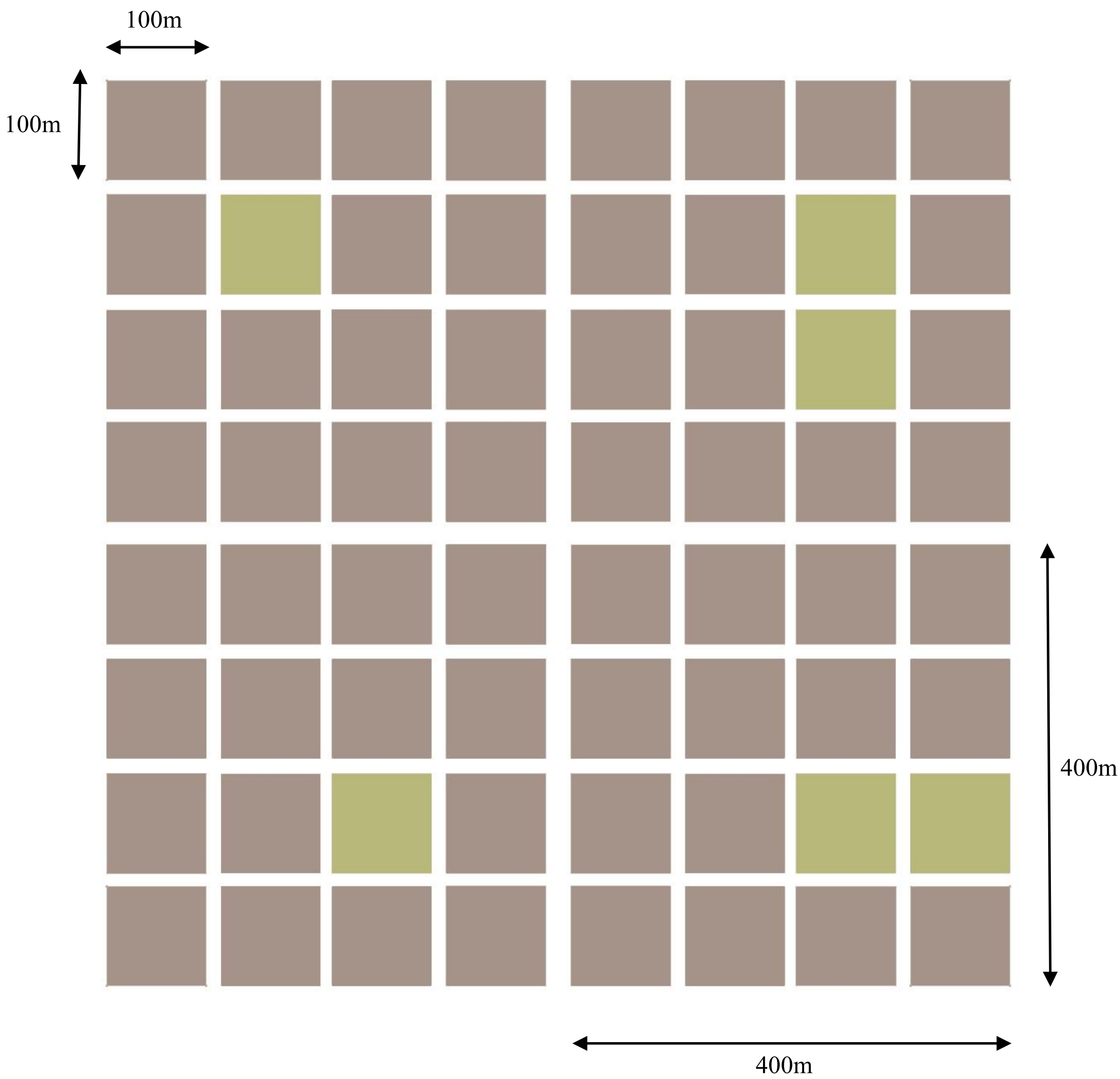


Figure 6.1: Arrangement of Urban blocks in the Generic model of Neighbourhood:

64 hectare neighbourhood

800 to 800 meters width

100 to 100 meters urban blocks

6 hectare green open spaces.

6.4 Stages in the Generic Modelling

In this section the process of the design is explained in four key steps. Through these steps the generic modelling starts from designing urban blocks and then the modelling process expands to the whole neighbourhood. The process starts from small scale and progresses to large scale and also progresses from simple models into more complicated combinations of urban blocks with different shapes and types in a neighbourhood. This step by step process helps to explain the reasons for each of the key design decisions.

6.4.1 Step one: urban blocks modelling

As discussed in Chapter Four, there are specific patterns of change in urban form as we go from low to high density. These main patterns of change show in five main types of urban block. In the first stage of the generic modelling, all of these five urban form types were modelled in three ranges of density which are 200, 400 and 600 dwellings per hectare (Figure 6.1). Looking at these models and trying to find examples in the real built environment similar to each type, it appears that some of these urban types are more common in lower density ranges (such as 200dph and lower) and some are more common in higher density developments. In this section the models and their common densities have been shown and explained and also some examples of real development from each specific common type are introduced.

In the next stage of the modelling, which is at the neighbourhood scale, these common block types are used for the modelling. More in depth and detailed analysis of design qualities in these block types at the scale of the neighbourhood are shown in the next chapter (analysis of generic models); but the brief analysis here demonstrates why some block types are preferred over others for the neighbourhood scale modelling.

In this section, real examples are used to demonstrate each of the urban form types. The main discussion and reasons for shaping these forms were discussed in Chapter Four. The examples provide evidence of the extent to which each of these urban form types can deliver specific design qualities. Referring to real examples here helps to develop a more tangible understanding of how each of the urban types which are used in this chapter for the generic models can appear in reality. Therefore, the generic design can consequently have a more valid basis in the real world. In the following sections, each urban type is discussed individually with reference to two real examples:

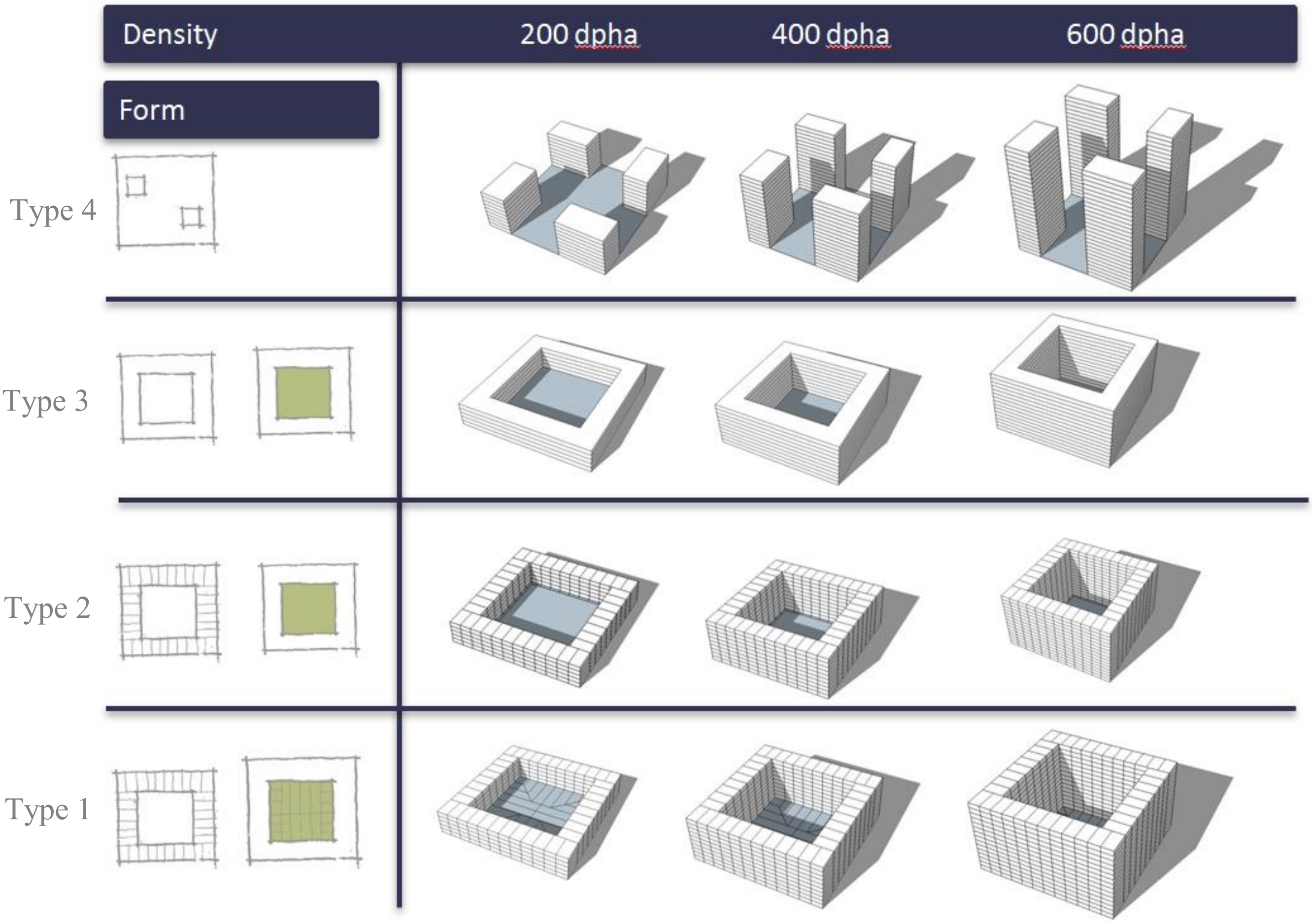


Figure 6.1: Four urban form types in three ranges of density.

Source: Author

Urban Form Type 1

As discussed in Chapter Four, this is one of the most common residential urban form types in the UK. This type consists of small plots and buildings with separate open spaces serving as back gardens within the block. The main feature of this typology is the potential for gradual changes in form due to the small separated buildings and open spaces. For this reason, this is a common type of urban form in traditional cities within the UK and Europe.

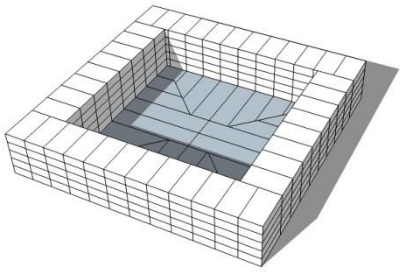
The first example of this type has been chosen from West London (figure 6.2). This urban form type can reach more than 200dph with buildings between four to six floors high. This is a common example of traditional housing form within London. Historically, such buildings could be used as individual terraced houses for large families. However, currently, buildings in this type of urban block are used as individual flats with each floor accommodating more than ten separate dwellings. This is partly because of the gradual change in household size to smaller families and also because of the higher property values of these residential blocks due to their proximity to Central London.

Despite the common use of this urban form in London historically, this typology is less frequently used for new residential developments. Part of the reason for this is that a large amount of space needs to be allocated in each of these small plots for circulation spaces such as stairs and lifts based on the more recent standards of design. In some of these traditional buildings, the amount of space allocated for staircases is very small and does not completely match the high number of flats allocated to these buildings.

Even with the drawbacks of this typology in terms of contemporary design and lifestyles, there are still examples where it has been used in new developments. Example 2 shows a recent design project from MVRDV which has the characteristics of this urban form type (figure 6.3). This project has small plots consisting of flats with narrow, divided back gardens. The main feature of this type is that small plots can provide opportunities for more diversity in building forms and, hence, to the streetscape. This form is also more adaptable for incremental changes in the long term similar to the traditional form in example one. This adaptability is due to the use of the small plots. As this example shows, new housing can be added to the back gardens without changing the height of buildings in the front or changing the character of the street. This is one of the features that makes this typology more flexible compared to the next urban form type.

On the other hand, the main drawback of this typology is that back gardens are generally small and narrow and, in high density areas, these spaces are highly likely to be overlooked. For this reason, the back gardens are unlikely to be used by individual families in the traditional manner; they are more likely to be used just as green spaces and are not commonly used by residents living in flats.

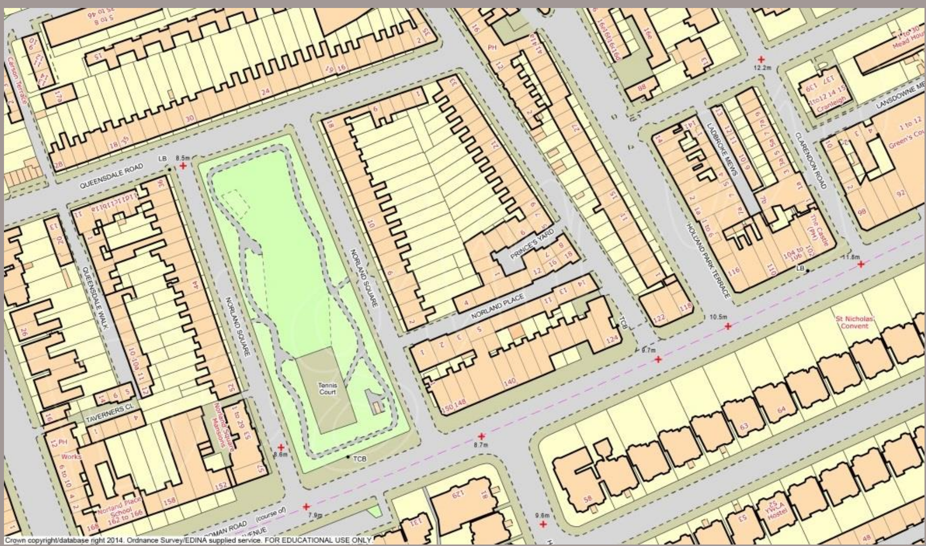
What follows is the main advantage of this urban form type lies in its potential for adaptation and the main drawback relates to the small narrow back gardens which are less useful where there are high numbers of residents. For this reason, this urban form type is rarely used in very high density areas. It is more common to see this urban form type in density ranges between 100dph to 200dph. The generic shape of this type in three ranges of density is shown in table 6.1. For the generic modelling, this urban form type is mostly used in the lowest density (200dph).



Urban form type 1:
Flats with private back gardens,
in 200dph range

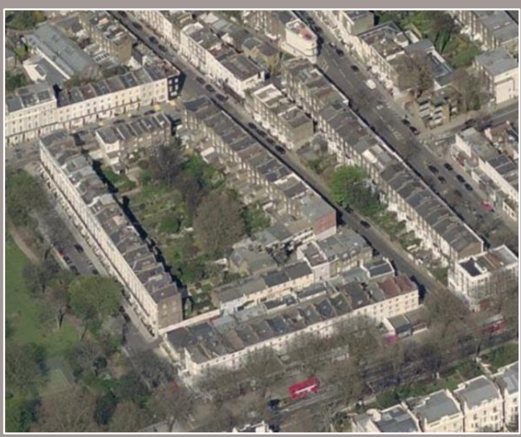
Norland Square, London

This is a common block type in London, particularly in Georgian and Victorian housing which may be used as one terraced house for a large family but is now used as separate flats.
Source: Google map



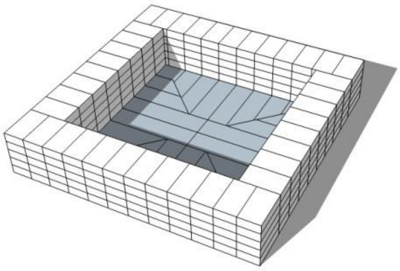
Narrow small size plots.

Source: Digimap



Ariel view, Source:
Bing Map

Figure 6.2: Real example of urban form type 1



Urban form type 1:
Flats with private back gardens,
in 200dph range

Emmen, Switzerland, Proposal by MVRDV Studio

Due to copyright reasons, the image has been removed in the online version of thesis.

Source:
http://www.dezeen.com/2013/07/11/mvrdv-wins-swiss-housing-competition/

Due to copyright reasons, the image has been removed in the online version of thesis.

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Figure 6.3: Example of urban form type 1

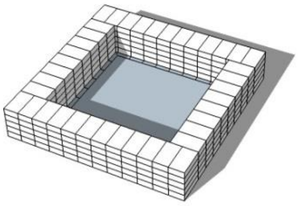
Urban Form Type 2:

As introduced in Chapter Four, the main feature of this type is the allocation of communal gardens instead of divided back gardens. As Tarbat (2014) shows, this form of urban block is more common in new residential developments in Europe with the benefits of small grain buildings while having the advantages of communal open spaces serving a higher number of residents.

The first example below (figure 6.4) shows a recent development in Denmark with five to seven floors on each side of the block and an average 10 meter width of plots and buildings. While such small plots bring visual diversity to the streetscape, the centre of the block works as a unified open space for the use of all the residents of the block. This type has recently been used in developments in London such as in Greenwich Millennium Village (figure 6.5).

The main advantage of this typology is the opportunity for social activities in the communal spaces which, as Masnavi (1998) points out, is one of the crucial issues in high density residential neighbourhoods. The communal gardens can provide space for residents to meet, relax and play and can create more of a sense of community among those living in high density urban blocks. Furthermore, this type of urban form offers more opportunities for all to use the open spaces compared to the separate small back gardens in type 1 which are normally only used by residents living on the ground floor. In addition, the maintenance and management of the open spaces is more likely to be carried out centrally and will therefore involve the community of residents as a whole.

Based on these features, this type can be more useful than type 1 in the higher ranges of density used in this study. Although both of these types have been used in the modelling, the second type is more often used in 200dph urban blocks compared to type 1. However, both of these types are used in order to offer a variety of choices to residents and to match their life styles and use of open spaces. Due to the small plots and buildings, this type is not commonly used in very high rise typologies (buildings with more than ten floors). Therefore, it is more likely to be used for urban blocks with a 200dph density.



Urban form type 2:
Flats with Communal back garden,
in 200dph range

Slusehomen Street, Copenhagen, Denmark

Source: Bing map

Source: Google map

Despite having one large communal garden in the centre of blocks, the buildings show high degree a variety in shape and design due to plot base typology.

Source: Bing map

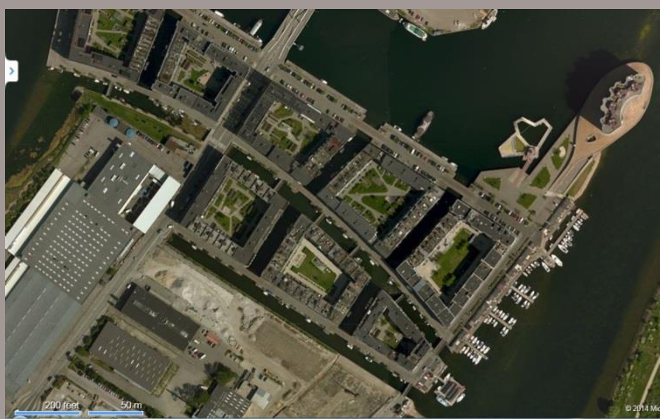
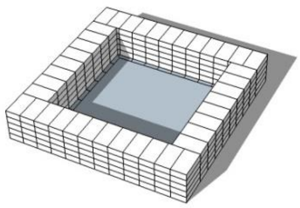


Figure 6.4: Real example of urban form type 2



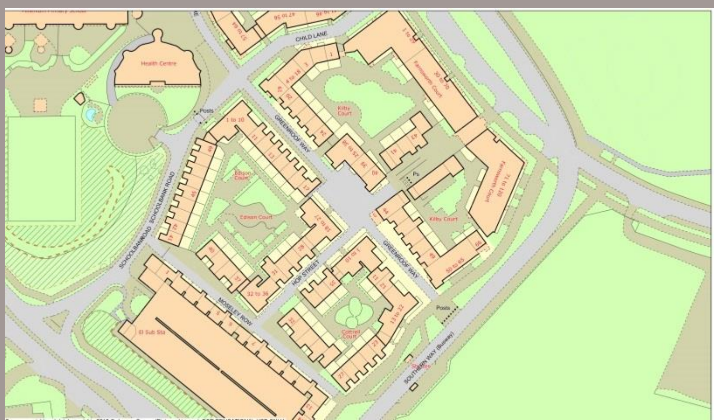
Urban form type 2:
Flats with Communal garden,
in 200dph range

Greenwich Millennium Village

Source: Bing map

Buildings in these urban blocks have diversity of shape and character and height; and also are flexible for incremental changes due to plot base typology.

Source: Google Map



Source: Digimap

Figure 6.5: Real example of urban form type 2

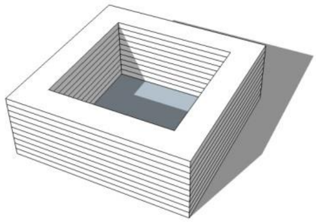
Urban Form Type 3

This type is more common in high density/ high rise developments, particularly those with buildings of more than eight to ten floors. It is also more common in new developments in London such as East Village (the Olympic Village). As discussed in Chapter Four, the main feature of this type is its very large plots or even totally block based form with no division between the buildings in the blocks. Figure 6.6, the East Village in London, shows a real example of this urban type with large buildings. Example two, Canada Water new developments in London, shows an example of urban blocks in this type with a completely block-based form with no division between the buildings (figure 6.7).

The large buildings in this type result in there being more corridors, usually in the centre of each floor, to provide access to the different dwellings. On the other hand, the total number of staircases and elevators used in these urban blocks is relatively small. From an architectural point of view, there is more room to have a variety of floor plans and flexibility in the interior design of the buildings.

One of the main opportunities afforded by this type is that, due to the large buildings, the roof tops can be used as additional communal green spaces for the entire block. Such roof gardens are common in real life examples of this urban form type such as in the East Village. Due to their size, these gardens can contribute to the overall biodiversity of the neighbourhood.

Figure 6.1 shows the generic form of this type in three ranges of density. As discussed above and in Chapter Four, this type is more commonly used in very high density developments. Therefore, in the neighbourhood modelling, this type has been used in both the 400dph and 600dph urban blocks.



Urban form type 3:
Large plots, with Communal back garden,
in 400dph range

East Village (former Olympic Village), **London**

Above left: Ground floor is used for non-residential use or as separate flats with direct access to the street which makes more active and personalised frontage,

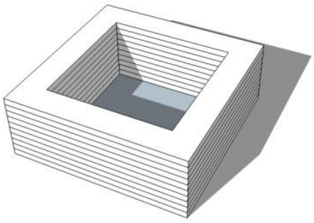
Above right: parking spaces allocated under the communal garden and the garden located on the first floor. Source: Author

Each block consists of about five large plots, Source: Digimap

Due to copyright reasons, the image has been removed in the online version of thesis.

Communal Garden, Source: http://www.eastvillagelondon.co.uk

Figure 6.6: Real example of urban form type 3



Urban form type 3:
Large plots, with Communal back garden, in 200dph range

Canada Water, London

Source: Author

An example of block base type without any plot division in three side of block.
Source: Author

Notion of plot is disappeared compare to the older urban fabric in left and right side of the map.

Source: Digimap

Figure 6.7: Real example of urban form type 3

Urban Form Type 4

Based on the discussion in Chapter Four, this urban form type is commonly used when the density target is so high that the buildings have more than 15 floors. In figure 6.1, the generic form of this type is shown in three ranges of density. Observing the real examples shows that, commonly, only in very high ranges of density (such as 600dph in figure 6.8 and 6.9) this type of urban form is used.

As explained in Chapter Four, the main feature of this type is that all private and communal open spaces have disappeared and only public open spaces remain in the urban layout. Based on this, the notion of perimeter blocks, which are common in the previous urban form types, has disappeared. In other words, the urban block layout which has been seen in the three previous types, with buildings on the periphery and private or semi-private open spaces in the middle changes into individual tower blocks arranged inside a cohesive public open space.

Due to the fact that this type consists of individual tower blocks, it can offer more variety in terms of the shape and footprint of its buildings compared to the regular perimeter block form of the previous types. In other words, this type does not have the limitation of using an urban layout with perimeter blocks because there are no private open spaces to be separated from the public areas by periphery buildings.

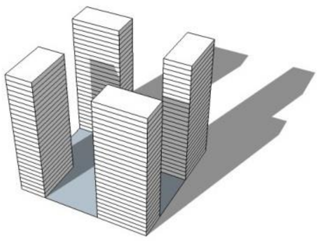
Figures 6.8 and 6.9 show two examples of this urban form type in London. As the examples show, this type can incorporate a variety of footprints and shapes of buildings. The first example has a linear shape to the buildings with connected public open spaces in between. The second example consists of four separate towers with public spaces surrounding them and in the middle.

The other key aspect of this form is that it is typically used in central areas or close to main transport hubs. Indeed, in central areas and hubs, it can be used for non-residential purposes such as shops and offices. Having more public spaces improves the permeability within the blocks which makes this type more useful for areas in the centre of the neighbourhood where there is a greater need for mixed use buildings, a variety of activities and good traffic flow.

The first example of this type is located next to one of the main bus stations in the south west of London. Many of the top floors of the buildings in this area are allocated for office space. Since all the open spaces are public, the mix of office and residential usage does not conflict

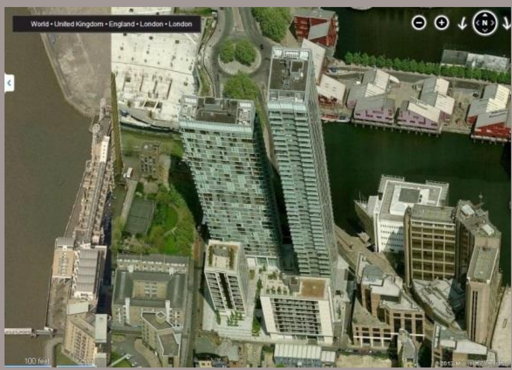
with the residents' use of open spaces while, in previous types, communal gardens can be considered private open spaces just for the use of residents so adding office space would not be as easy as for this type of urban form. Example 1 is well located within walking distance of the Canary Wharf business hub and less than 200 metres from the Dockland Light Railway (DLR) station. This example consists of two residential and two office towers next to each other in one urban block and a completely public open space in the middle.
In the generic modelling, this type is also used close to the centre of the neighbourhood and for the highest density urban blocks.

Since there are a variety of forms for this type, for the generic model, one simple and common form of this type has been designed as shown in figure 6.1. This type is relatively similar to the second example explained in this section which consists of four individual tower blocks at the periphery of the block with completely public open space in the middle. This form has some of the advantages of previous types with perimeter blocks, such as enclosure and surveillance of the surrounding streets, but it also brings more permeability to the overall design because it offers public access to the centre of the block. Moreover, situating the four towers at the maximum distance from each other can minimize the overshadowing problem associated with such high rise buildings. Based on this discussion, all the generic types which are used here are schematic designs showing what type of urban form is used, in general, in the scheme. However, in reality, there is the potential for slight differences and flexibility in the final design.



Urban form type 4:
tower blocks surrounded by public spaces, in 600dph range

London Dockland

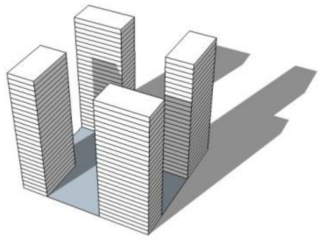


Ariel view of the urban block
Source: Bing Map

View of the towers from the north side
Source: Author

An urban Block containing Four towers with public open space in the middle. (Centre of the map)
Source: Digimap

Figure 6.8: Real example of urban form type 4



Urban form type 4:
tower blocks surrounded by public spaces,
in 600dph range

St. George Wharf, London

Ariel view
Source: Bing map

All open spaces inside the block are publicly accessible and interconnected via open corridors.
Source: Author

Footprint of the whole block and the public open spaces between the buildings
Source: Digimap

Figure 6.9: Real example of urban form type 4

Main Advantages of each common block type in terms of delivering design qualities

In this section, the main urban form types have been explored and real examples of these forms were presented. Referring to real examples can help to show how the final generic model may look like in reality. Equally, the discussion of each type with evidence from real examples helps to provide a more precise reason for choosing specific types at different ranges of density.

At the start of this section, figure 6.1 showed all the different urban form types in three target ranges of density. This table reveals all the possible options in different ranges of density. Now, based on the discussion of each type and having referred to real examples, figure 6.10 shows which type is used in a specific range of density in the final neighbourhood model. As the table shows, at lower densities such as 200dph, the first two urban form types are more commonly used, while for higher densities such as 400dph and 600dph, types 3 and 4 are preferred. Despite these overall trends, there is no rigid use of just one type in each range of density. This is because, as explained in the examples, such types can deliver specific qualities more than the others. Therefore, through the design process, the author has tried to use a variety of urban form types and offer a variety of living spaces for residents.

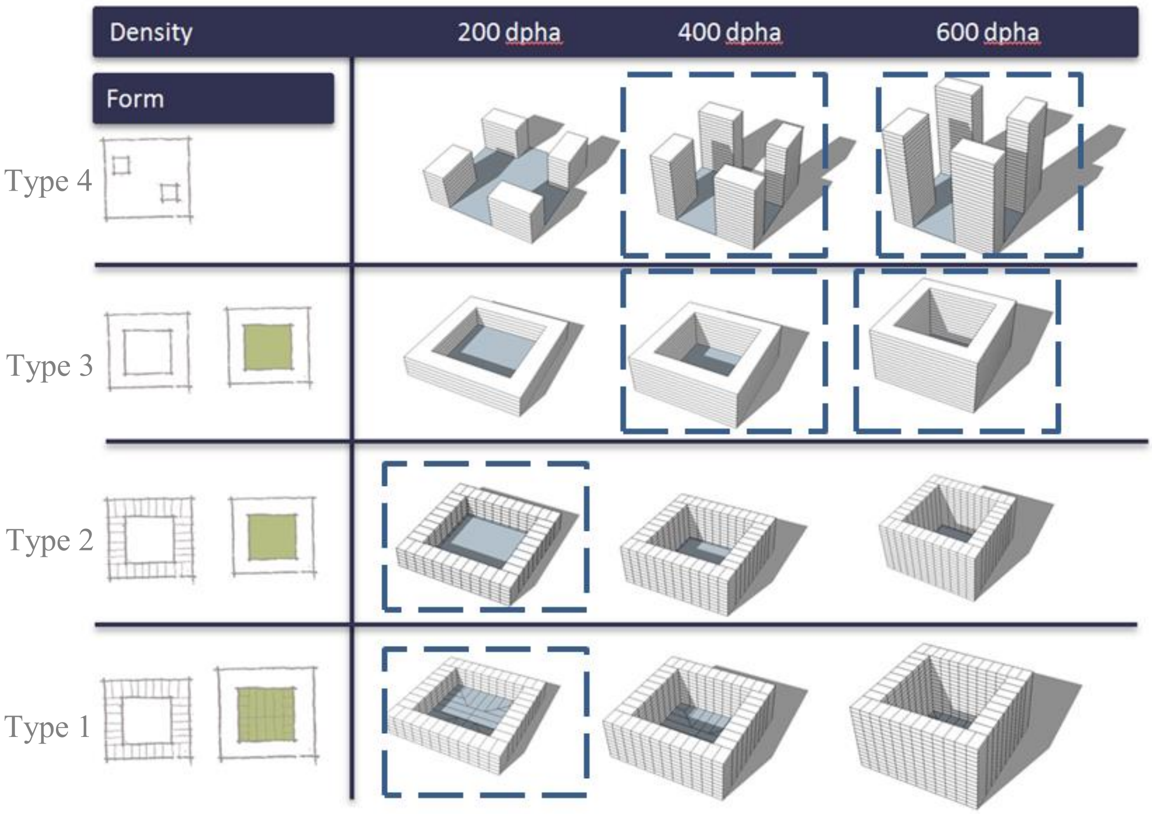
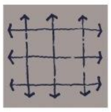
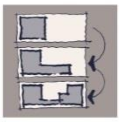


Figure 6.10: Common urban form types in three ranges of density. Source: Author

Table 6.2: **Summary of main design decisions in stage 1**

	**Permeability** Keeping block size to 80x80m
	**Diversity** Considering plot based types of block as prior choice to increase visual variety and offering better space for small shops and services
	**Flexibility** Considering plot base types of block as prior choice to have more opportunity for gradual changes in grains of the city. Choosing communal open space instead of private gardens in higher densities to have better opportunities for outdoor communal activities such as playing, meeting and resting
	**Biodiversity** Keeping block size around 80x80m to have a good size of back garden for planting and vegetation Keeping buildings at the periphery if the block is no more than 12m depth to save green core of blocks.
	**Environmental Comfort** Using perimeter block layout as much as possible on ground floors to control wind tunnel effect streets
	**Safety** Using perimeter block layout to have clear separation of public, communal and private realm and having surveillance from buildings on all surrounding streets.
	**Resource Efficiency** Keeping depth of buildings to 12m to have natural ventilation and sunlight for most of the interior spaces in the buildings

6.4.2 Stage 2: Neighbourhood modelling

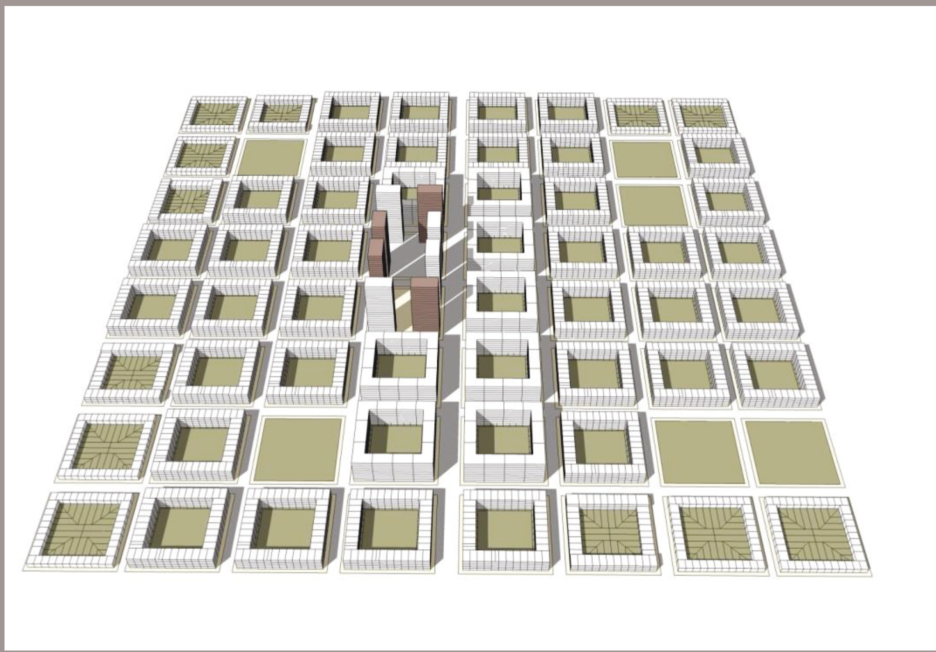
In this second stage, modelling was carried out in an area of land which is 800m by 800m as explained in the section 6.3 about design bases and standards.

It was considered necessary to have different densities for blocks in this neighbourhood because, in this way, we can achieve more variety of buildings, plots and open spaces which brings more variety of choices for residents. The design can be more inclusive of different residents' preferences. For example, singles and small families can live in high rise flats close to the high street without any private or communal open spaces, while larger families can also have the opportunity to live in blocks in less active streets with private or communal open spaces with more parking spaces.

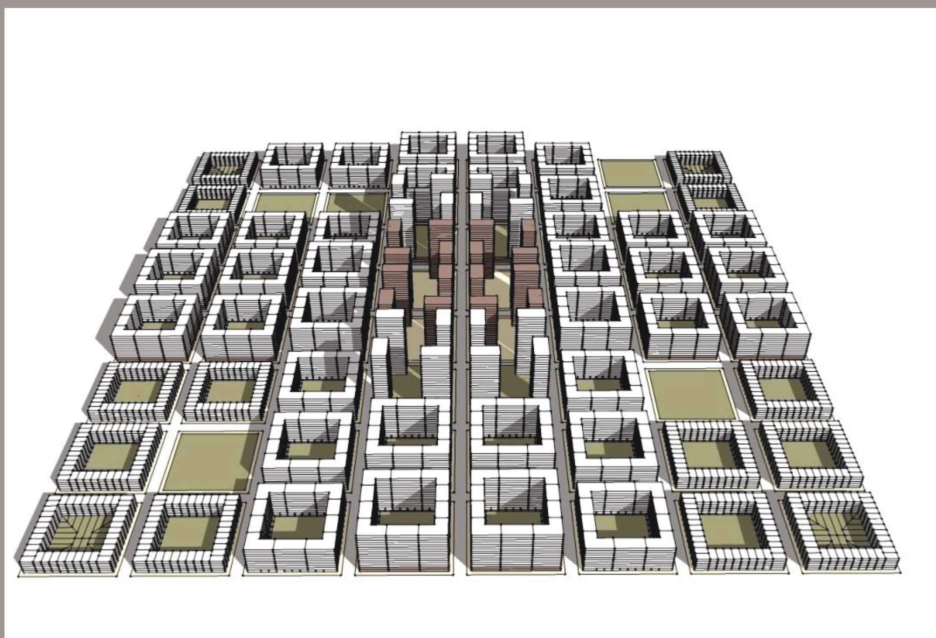
Blocks with higher density are located closer to the main central street to increase the overall accessibility and proximity to public transport hubs (figure 6.11 and 6.12).

Non-residential use is located on the ground and first floors of the main street and the street which has a junction with the main street in the centre, so that most services are visible from the centre of the neighbourhood. In the centre of the neighbourhood model two urban blocks are allocated with more accessible public spaces around towers - type 4 - which makes a larger public open space for the most active area (figure 6.11: centre of the neighbourhoods). Two of the towers in these urban blocks are allocated purely for non-residential use such as offices to reach the target of non-residential floor space (see figure 6.11 200dph model). However, these towers are located close to the residential towers so that during the night when the offices are closed surveillance of the public space remains.

Considering the design standards, green public spaces are distributed within four quarters of the neighbourhood in such a way that all residential blocks are located less than 200 meters distance from them.



Neighbourhood model in 200dph residential density



Neighbourhood model in 400dph residential density

Residential spaces

Main non-residential spaces

N

Figure 6.11: Initial stage of Neighbourhood modelling

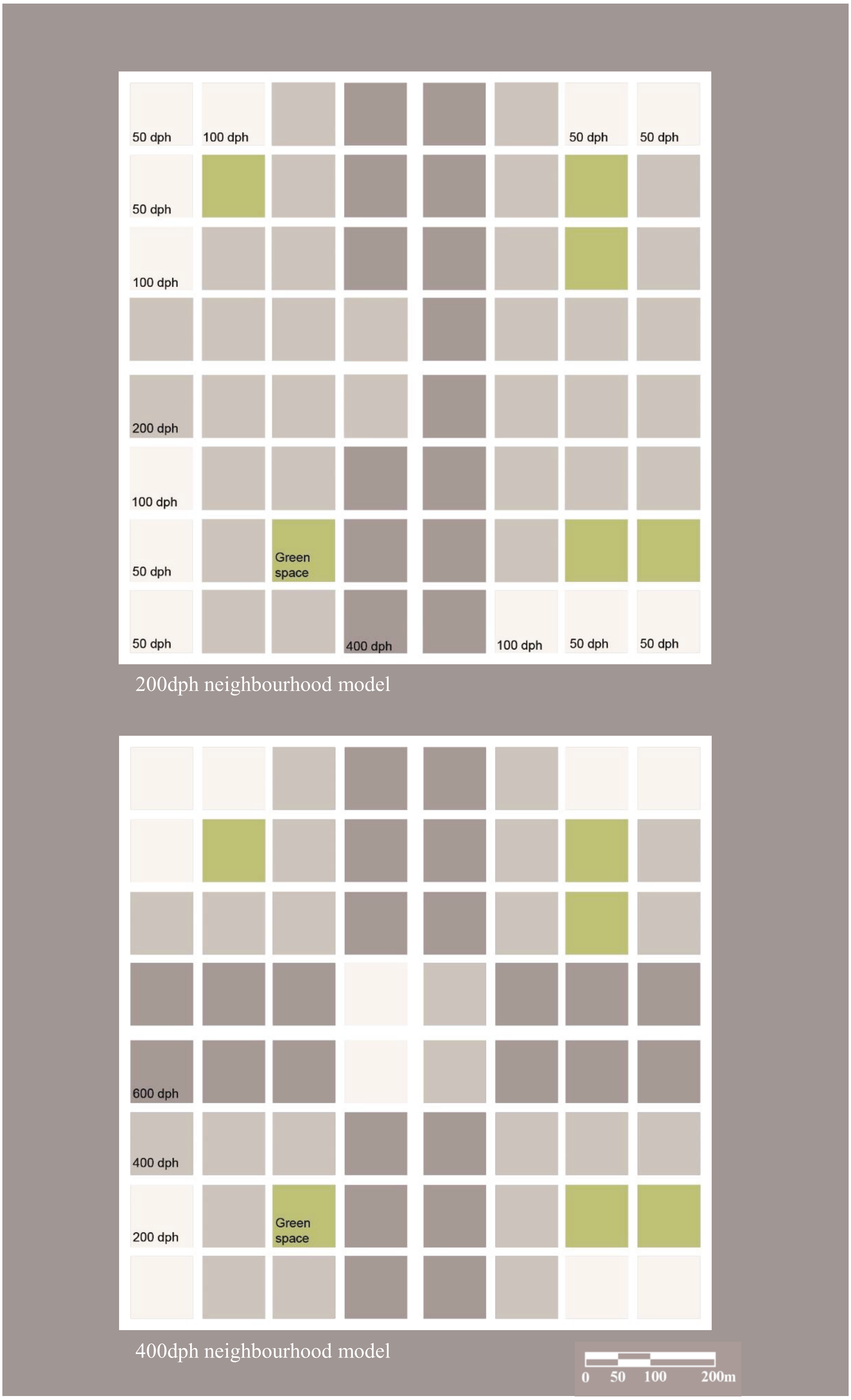
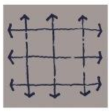


Figure 6.12: Density gradient change within the neighbourhood.

Table 6.3: **Summary of main Design Decisions in stage 2**

	**Permeability** Keeping all blocks to 89x80m size with no loops or cul de sacs in the street pattern to have maximum flow of traffic
	**Accessibility** Keeping all dwellings within an area of 800x800m with a maximum 400m distance to public transport and other services Distributing green spaces in such a way as to have a maximum 200m distance from all residential blocks. Density gradient designed in such a way as to have higher density in central areas and lower density at the edge of the neighbourhood so that, overall, more people live closer to the central services.
	**Diversity** Having a variety of densities and block types results in a variety of visual experiences in the different streets of the neighbourhood For the same reason, different types of houses with different types and sizes of open spaces are designed.
	**Biodiversity** Public green spaces are located in the four quarters of the neighbourhood with a maximum 200m distance from all dwellings.
	**Energy Efficiency** Use of cars is reduced, potentially, because services and public transport are located within walking distance from all dwellings.

6.4.3 Stage 3: using hybrid urban forms

In this third stage, the generic block models have been re-designed in a more complex way in order to achieve some other design qualities. These new designs are referred to as 'hybrid' models because these are the result of mixing the different main types explored in stage 1.

As discussed in the conceptual framework, as we change block types from lower densities (like type 1) to higher densities (types 3 or 4) we may lose some significant qualities. For example, one of the major differences is that the plot base block types which are common in low density areas become rare in high density areas. This results in a lack of adaptability, and fewer opportunities for visual variety and personalisation. Therefore, the whole purpose of designing hybrid models in high density areas is to mix the block types in such a way as to restore the advantages of lower density block types.

Here, two main types of hybrid block are introduced in the research. Although it can be argued that there may be other hybrid models, the overall observation of urban blocks for this research shows that most block types can be categorised into one of the main block types in stage 1 or the hybrid types which are introduced in this part.

Hybrid type one:

In this block type, terraced houses are designed with private open spaces in the higher floors or on the roof. In this way, there is no need for a large back garden and the amount of open space in the overall site is reduced while most of the houses have their own private open space with separate plots. Thus, this block type has the advantages of terraced houses such as adaptability, flexibility for gradual changes in the urban grain and the opportunity for personalisation in open spaces. This block type can also have a much higher density than terraced housing which, as has been previously explained (Chapter 2: Section 2.7 and figure 2.4), has limitations in exceeding a certain range of density (Alexander et al, 1988). Figure 6.14 shows the examples of this hybrid model.

While terraced housing cannot exceed a density around 150dph, as has been explained in previous chapters, the generic modelling aims to reach 200dph with this hybrid block type. In this way, this block model can also be used in a generic neighbourhood.

As appears in the model (figure 6.13) despite maximising the footprint of buildings and using roof gardens as private open space for these houses, a large number of flats still have to be added to the model to reach 200dph. This shows that these hybrid types still cannot reach a very high density. This model will be used in the next stage of the design, at the neighbourhood scale, as a replacement for 200dph blocks in locations where it may be appropriate in order to improve the design quality.

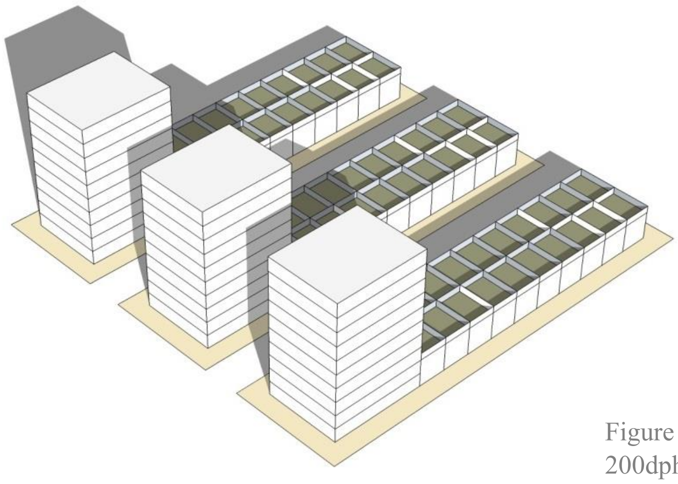


Figure 6.13: Hybrid block type 1 with 200dph density

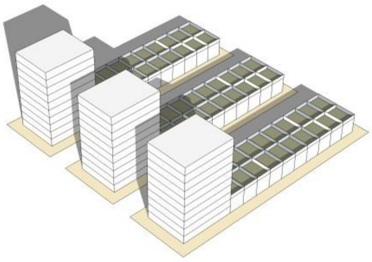
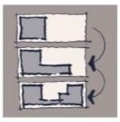
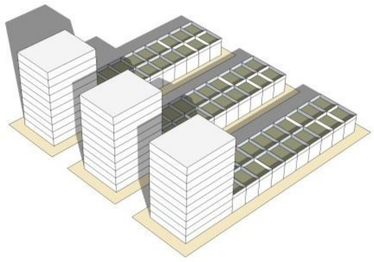


Table 6.4:
Key advantages of **Hybrid form 1** to the common block types

	**Diversity** Greater potential for personalisation in front spaces (visual diversity)
	**Flexibility** Greater potential for changes in the height of buildings because of individual ownership of plots Greater potential for interior and facade changes in individual buildings.
	**Character** Potential to save overall character of the area in lower density neighbourhoods, particularly in the context of the UK where terraced housing is common.



Hybrid Block Type two real examples

Chatsworth garden, London

Due to copyright reasons, the image has been removed in the online version of thesis.

Due to copyright reasons, the image has been removed in the online version of thesis.

Using the roof top as a private garden has reduced the size of the block and increased the density, Source: http://www.peterbarberarchitects.com/chatsworth-gardens

Borneo - Sporenburg, Amsterdam

Due to copyright reasons, the image has been removed in the online version of thesis.

Using patios and roof top gardens in very small plots,
Source: https://prezi.com/aohxb73urga1/building-types/ + Google map

Figure 6.14: Real examples of Hybrid urban form type 1

Hybrid model 2:

In this model, the plot based flats (block type 1 or 2) are mixed with tower blocks. Again, the aim is to reach higher densities while preserving the design qualities of plot base design in lower densities. In this modelling the target density is 400dph. Two tower blocks, each with 100 dwelling spaces, are added to the existing 200dph plot base model to reach 400dph (figure 6.15). In table 6.5 the main advantages of this hybrid block type compared to regular block types with the same density are explained.

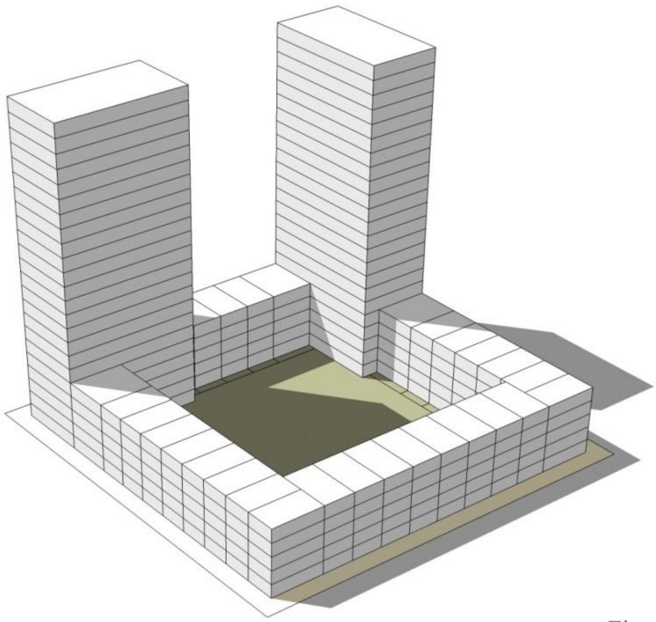


Figure 6.15: Hybrid block type 2 with 400dph density

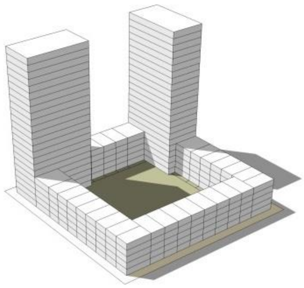
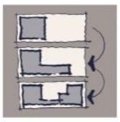


Table 6.5:
Key advantages of **Hybrid form 2** compared to the common block type

Diversity

More opportunity for local non-residential use on the ground floor because of small plots
More opportunity for visual variety because of the small size of plots and buildings
More opportunity for personalisation of the facades
Variety in types of house in terms of having both low rise buildings and high rise towers together.
Human scale size of grains and character of street in majority of block perimeter

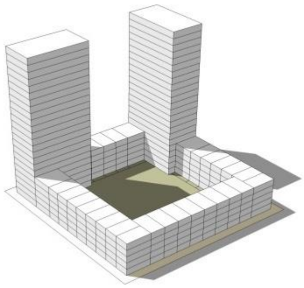


Flexibility

Having the advantages of plot base types in terms of smaller sizes of land with more individual ownership and opportunity for changes in the building interiors, facades or possible extensions in height and depth
More flexibility for gradual changes in the city grains in the long term.

Legibility

Towers may provide variety in the character of the streets around the block and represent landmarks in the neighbourhood scale.



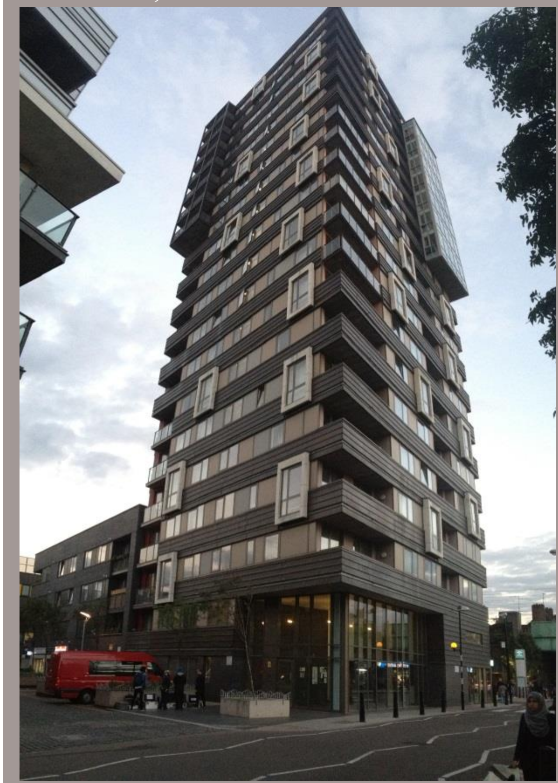
Hybrid Block Type two real examples

Vancouver, Canada

Source: Bing map

Source: Google map

Shadwell, London



Refurbishment of a post war tower block into a tower at the corner of a perimeter block, Source: Author

Greenwich Peninsula, London

Human scale, lower height buildings and small plots at the street level with additional high-rise towers at the core of the block Source: Author

Figure 6.16: Real examples of Hybrid urban form type 2

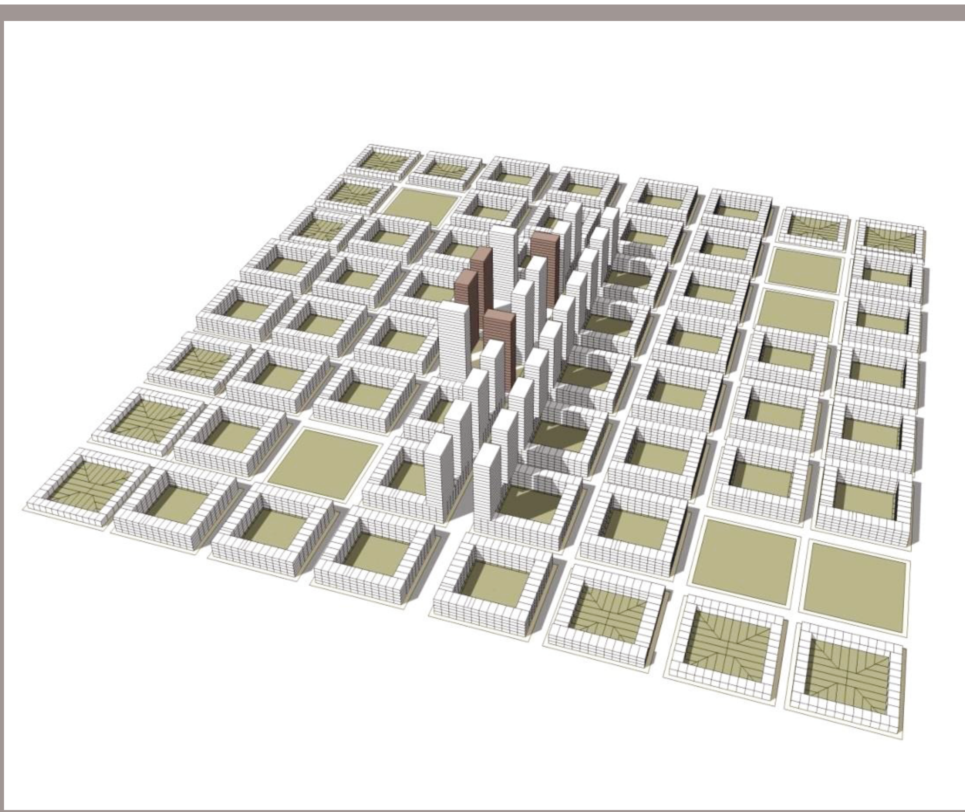
6.4.4 Stage 4: final considerations at the neighbourhood scale

This is the final refinement of the generic models. Here, we attempt to consider all design qualities together and, where necessary, make alterations in design. Issues such as street hierarchy, diversity in visual experience and legibility in the neighbourhood are considered as well as issues such as overshadowing.

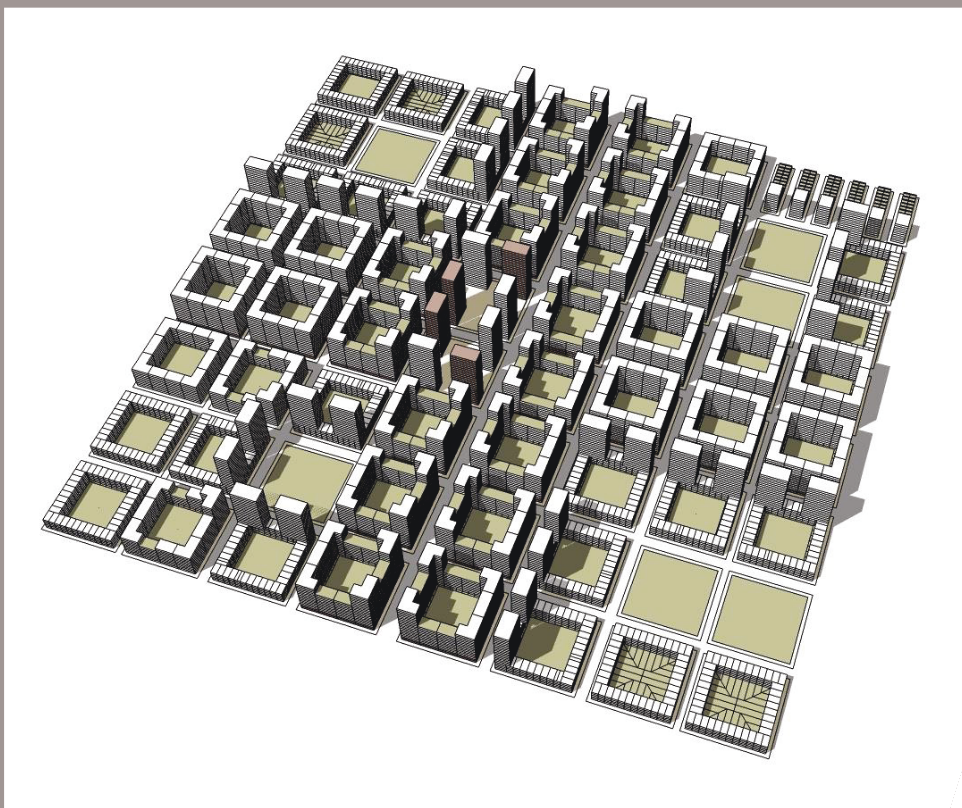
As a major change, the hybrid models are added to the scheme as replacements for the regular block types where this replacement might improve specific design qualities. These hybrid models are located and designed in such a way as to improve qualities such as legibility, by making nodes and diversity in the character of the streets, and providing environmental comfort by considering overshadowing issues.

In addition, a hierarchy of street patterns has been considered for the scheme. The main road has been designed as a wider high street; on the other hand, the closest street to the edge of the neighbourhood has been reduced in width.

Final refinements for residential use were carried out. Non-residential use was concentrated on blocks next to the main street. In addition, non-residential use was located around one green public space in the 200dph model and two green public spaces in the 400dph model. In this way, a variety of experiences in public spaces are delivered, with both quieter residential public spaces and active mixed use public spaces.



200dph model with hybrid block types to provide a different character for the main street. Buildings on all other streets remain between 2 to 5 storeys high.



400dph model with hybrid block types to vary the character of the different streets and open spaces

Figure 6.17: Final generic models of neighbourhood in two ranges of density

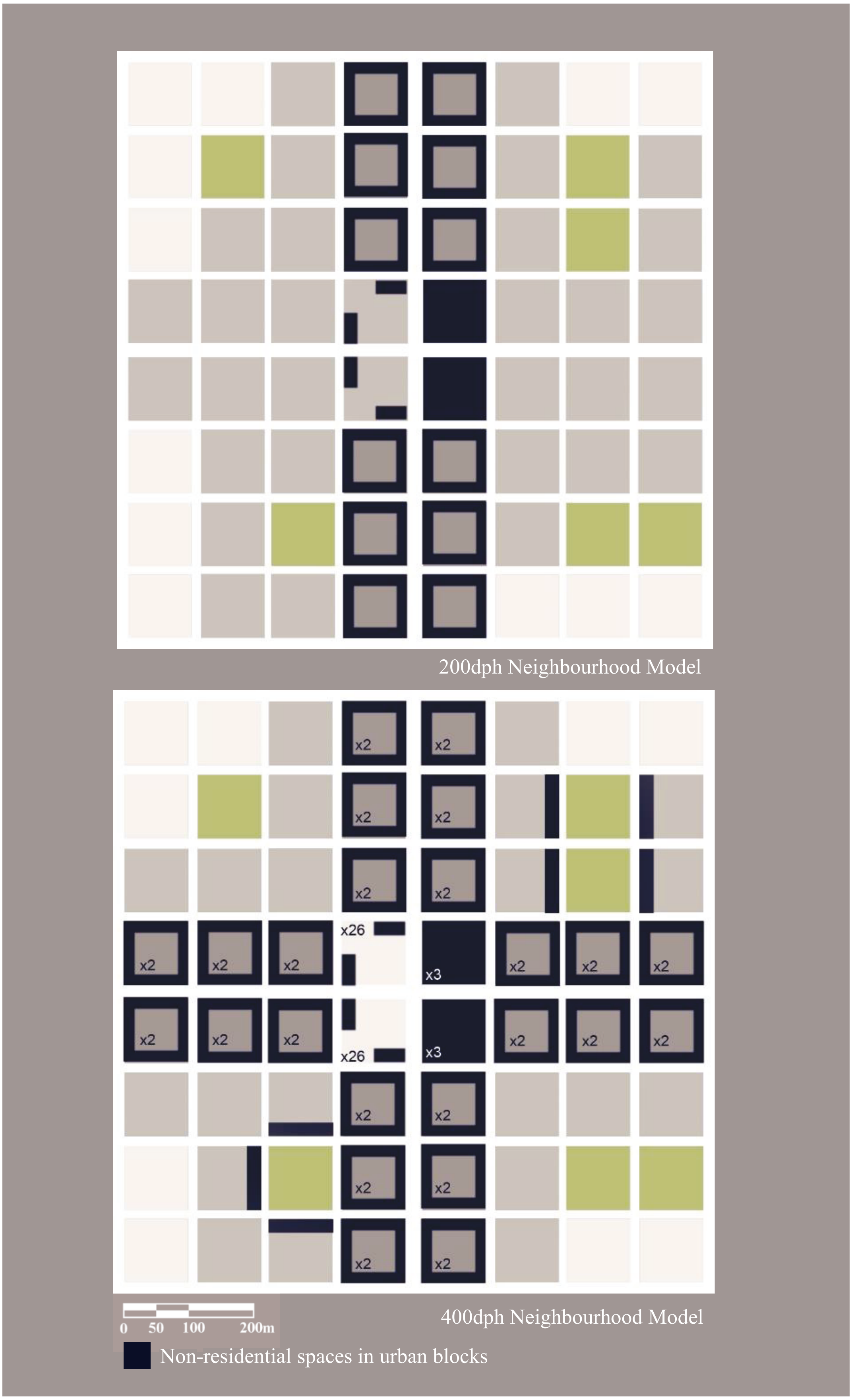


Figure 6.18: Neighbourhoods’ non-residential space distribution

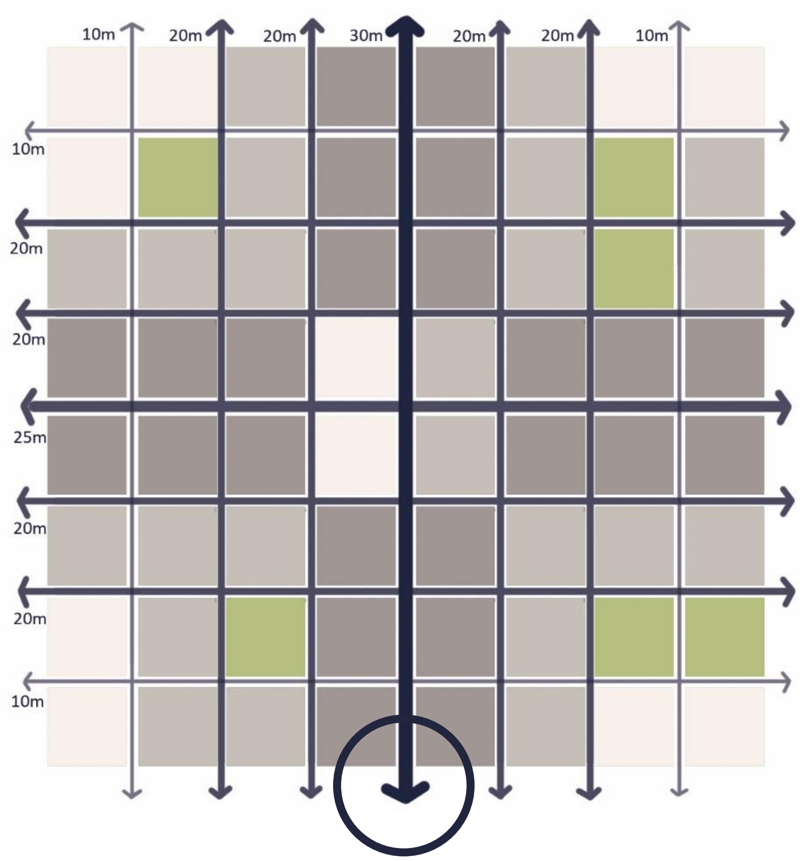
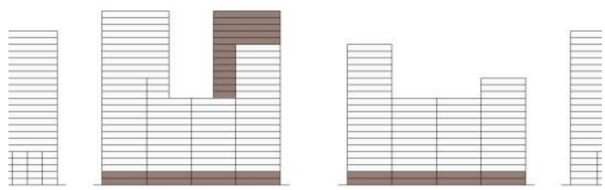
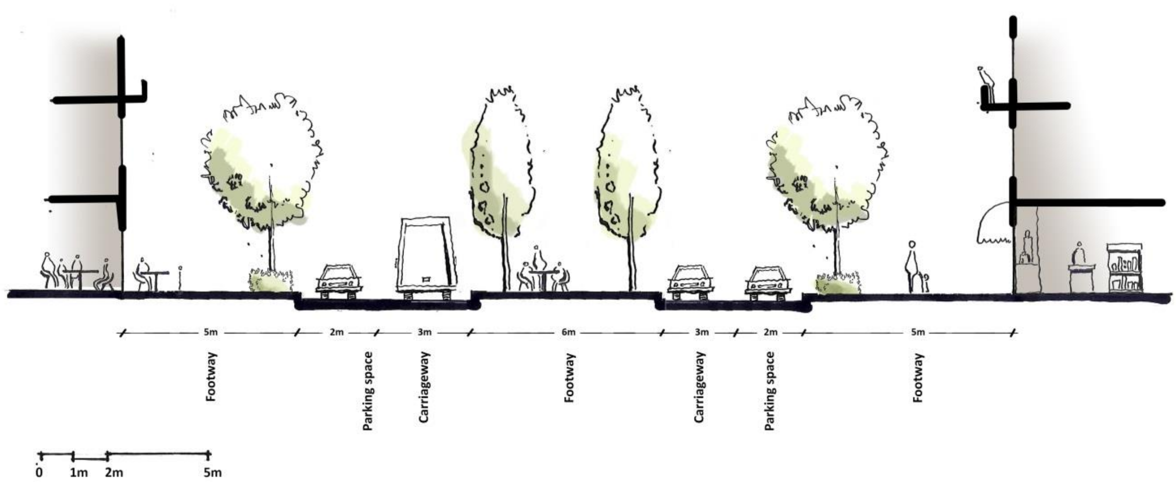


Figure 6.19:
30m width main street section





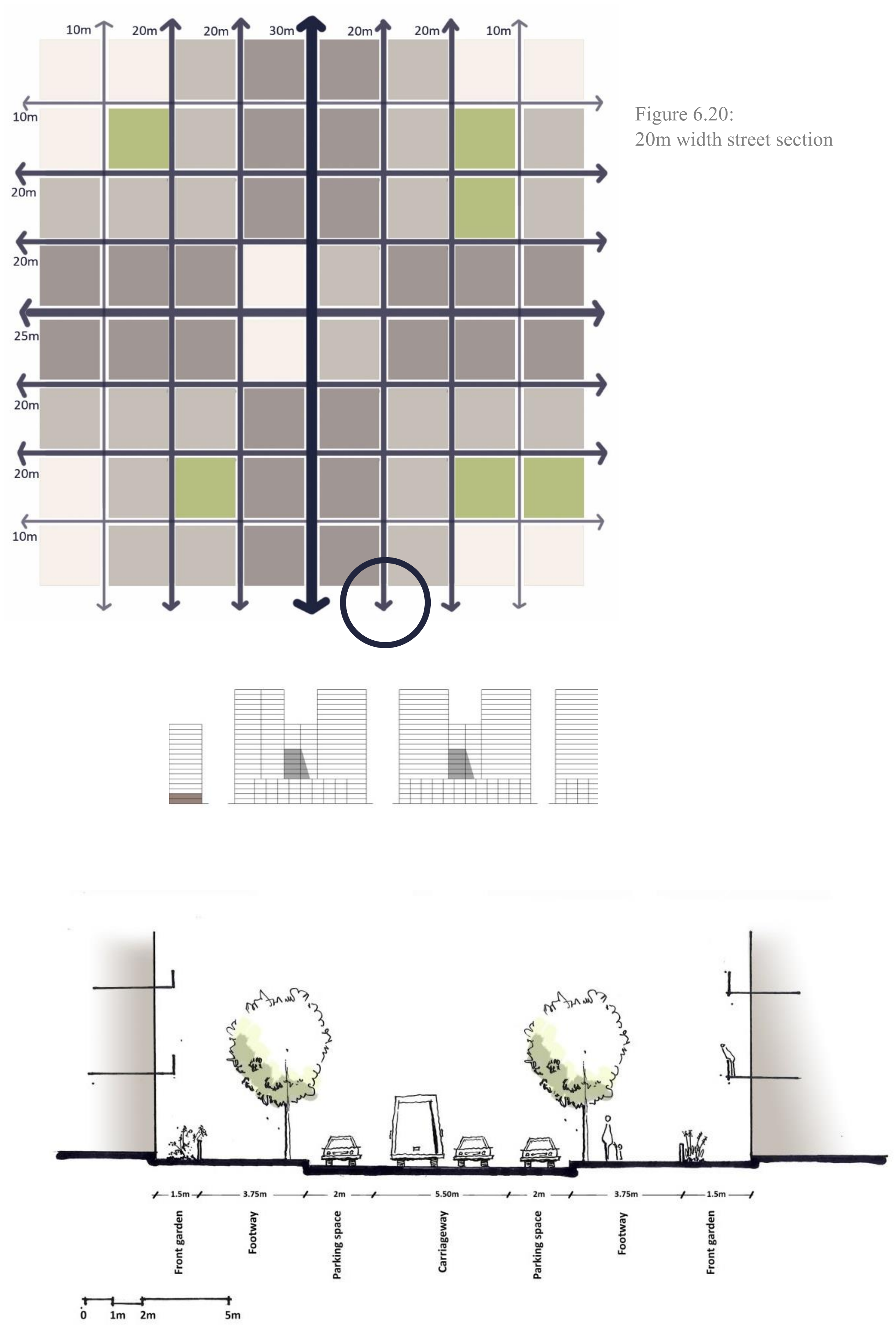


Figure 6.20:
20m width street section

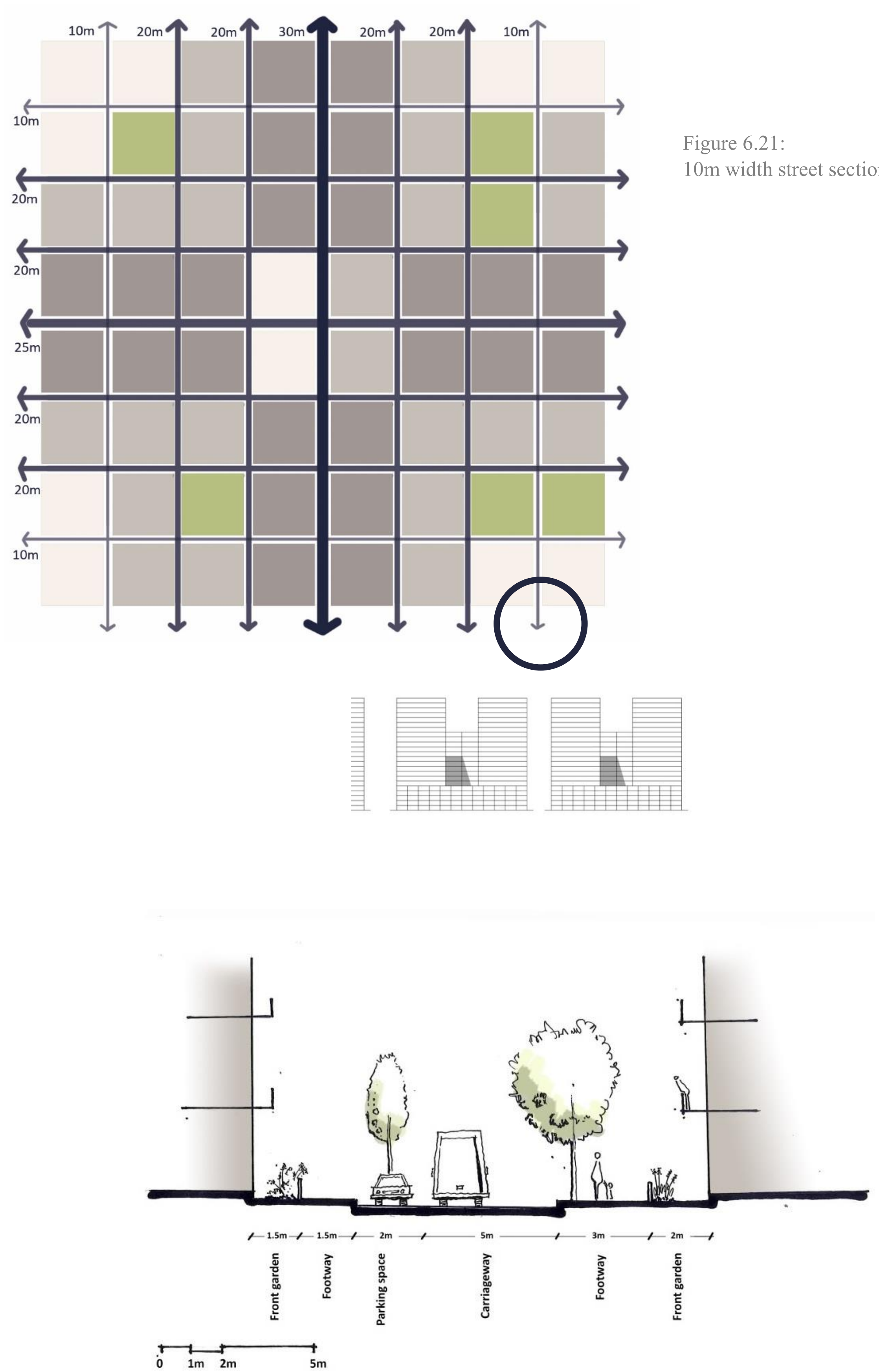
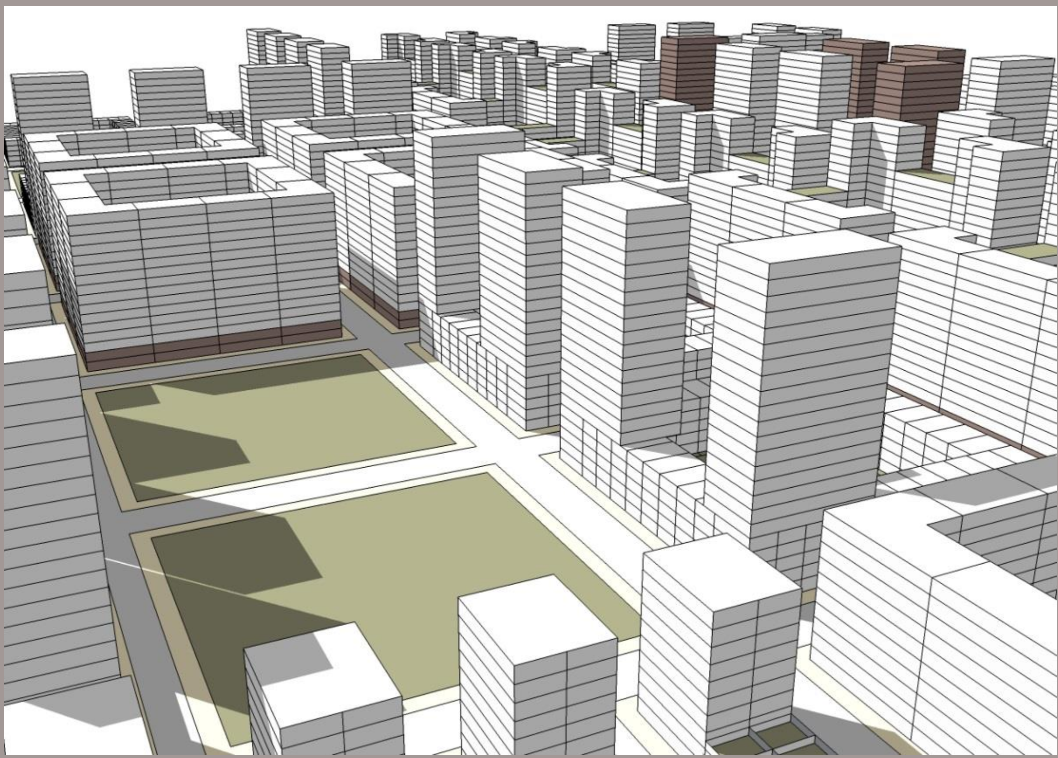
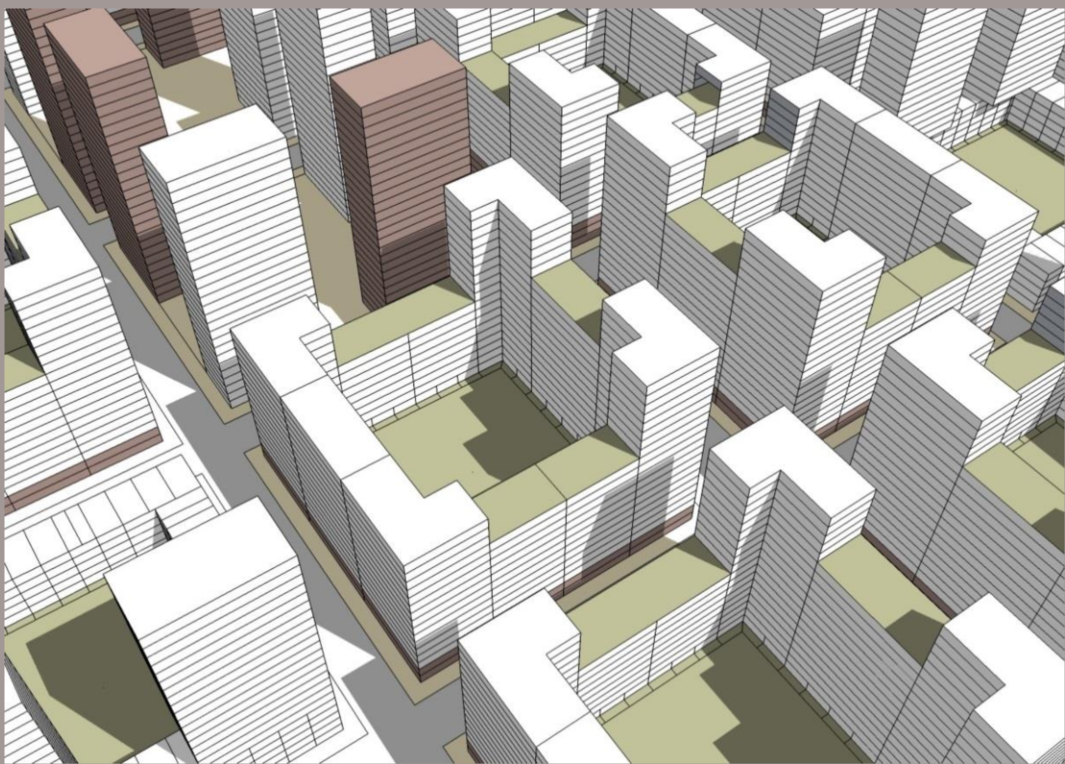


Figure 6.21:
10m width street section



Providing different characteristics of open spaces



Considering overshadowing issues,
Making communal green spaces at different floor levels

Figure 6.22: closer views from 400dph generic model for better understanding of the shape of blocks, buildings, plots and open spaces.

6.5 Conclusion

In this chapter, the process of the generic modelling and the rationale behind each step have been explained. Based on this modelling, the overall physical characteristics of the neighbourhood with two different ranges of density has been illustrated. The aim has been to attempt to show in general the possible characteristics of a neighbourhood with the maximum density target for London (400dph) and one with a lower density (200dph) while considering density standards and design quality considerations based on the planning and urban design literature.

This process of design showed the possibility of systematically predicting the possible shape of a neighbourhood in different ranges of density. Using urban design standards and common patterns of urban form, it is possible to develop neighbourhood models in different densities and investigate their potential in terms of delivering good quality design. Such a method of design will enable designers to investigate different urban form possibilities with more freedom, in their ideal shape and regardless of the limitations of real sites.

Although some analysis and assessment of design qualities was necessary in order to go through the stages of design, the main analysis of the generic modelling will be set out in the next chapter. In this chapter, generic blocks and neighbourhoods with different densities were modelled. In the next chapter, an analysis will be carried out to see to what extent each design quality is improved or reduced as a result of density changes and according to different design decisions.

Chapter Seven:
Generic Modelling; Evaluation and Findings

7.1 Introduction

In the previous chapter, generic models of neighbourhoods with different target densities were developed. This chapter analyses and evaluates these models checking the degree to which the design qualities are delivered in each model. Based on this, the primary and more general findings of the research are developed in this chapter. The findings are used to propose initial design principles which are further applied in the second part of the testing in the next chapters of the thesis.

The chapter addresses the fourth objective of the research:

Objective 4: To use the analytical framework to evaluate changes in urban form and urban design qualities through generic models and to propose preliminary theoretical propositions and urban design principles in order to improve urban design qualities in densification schemes.

The chapter explores the main difference in the generic models in terms of changes in the elements of urban form described in Chapter Two. The main analysis of the chapter is then related to the changes in each design quality explored in Chapter Three. The analysis is carried out based on the indicators of urban design qualities identified in the analytical framework in Chapter Five. Hence the analysis shows to what extent these indicators of design qualities change from one generic model to another. Based on this analysis, the initial findings of the research are developed. These findings fall into two major categories: one, the facts about improvements and compromises in design qualities as a result of changing neighbourhood density. Second, the recommendations or urban design principles for better delivery of the qualities in high density design schemes. These principles and findings are then used in the next chapters of the thesis for an inquiry by design process on a real site.

At the end of this chapter, it is intended to have a more practical understanding of the interrelationship of the three concepts of density, form and design qualities. While these relationships and their explanation were examined in the theoretical part of the research, at the end of this chapter, the theories are shifted to a set of clearer recommendations useful for designers when producing a design scheme to increase the residential density of neighbourhoods.

7.2 Analysis of design qualities

This section is related to the analysis of design qualities in the final generic design schemes developed in Chapter Six. Each sub-section explains the degree of delivery of particular design quality comparing the models in 200dph and 400dph. The following tables (table 7.1 and 7.2) summarise the findings of the analysis of qualities according to the indicators established in Chapter Five.

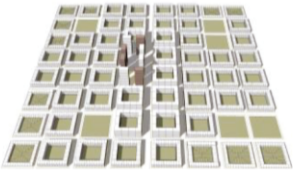
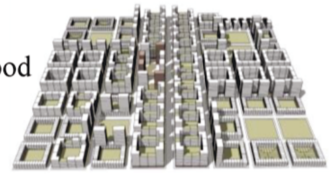


Table 7.1: Analytical table for **200dph** generic model of neighbourhood

(See the main extended analytical table in chapter 5)

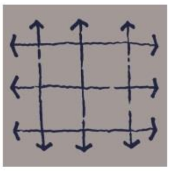
Urban Design Qualities	**Indicator**	**Criteria** Low	medium	High
permeability	Average length of block			
	Existence of cul-de-sacs and dead ends			
Accessibility	Density gradient designed according to main transport and business nodes			
	Walkable distance to services			
Diversity	Allocation of non-residential uses			
	Proximity to main non-residential uses: Primary school			
	Proximity to main non-residential uses: secondary school			
	Proximity to main non-residential uses: medical Centre			
	Proximity to non-residential uses: main shopping area			
	Active edges produced and distribution of non-residential uses			
	Diversity in dwelling size			
Visual variety	Opportunity for personalization at the ground floor of buildings			
	Opportunity for vertical division of façade to improve diversity in visual experience			
Adaptability	Potentials for change of use in dwellings: access from building to public space			
	Potentials for gradual change of urban form			
	Opportunity for communal activities in semi open spaces in center of the blocks			
	Possibility for extension in buildings			
Biodiversity	Total Public green space per person			
	Total Communal green space per person			
	Connectivity of green spaces			
	Accessibility to green space (within walking distance of dwellings			
	Possibility for Variety of activities and character in green space			
	Opportunity for use of greenery on exposed surface of buildings			
	Opportunity for local food production (allotments)			
Environmental comfort	Receiving sunlight for all dwellings during the day			
	Receiving sunlight for all green open spaces during the day			
Resource efficiency	Average exposed surface of dwellings (for loss of energy)			
Legibility	legibility of public space network			
	Legibility through use of landmark buildings			
	Change of character of buildings and open spaces from center to edge of neighborhood			
	Varity of public spaces character within neighbourhood in terms of form, use and activities			
Character & Distinctiveness	Similarity of form and grain size in the urban layout to surrounding built environment			
	Respecting the existing height of buildings within the area			
	Distinctive characteristic of neighborhood from surrounding areas			
Safety	Overall length of Active edges at ground level of streets			
	Clarity of public, communal and private space			
Privacy	Keeping appropriate back to back distance of dwellings			
	View from street to the house in ground floor			
	View on private gardens from other dwellings			

Table 7.2: Analytical table for **400dph** generic model of neighbourhood



(See the main extended analytical table in chapter 5)

Urban Design Qualities	Indicator	Criteria		
		Low	medium	High
permeability	Average length of block			
	Existence of cul-de-sacs and dead ends			
Accessibility	Density gradient designed according to main transport and business nodes			
	Walkable distance to services			
Diversity	Allocation of non-residential uses			
	Proximity to main non-residential uses: Primary school			
	Proximity to main non-residential uses: secondary school			
	Proximity to main non-residential uses: medical Centre			
	Proximity to non-residential uses: main shopping area			
	Active edges produced and distribution of non-residential uses			
	Diversity in dwelling size			
Visual variety	Opportunity for personalization at the ground floor of buildings			
	Opportunity for vertical division of façade to improve diversity in visual experience			
Adaptability	Potentials for change of use in dwellings: access from building to public space			
	Potentials for gradual change of urban form			
	Opportunity for communal activities in semi open spaces in center of the blocks			
	Possibility for extension in buildings			
Biodiversity	Total Public green space per person			
	Total Communal green space per person			
	Connectivity of green spaces			
	Accessibility to green space (within walking distance of dwellings			
	Possibility for Variety of activities and character in green space			
	Opportunity for use of greenery on exposed surface of buildings			
	Opportunity for local food production (allotments)			
Environmental comfort	Receiving sunlight for all dwellings during the day			
	Receiving sunlight for all green open spaces during the day			
Resource efficiency	Average exposed surface of dwellings (for loss of energy)			
Legibility	legibility of public space network			
	Legibility through use of landmark buildings			
	Change of character of buildings and open spaces from center to edge of neighborhood			
	Varity of public spaces character within neighbourhood in terms of form, use and activities			
Character & Distinctiveness	Similarity of form and grain size in the urban layout to surrounding built environment			
	Respecting the existing height of buildings within the area			
	Distinctive characteristic of neighborhood from surrounding areas			
Safety	Overall length of Active edges at ground level of streets			
	Clarity of public, communal and private space			
privacy	Keeping appropriate back to back distance of dwellings			
	View from street to the house in ground floor			
	View on private gardens from other dwellings			



7.2.1 Permeability

Through generic modelling, this quality does not change. This is because of the fixed size of the blocks and street patterns which were used for the modelling based on the permeability standards from the urban design literature. This quality will be investigated in more depth in the Third Part of research (Chapter Eight to Ten), local design process on real site, with the existing street patterns and restrictions which the site dictates for the size of blocks.

7.2.2 Accessibility

Based on the theoretical part of the thesis, the main variable related to the quality of accessibility is the location of the majority of dwellings within a walkable distance to public transport and main services. In both design schemes, the overall size of the neighbourhood is designed to be 800 by 800 metres which leaves a distance of 400 metres from the edge to the centre of the neighbourhood. The majority of the main services, mixed use buildings and bus stops are located in the centre of the neighbourhood and the central north- south streets. All the dwellings in both schemes are therefore less than five minutes' walking distance from local services. Hence, the quality of accessibility is delivered at an appropriate level in both schemes.

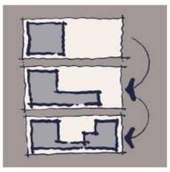
On the other hand, the overall density gradient and the distribution of density is also designed to contribute to the feature of accessibility. As figure 6.12 in Chapter Six shows, the highest density urban blocks are located closer to the centre and the lowest density at the edge of the neighbourhood. Hence, this consideration has helped in reducing the average distance of the dwellings from the services and further improves accessibility within the walkable size of the neighbourhood.

7.2.3 Diversity

Some aspects of the quality of diversity have been delivered at a high level simply by establishing and applying the standards and bases for the modelling. The target rate of mixed use space, established in the previous chapter has been delivered in both final models. This means that both models provide an appropriate level of non-residential use for the number of houses in the two schemes. Clearly, the 400dph scheme requires a higher amount of more mixed use space to respond to local demand. In this way, a higher number of streets with non-residential uses on the ground and second floors are allocated in the design. Therefore, more active streets with a variety of shops and services are provided in this scheme. Similarly, based on the standards considered for the design, a variety of dwelling sizes have been allocated to the project. The detailed design of the housing is not of concern for this study, but reaching the amount of space and plot ratio appropriate for such a level of dwelling size diversity was the target, which was delivered for both generic models.

Despite having a high proportion of non-residential space in the schemes, a variety of experiences from very busy to quiet, and completely residential streets, is delivered in both schemes. Even in the 400dph scheme, some public green spaces have mixed use ground floors on the periphery and some have a purely residential character in the surrounding areas. In this way, a variety of experiences and choices from highly active to quiet and residential areas is delivered in both schemes. This condition would give residents more options for choosing an appropriate living space based on their lifestyle, age and family size.

While it has been attempted to create a variety of experiences from the centre to the edges of the neighbourhood, in the 400dph scheme, the potential for having visual diversity has been reduced in a particular way. The increase in density and non-residential uses has resulted in the use of urban types with large plots and block based characteristics. In this way, the vertical division of the façade of the buildings and the streetscape is not as evident as in the largely plot based urban form in the 200dph scheme. The opportunity for personalisation and variety in form, which can be delivered more easily in plot based morphology, is therefore reduced as a result of the increase in density.



7.2.4 Adaptability

Based on the discussion in Chapter Four, many of the advantages of adaptable urban form can be achieved by keeping small grain and particularly plot based types. Observing the two design schemes (figure 7.1), it appears that shifting from 200dph to 400dph has changed the form significantly, from small plots (7 to 8 metres width) to large ones (20 to 30 metres width). The grain size, overall, has been increased in this densification process and therefore the adaptability potential of the urban form has been reduced. This is mostly due to choosing more block based forms in higher densities, particularly for urban blocks of 400dph and 600dph. It is also common in real examples of high density developments within London to have large size plots and buildings in this density range.

The other indicator of the quality of adaptability is the potential for a variety of uses of open spaces. As discussed in Chapter Four, the use of urban form types with communal gardens instead of private gardens can deliver more opportunity for a variety of activities in open spaces. As it appears in the design schemes in most of the blocks of the neighbourhood, communal gardens have been allocated instead of private gardens. New blocks with private gardens have been designed to create a variety of choices for residents. Another benefit of such communal gardens is that parking spaces and non-residential uses such as shopping centres can be allocated underneath these open spaces. This type of design is more viable when the open space is not divided into separate small spaces for individual dwellings.

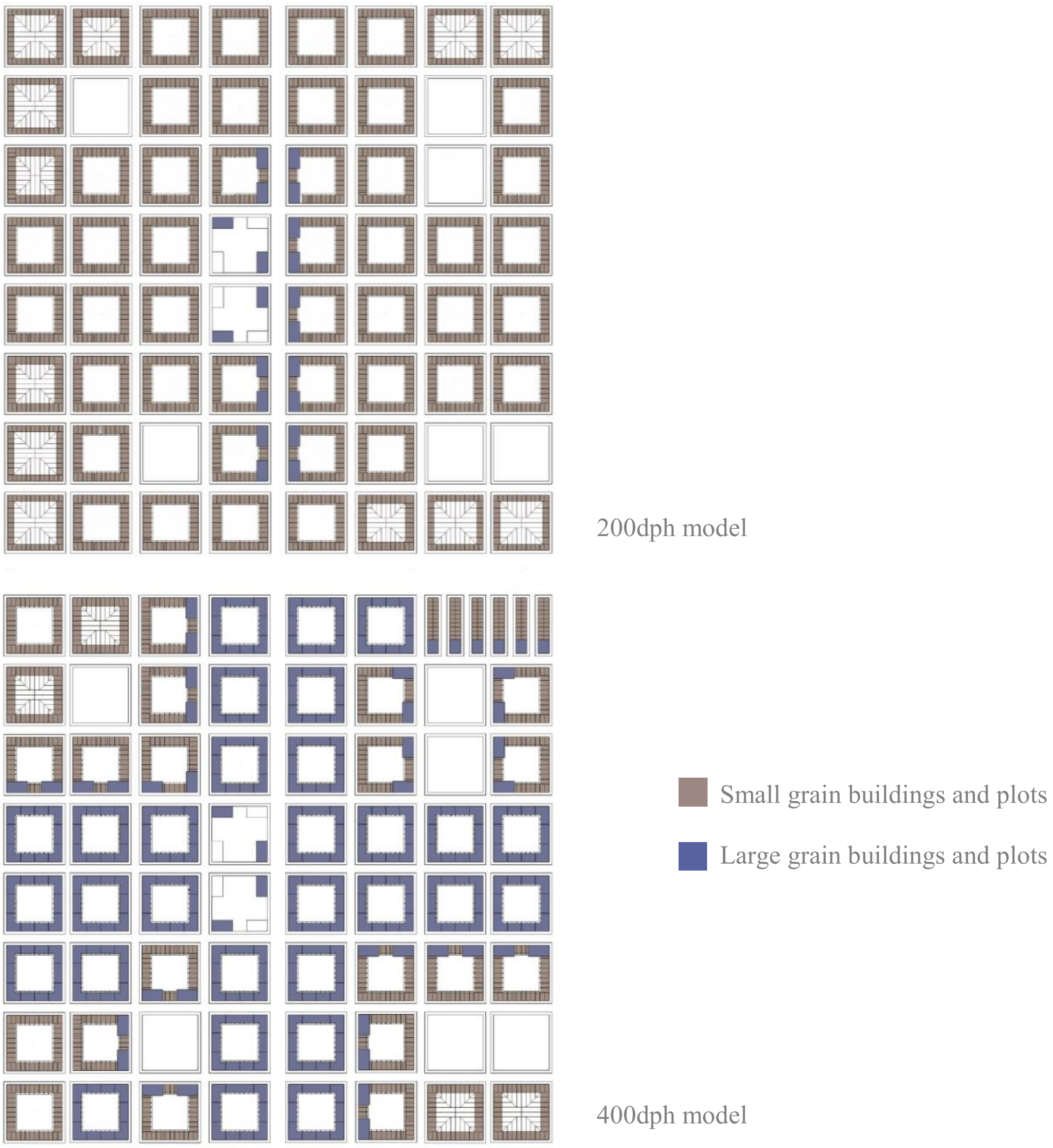


Figure 7.1: Change in grain size from 200dph to 400dph model.
Source: Author

7.2.5 Biodiversity

Regarding the quality of density, the same amount of public green space has been allocated in both schemes. These spaces are distributed in such a way that all dwellings are less than 400 metres (5 minutes' walk) to local parks. However, naturally, the pressure of use on green spaces in the 400dph scheme will be higher, which may also bring greater possibility for social interaction. Overall, delivery of the minimum amount of green space was possible for both schemes, but because of the higher number of people in the 400pdh scheme it is more crucial to manage other aspects such as cleanliness and time of use of these green spaces.

Other than public green spaces, both schemes provide a similar amount of communal and private open space which contributes to the biodiversity of the neighbourhood. Incorporating communal spaces other than private gardens helps to provide more equity in use and experience of green spaces among residents. However, some dwellings with private gardens have been allocated to the schemes to deliver a range of choices for residents.

Overall, relatively, the same amount of green space has been delivered in both schemes and the 400dph scheme has greater capacity for roof garden due to its large plots and buildings (see CH6: figure 6.22). However, the amount of daily sunlight is lower for green spaces in the 400dph model. Also, some of these green spaces are not at ground level. These green spaces (located on the roofs of dwellings or shopping centres) may have limited capability to help the drainage of rain water because they do not have a direct connection to the ground soil. Therefore, some drawbacks in the quality of green spaces in the 400dph scheme exist, despite the higher proportion of green space.

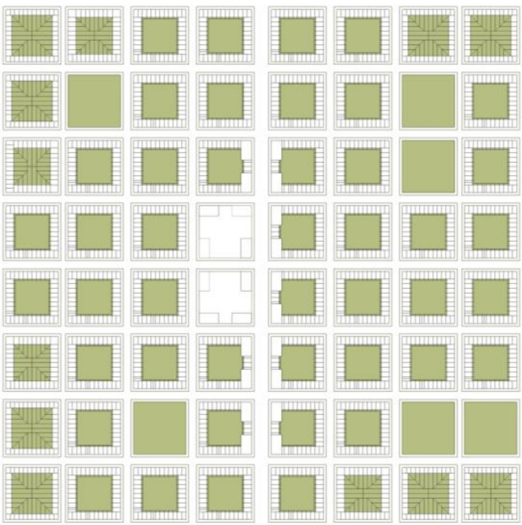


Figure 7.2: the amount of green space remained the same in both generic models due to keeping same size of blocks and footprint of buildings. Source: Author

7.2.6 Environmental comfort

The main issue regarding environmental comfort in design relates to the problem of overshadowing. As figure 7.3 shows, increasing the density and height of the buildings has a negative impact on this quality. However, even in the 400dph scheme, the majority of green open spaces, particularly public green spaces, will have a few hours of sunlight during winter. However, some dwellings on the lower level and on the north side of the streets may not receive any sunlight during the day.

The variation in the height of the buildings in the 400dph scheme has also contributed to this quality. As appears in the scheme, reducing the height of the buildings on the south side of the blocks will help to bring more sunlight into the communal gardens and lower level flats. However, overshadowing remains an inevitable consequence of increasing density.

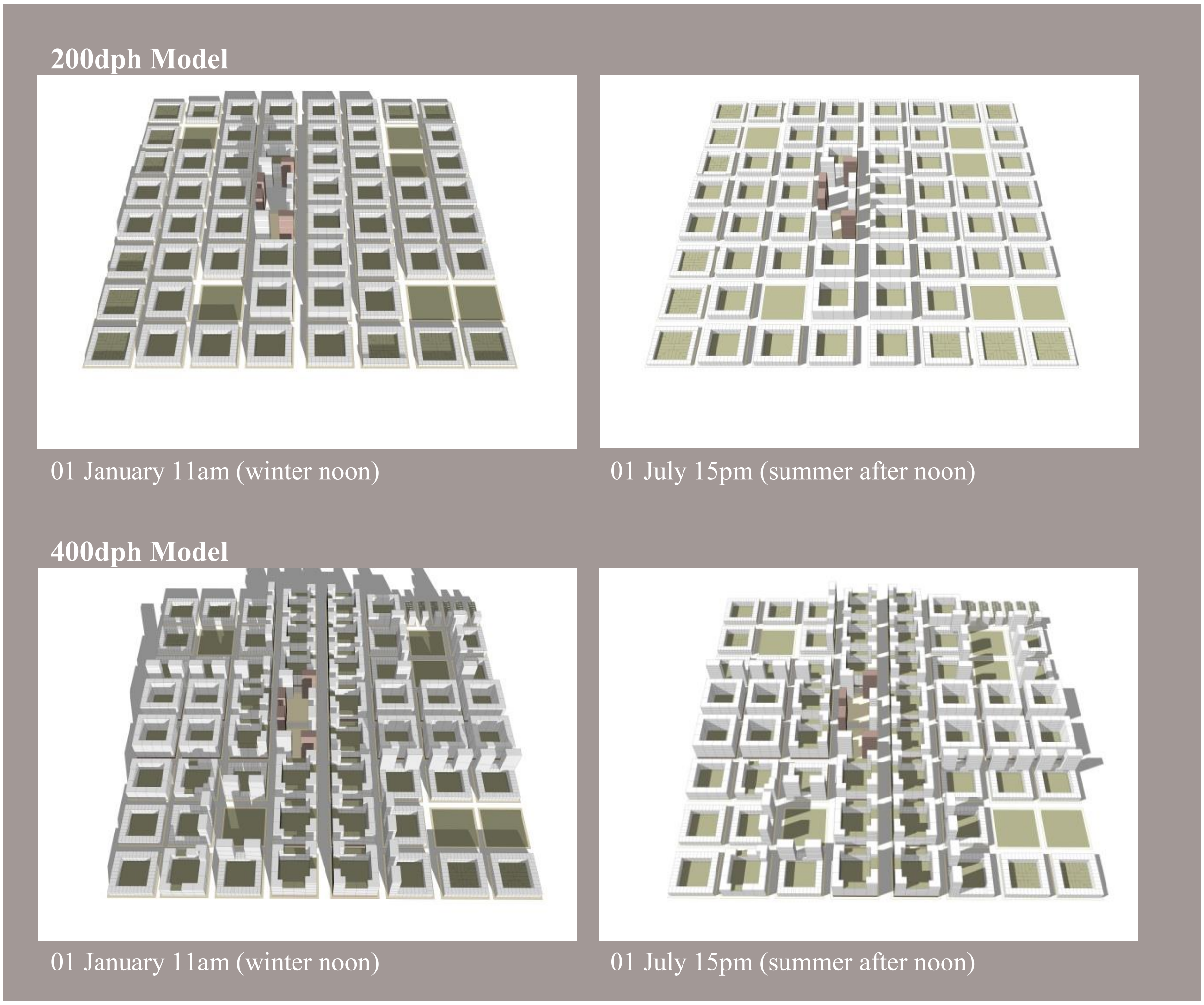
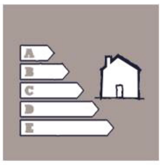


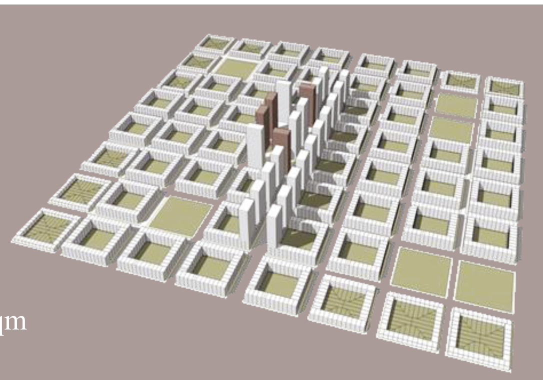
Figure 7.3: Shadow analysis for the generic models. Source: Author



7.2.7 Energy Efficiency

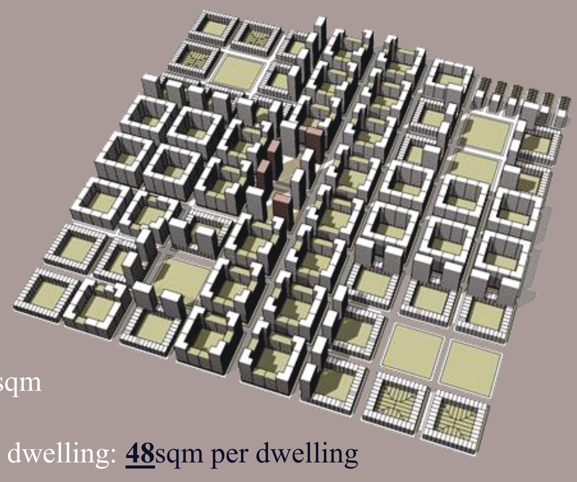
One factor in the quality of energy efficiency concerns the issue of reducing users' dependency on cars. This outcome has been achieved in both schemes because of the high level of accessibility delivered in the scheme, and also because of the restriction in the size of the neighbourhood which puts all the main local facilities within walkable distance.

The other issue relates to reducing the amount of exposed surface of the dwellings and preventing energy loss via design. The increase in density to 400dph has actually reduced the amount of exposed surface (figure 7.4). Although using a variety of heights and hybrid block types has slightly added to the exposed surface of the buildings, overall, the advantages of using these urban types and the improvement in other qualities are of more significance to the potential energy loss of the buildings. Moreover, the matter of energy loss may be more related to the architectural level and use of appropriate materials and insulation.



200dph scheme exposed surfaces

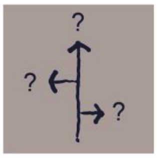
- Total Exposed surface: 682164sqm
- Number of dwellings: 12800sqm
- Average exposed surface of each dwelling: **53**sqm per dwelling



400dph scheme exposed surfaces

- Total Exposed surface: 1243140sqm
- Number of dwellings: 25600sqm
- Average exposed surface of each dwelling: **48**sqm per dwelling

Figure 7.4: Measuring average exposed surface of dwellings in each neighbourhood model. Source: Author



7.2.8 Legibility

The delivery of the quality of legibility is related to the use of the physical elements identified by Lynch (1960). The design of both schemes has resulted in a form with high-rise buildings centrally located. These high-rise buildings can play a role as landmarks, not just for the neighbourhood, but also on a city-wide scale. Moreover, the main road, particularly in the 200dph scheme, has a different character with more enclosures and a higher street skyline. This also provides a significant path in the neighbourhood which makes the area more memorable and helps people to find their way.

Other than these design considerations, an effort has been made to try to surround the public green spaces in the schemes with buildings of varied character. Some green spaces are in more active areas with non-residential ground floor spaces, and some are in completely residential areas of the neighbourhood. In addition, the skyline of the surrounding buildings is different from one pocket park to the other. All these considerations have helped to create a variety of character for the areas within the neighbourhood so that they are more distinguishable for residents and passers-by.

7.2.9 Character and Distinctiveness

Character and distinctiveness are qualities which are closely related to the existing characteristics of the neighbourhood and surrounding area. Since this part of the study tries to explore the matter of densification in a generic and abstract way, there is not much of an issue to be discussed about this quality until the local design chapters. This quality is more of concern in Third Part of the research (Chapter Eight to Ten) while densification schemes are designed for a real site with the challenge of respecting the existing character of the neighbourhood.

Nevertheless, it should be stated that through the design of these generic models, it has been attempted to use a variety of forms and morphological types. Since the existing character does not matter in this modelling, the design process has been undertaken with more freedom to explore these varieties of form. The main benefit of such a variety of form is that large changes in density gradient can be put in place in the schemes which contributes to the qualities of accessibility and the diversity of choices and experiences. However, throughout the local design, and within an actual site, compromises in these qualities may need to be made in order to respond to and reinforce the local character of the neighbourhood.

7.2.10 Safety

The main aim for delivering safety in design is to have visual surveillance of all public spaces. Due to the use of perimeter block forms for all the urban types in the models, all the streets and public open spaces in both of the schemes have the potential for such visual surveillance. Moreover, in the 400dph scheme, buildings have been designed at different height levels in a block. In this way, the roof gardens also provide visual surveillance from adjacent buildings. This is a crucial matter, particularly in such high density schemes because the roof garden is used by a large number of residents and therefore has the character of a semi-public open space. In this case, some windows are also designed for overlooking these spaces to have a greater sense of security.

As is discussed in the design qualities chapter (Chapter 4), the large number of residents in each building results in vulnerable circulation spaces, such as corridors and stairs. These spaces again have a quasi-public character in large and high rise residential buildings, but with a low level of surveillance. Therefore, it can be recommended that even with large buildings and plots, the building should be divided into smaller parts vertically and horizontally. In this way, access to different parts of large buildings can be restricted and circulation areas can provide more of a feeling of private or quasi-private (communal) spaces and neighbours can better know and identify non-residents.

The other aspect of safety has to do with the time of use of urban areas and public spaces. It is preferred to have a variety of residential and non-residential uses within the neighbourhood so that urban areas will be used throughout the day and night. Having a mixture of residential and non-residential buildings on all urban blocks in the central part of the neighbourhood has the potential to help both schemes feel safer by avoiding having empty buildings in the mixed use central area during the night. In other words, residential buildings which are more likely to be occupied at night provide surveillance on the main streets at night. This is a quality which in some cases can be missed in high density developments due to the high concentration of solely non-residential uses in town centres.

7.2.11 Privacy:

The quality of privacy has to be delivered by having appropriate back to back distance between dwellings. Given this, in both schemes, the perimeter blocks have been designed to be 100 metres wide, with buildings of 12 to 16 metres in depth, the back to back distance between the houses is more than enough for residents to have sufficient privacy.

In addition, as explained in Chapter Four, the high level of overlooking onto private gardens could make them less usable due to the lack of privacy. Based on this, it is preferred to reduce the number of blocks comprising block types with private gardens (type 1 and hybrid type 1) to a minimum and place them only at the edge of the neighbourhood where there is the lowest density. Instead, communal gardens are more regularly used in the design scheme.

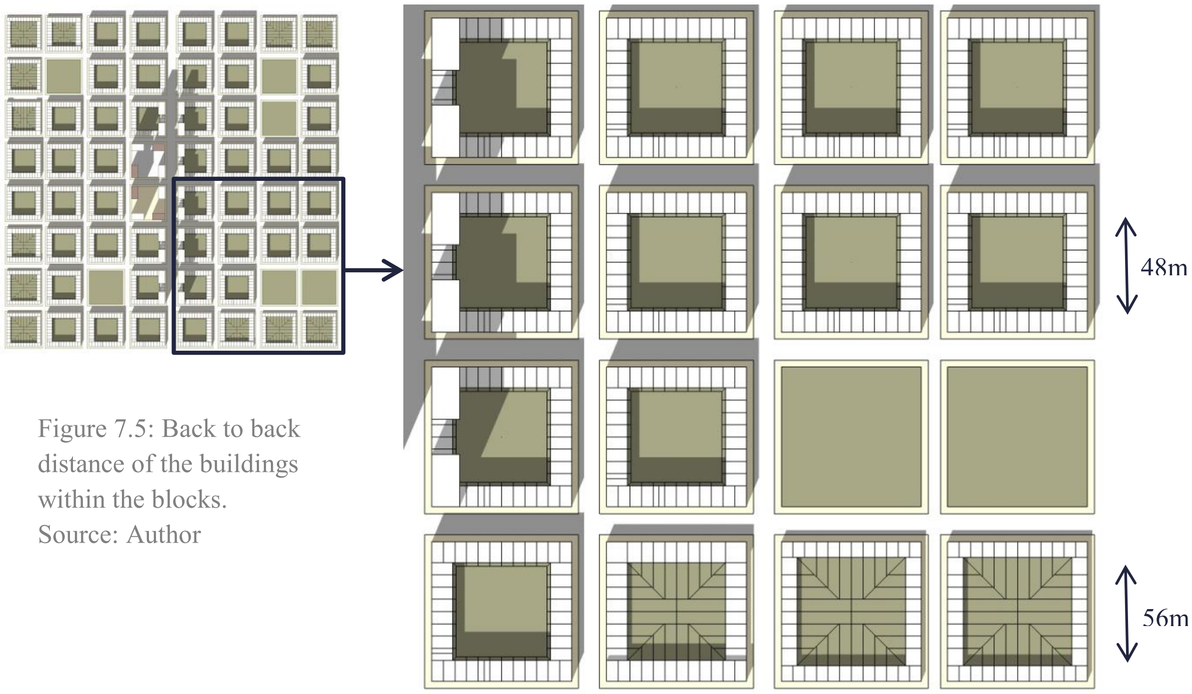


Figure 7.5: Back to back distance of the buildings within the blocks.
Source: Author

7.3 Main Findings from the Generic Modelling and Analysis

Based on the analysis from the previous section, in the following section, the key findings of the study are now explained.

7.3.1 Overall delivery of the urban design qualities

Overall, after reviewing the analysis tables (table 7.1 and 7.2) it can be seen that many of the design qualities which are of concern in this study are relatively achieved in both ranges of density. This is mostly because of the design considerations at the starting point of the modelling. Most of these features have been delivered by designing an appropriate urban layout both in terms of the scale of the blocks and the entire neighbourhood. At the starting point of layout design, the urban form types which were introduced were ideal forms which deliver basic design qualities for the neighbourhood as a whole. These urban form types have features such as: appropriate sized blocks and allocation of buildings at the periphery of the blocks separating the public and private spaces, and thereby surrounding and allowing surveillance of the street. Moreover, the footprints of the buildings in these urban types are designed in such a way as to keep an overall balance between mass and space in the neighbourhood and provide space for greenery.

7.3.2 Trade-offs between the amount of open space and the footprint of the buildings

Observing the models and the process of design, one of the main issues which makes a significant difference to the urban form of the models is the amount of public open space allocated to the neighbourhood as a whole. In the schemes for this study, as discussed in Chapter Six, four hectares of public open space were allocated to the neighbourhood. These open spaces were distributed so as to be less than 400m (5 minutes walking distance) from all dwellings, on average, and to provide a varied character to the open spaces within the neighbourhood. However, in order to provide these open spaces, the density of other urban blocks has to be increased to achieve the overall target density of the neighbourhood. Therefore, increasing the amount of open space has a significant impact on the form and urban type which is used for the other urban blocks in the model.

The modelling process shows that decisions about the amount of public green open space for the neighbourhood can have a significant influence on the form. Therefore, this is one of the main design trade-offs in high density areas. As figure 7.5 shows, on one side of this trade-off, the designer can decide to have buildings with a larger footprint and a low rise type of urban form. On the other side, the designer can minimise the footprint of the buildings and maximise the size of the green spaces. While this is just a diagrammatic presentation of the situation, in reality, an increase of green space can result in a high-rise type of urban form such as types 3 and 4. Therefore, some qualities are inevitably compromised. For example, the overall grain size in the neighbourhood becomes larger and less adaptable for future changes and a high rise typology can create a more significant overshadowing problem.

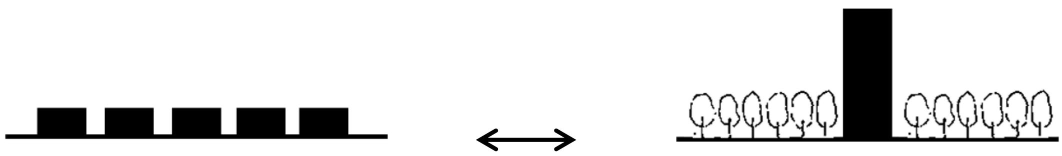


Figure 7.6: balance between footprint of building and amount of green open spaces.
Source: Author

This issue of the amount of green space and the footprint of the buildings will become more important when designing at the real site in the third part of the thesis. This is because the existing amount of open space can influence the designer's decision as to whether or not it is necessary to allocate new green spaces in the design scheme. In addition, the attitude of local residents becomes important and can play a key role in making such trade-offs. This is because designers have the choice of providing more green space for the neighbourhood, but the consequence of this decision is that the overall design may need to be high rise which can have a negative influence on the character of the neighbourhood and the attitudes of the residents towards the new developments.

7.3.3 Changes in the size of the grain

Through the process of design and analysis, one of the design qualities which changes significantly is the quality of adaptability. As can be seen in the final models, an increase of density from 200dph to 400dph resulted in the use of a larger grain in the urban form. This larger grain appears both in the buildings and the plots and changes the typology of an area from plot-based to block-based. This means that a larger number of dwellings are allocated to a single building and more communal spaces are used instead of private open spaces. As discussed in Chapter Three (adaptability section), such a design leaves less possibility for changes in the form and function of the spaces in the neighbourhood. The residents also have less control over changes to the form of the buildings and the activities which happen in the open spaces because of the communal ownership of the space. Therefore, one of the key impacts of increasing density is that, inevitably, the adaptability and the ability of residents to make incremental changes to the living space are reduced.

On the other hand, using appropriate types of form, higher density can bring more opportunity for communal activities in the open spaces. While private open spaces are mostly limited to balconies and small front gardens, the communal gardens in urban form types 2 and 3 can bring opportunities for more social interaction between neighbours with common uses being meeting up, relaxing and playing. Therefore, while residents may have less individual control over such spaces, there are more opportunities to introduce new communal activities to an area and to create a sense of community within each of the urban blocks.

Based on this argument, this research suggests that, in order to make more use of open spaces in high density developments, urban form types with communal open spaces (types 2 and 3) are preferable. An important consideration for these typologies is to make the communal open spaces more active and safer for residents. This goal can be achieved by incorporating windows overlooking the communal garden for surveillance purposes and allocating small back gardens (as small as 1 meter depth) to residents to allow for some degree of personalisation. Moreover, designing the main entrance of the buildings and the staircases to lead to and from the communal garden can increase the flow of residents and the potential for social activities in these spaces. Overall, communal open spaces can bring new opportunities to the high density urban form which may not be common at lower density.

7.3.4 Use of hybrid urban form

Another key finding from the modelling and analysis process is that, in high density design schemes, the use of hybrid urban forms can significantly improve the design qualities in the neighbourhood. The modelling in this part of the study has a generic shape, but hybrid forms can vary in the case of real examples. The key considerations in relation to hybrid urban forms are to concentrate the large, high rise buildings within a small part of the block or adjacent to particular streets and open spaces and then keep a mid-rise, small grain type of urban form for most of the rest of the neighbourhood. Such a design approach can take many different forms, of which two of the most common are used in the third step of the generic modelling in Chapter Six. For example, as another way of using this idea, Figure x shows a new neighbourhood which has been developed in Amsterdam. This neighbourhood has the overall shape of terraced houses with narrow and small plots which gives a sense of visual diversity. However, in the central part of the neighbourhood, one urban block with very high density can accommodate a large number of dwellings and significantly increases the overall density of the neighbourhood similar to urban form type 3. Therefore, instead of changing the form of the entire neighbourhood into a high rise, large grain development, only one block is designed in this way. Obviously there are limitations which prevent a designer from reaching very high density in this way, but the example shows how hybrid forms can focus the increase of density in specific areas and can maintain a mid-rise, small grain type of form for most of the neighbourhood.

As a result of using the hybrid form concept, many design qualities can be improved in a neighbourhood. The smaller grain can offer a more adaptable urban form. Also, by comparing the models in Chapter Six before (step 2 of the design) and after the use of hybrid forms (step 4), it appears that, by using a hybrid model, the problem of overshadowing can be concentrated in a specific part of a neighbourhood instead of the whole area. Furthermore, the concentration of high rise buildings in particular areas can make the neighbourhood more legible and makes a difference to the character of the streets.

7.3.5 Overall form of the neighbourhood

Observing the models in the 200dph and 400dph ranges, the study shows that an increase of density in such ranges inevitably results in a higher rise form of neighbourhood. The 400dph range has buildings with an average of eight to ten storeys and even the 200dph range has significantly more high-rise forms in the central part of the model.

The issue which becomes important here is the distribution of high-rise and high density urban forms within the neighbourhood. Overall, there are two ways to approach the density distribution; the first (figure 7.6, left) is to have equal density across the neighbourhood as a whole from the centre to the edge; the second (figure 7.6, right) is to concentrate the higher density forms in one area (normally in a central area) and reduce the density elsewhere (normally at the edge of the neighbourhood). In this situation, the density gradient becomes the important consideration, whether to have a similar density for the whole area or vary it from the centre to the edge.

Figure 7.7: Distribution of density within the neighbourhood from centre to the edge.
Source: Author

Understanding the advantages and disadvantages of each extreme can help a designer to make better design decisions for any specific locality. In low to mid density neighbourhoods, where it is common to see terraced housing or blocks of flats comprising four to five storeys, urban forms with an equal distribution of density may be more common. These neighbourhoods have relatively similar characteristics from the centre to the edge, giving a cohesive shape to the whole area. However, in higher density urban forms, it is more common to have very high density in the centre and low to mid-range density at the edge of the neighbourhood. A gradual change in density within a neighbourhood can have significant effects on the design qualities. Neighbourhoods with higher density in the centre tend to have more residents living closer to the central services and transport hubs. Therefore, the neighbourhood has higher accessibility. Moreover, the differences in the shape and character of the neighbourhood from the centre to the edge can improve legibility. In addition, such variety of form can offer different living choices from the active centres of the neighbourhood to the quiet, low density areas at the edge. In this way, the neighbourhood can provide a variety of choices to serve a diverse range of life styles.

In the generic modelling for this study, the author has tried to vary the density from the centre to the edge. In this way, the previously explained design qualities are achieved in the neighbourhood models. Moreover, changing the form to hybrid urban types (step 3 of the design in Chapter Six) has again created differences in density from the busy central streets to the quieter, more residential streets at the edge of the neighbourhood. Understanding these trade-offs and the features affecting the distribution of density in the neighbourhood can help the designer to identify the most appropriate design for different sites.

7.4 Conclusion

Overall, this chapter has covered the process of analysis of the generic models designed for this research. The chapter has explored all the design qualities of the research comparing the degree of delivery of these qualities between two generic models.

This part of the research has helped to identify some of the main changes in urban qualities which occur during the process of intensification via a generic inquiry by design method. However, as discussed in the findings, designers' choices with regards to matters such as the amount of public open space and the distribution of density can influence the degree to which each quality can be achieved. In other words, the choice of the designer in relation to urban form can create trade-offs between the delivery of different qualities.

What becomes important here is the priority given to different design qualities. In other words, the choices of the designer show which design qualities have greater priority in the design process. However, such choices are not completely dependent on the designers' preferences, but also reflect the existing conditions of the site. The two main areas which can influence such decisions are, firstly, the physical context of the neighbourhood in terms of its existing characteristics and form and secondly, the attitudes and preferences of the local residents. These two aspects are the most important factors which guide the design process to make locally appropriate choices and trade-offs between design qualities.

Based on this further process, the study focuses on a specific site in London. An inquiry by design process is carried out further to test to what extent it is possible to make such trade-offs and design choices based on the precise local needs of a neighbourhood. At this point, the first testing part of the research is completed. From the next chapter onwards, the second part of the testing starts. The findings from the generic modelling and the analysis in this chapter are still general. These findings are applied and tested again in the next part on a real neighbourhood. In this way, the general findings from this part will become more precise and adapted specifically for a particular residential neighbourhood to check the applicability of the recommendations.

Chapter Eight

Local Design: Assessing Place issues

8.1 Introduction

Through the last two chapters, the first part of the testing for the thesis was completed. The first testing was about generic modelling and analysis. The study was carried out in ideal and abstract conditions. In this way, the theoretical relationship of neighbourhood density and design was investigated, with the aim of reaching the optimum urban form in high density areas and the maximum delivery of design qualities.

From this chapter onwards, the second part of the testing starts. The testing is again carried out via an inquiry by design method; similar to the previous part, but the application of the method is on a real neighbourhood. The study here is focused on a specific neighbourhood in London: the Finsbury area in South Islington. Focusing the study on a real site, the limitations of and obstacles to design in an existing built environment which was not dealt with in the ideal generic models become the main focus of the study. In this way, the research started with a simpler process of inquiry by design to establish and test basic design principles, but here the issues become more complicated considering the compromises necessary for a real site design scheme.

This part of the thesis includes three chapters. As discussed in the conceptual framework (Chapter Four) when focusing on localities, two main subjects become important to be considered in the design process: first, place matters which relate to the existing physical condition of a site (Chapter Eight), secondly: people matters which relate to the demands and attitudes of local residents towards new residential developments in the area (Chapter Nine). Based on the investigations in these two chapters, the main design schemes at different densities are developed with the final analysis of the design schemes (Chapter 10). Based on this, these three chapters cover the fifth objective of the research:

To test the theoretical propositions by applying the urban design principles to a realistic densification scheme for a local neighbourhood in London.

This chapter deals with the place matters related to a chosen locality. The aim of the chapter is to investigate how the existing physical form of the site may influence the design process. The key issues related to the morphological character of the neighbourhood and the plans for further intervention in the physical form of the area are reviewed in this chapter.

First the site area is introduced showing the location in London and in the Borough of Islington. Then, the main features and character of the area are described in terms of physical form and the overall relationship to the city as a whole. Then, plans for future developments, particularly with regards to increasing the number of houses are reviewed. The main part of the chapter analyses the existing urban form of the area. This analysis is based on the analytical framework in Chapter Five to show the existing patterns of urban form and morphological elements. The analysis process aims to evaluate to what extent the design qualities suggested as important in this research are delivered in the existing conditions of the site. Each design quality from Chapter Four is therefore discussed again separately in this chapter with a focus on the local site for this study.

8.2 Finsbury area

The Finsbury area in the Borough of Islington in London was chosen as a case study for the research. This section explains the geographical and morphological characteristics of the area. In addition, the historical changes in the character, demography and morphology of the area are explored. The existing conditions of the area in terms of demography, housing and urban form are introduced. The general future plans for developments within the area are also explored. Overall, this section provides an overview of the area with regards to the main points of density and urban form.

8.3 Finsbury in South Islington

Finsbury area is in the southern part of the Borough of Islington (figure 8.1 and 8.2). The area is located adjacent to Central London and at the edge of the business led part of the city.

The main area allocated for further housing development in Finsbury is next to the City Road. This area which is located on the north side of Finsbury has more of a residential context compared to the south part of the area which is at the edge of the City of London.

Due to copyright reasons, the image has been removed in the online version of thesis.

Figure 8.1: Location of Borough of Islington in London and
Location of Finsbury area in South of Islington.
Source: Left: Wikipedia.   Right: Islington Council 2012

Figure 8.2: Ariel view of Finsbury. Source: Bing Map

8.4 Criteria for site selection

In order to choose an appropriate site for this study, many different options were considered. The aim was to find a neighbourhood with the potential for new residential development and with the potential for high density development. London has high demand for new housing and high density residential developments are more common in it (GLA, 2003). Therefore, the main investigation for site selection focused on this city. The London Plan and the areas for new development in it were reviewed.

In studies undertaken by Greater London Authority (GLA, 2011) the target areas for neighbourhood scale new developments are classified in two main categories of Opportunity areas and Intensification areas. The Opportunity areas are the ones with large empty spaces within the city. Due to the large size of the Opportunity areas, these allocated spaces can accommodate a large number of new houses. However, the additional new developments in these areas may not necessarily need to be high density. These areas are chosen for large scale development of new houses in the city with a typically medium density range.

The Intensification areas were also checked for this study (London Development Agency (LDA), 2009; GLA, 2011). These are the areas which contain brown field and vacant spaces within an existing neighbourhood. These areas are more likely targeted to increase the current density and change the existing form of the urban area. However, most of these areas are in the outer part of London and they do not allow the range of densities related to this study. The areas in the inner part of the city were commonly targeted to increase non-residential spaces and provide business opportunities rather than to increase residential density.

While the main selected sites for new developments in the London Plan (GLA 2011 and 2015) do not match the criteria for this study, the site selection process focused on other possibilities. Finally, the search focused on areas with the potential for new residential developments closer to central London. In this way, the areas have more potential for high density residential development.

The Borough of Islington in this case has a distinct character. This Borough is situated at the edge of the City and expands to the north side. In particular, the Finsbury area is located exactly at the south edge of the Borough and close to Central London (figure 8.1). Such a situation creates considerable potential for high density types of urban form and high demand for new housing close to the jobs and services in Central London. On the other hand, as is further explained in this chapter, this area has much potential for new developments due to the existing vacant spaces and low quality buildings which could be redeveloped (Islington Council (IC) 2006a; IC, 2006b; IC, 2012). Therefore, the area has appropriate potential for new housing development and especially in a high range of density which may not be common in all areas of the city. The issue of potential for high density development is crucial for this study. This is because, if there is no such demand for new housing and increased density is not such a common pattern in the area, then high density schemes may not be acceptable to the local residents.

From another point of view, the mixed morphological characteristics of the site are also an advantage for this study. The area does not have a unique and unified character. The buildings in the area were developed using many different typologies and there is no unity in the form of the neighbourhood (see figure 8.2 and 8.5). Therefore, intervention in the physical form and characteristics of the area which is inevitable in higher density schemes, is more acceptable to the locality. Moreover, another morphological feature of these areas is that the allocated spaces for new development are relatively pepper potted within the existing neighbourhood. The process of designing new houses depends on limitations which the existing urban form dictates to the designer. This is exactly the intention of the second part of the testing in this research. In other words, the complex condition of the site can contribute to a more precise evaluation of the research theories in practice and to investigating the applicability of the design principles that have been developed based on the simple generic model.

In the following parts of the chapter, the past, the current context and the possible future of the area is explored in more detail.

8.5 Historical and demographic context of the site with regards to changes of density and morphology

In order to provide a context for understanding the existing condition of the Finsbury area, this part of the chapter describes the historical changes in the area. The focus of this exploration is on the two notions of morphological changes (place matters) and demographic changes (people matters). This review will then be used as a base for further investigation of place and people matters in the existing condition of the area in Chapters Eight and Nine.

The population of Finsbury has undergone many changes over time (IC, 2011). The highest population density in the area is related to the 19th century and during the industrial period. The area was characterised by industrial factories and populated by factory workers. After the industrial period and the closing down of the factories, the population fell. The process of counter urbanisation mostly happened during the second half of the 20th century. In this period of time, economic problems in east London and a lack of jobs have again reduced the population of the area (Green, 2009; IC, 2013).

In addition, the physical form of the area experienced major changes as a result of the demographic changes. The closure of factories resulted in vacant spaces and buildings in the area. The Second World War saw significant destruction in the neighbourhood. After the war, many new residential developments were constructed in the area in the shape of estate tower blocks (figure 8.3). However, overall, due to the economic problems and the reduction in the population of the area, many vacant spaces and low quality buildings persisted.

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Figure 8.3: Finsbury Estates. Tower blocks which were developed during the post war era in Finsbury. Source: Green, 2009

8.6 Current demographic and morphological condition of Finsbury

From the 1990s onwards, the population of Finsbury again started to increase (IC, 2011). This was due to the economic changes in the city and the focus on the development and regeneration of East London. The proximity of Finsbury to the business hubs in Central London contributed to the new increase of density in the area, while London has become a cosmopolitan city and absorbs new residents, particularly from outside of the UK. Most of the new residents who have come to Finsbury during recent years are from non-English ethnic backgrounds. The new residents are commonly employed by the businesses in the central part of the city. The reason for choosing Finsbury as a place to live is mostly due to its proximity to these opportunities within the City (IC, 2011).

As table x shows, the population of Finsbury is expected to grow in the next twenty years. The population change will also be aligned with a decline in the number of elderly people and the growth of the working population. Between 2001 and 2007, the population of the area increased by around 20 percent (IC, 2013).

Due to copyright reasons, the image has been removed in the online version of thesis.

Figure 8.4: past and future estimated population density (people per hectare) in the South Islington, showing the expectation for increasing density and population. Source: IC, 2013

Overall, the population of South Islington faces the challenge of poverty with low saving rates and less than national average incomes. On the other hand, the area has potential for new employment and economic growth. Currently the overall population of Finsbury contains older and relatively low income residents and new residents who are more likely to have higher incomes and from non-English ethnic backgrounds (IC, 2013). The recent increase of population is also more likely to be from the second group and from more highly educated people who target the new high tech jobs available in the area (IC, 2013). This is because of the concentration of high tech and IT related type of businesses growing particularly in the south of the borough around Old Street. The area has recently been referred to as London’s Silicon Valley due to this new business concentration (GLA, 2015).

Due to this demand for housing in the area and its proximity to jobs and opportunities in Central London, it commands a significantly high price for residential flats. The area has one of the highest prices for buying or renting houses in London. This circumstance of high demand for housing has resulted in rapid growth of residential developments within the area in recent years. There are many examples of high rise residential towers having been developed in the area and many new ones are in development (see figure 8.4 and 8.5).

Based on these conditions, the existing physical form of Finsbury has a highly mixed character. The buildings' urban form contains a variety of types including traditional terraced houses, post war estate blocks and high rise new towers. These different types of urban form are mixed together without any exact order and in a relatively pepper pot shape. This is because of the historical conditions of the area. In each period of time, certain typologies became common in the area and then, due to the reduction in the number of residents or the circumstances of the war, some of the buildings were demolished and new types of urban form developed in the vacant areas. This process resulted in the current physical condition of Finsbury with its mixed character and many vacant spaces providing potential for new developments.

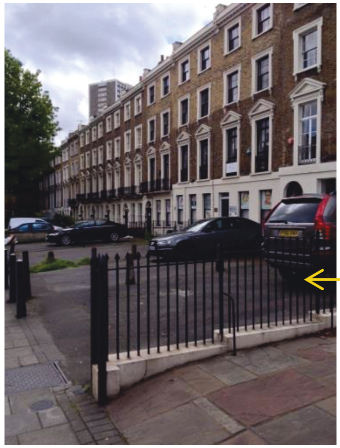
Figure 8.5: City Road, South Islington; Mix of old terrace houses with new high rise towers. Source: Author

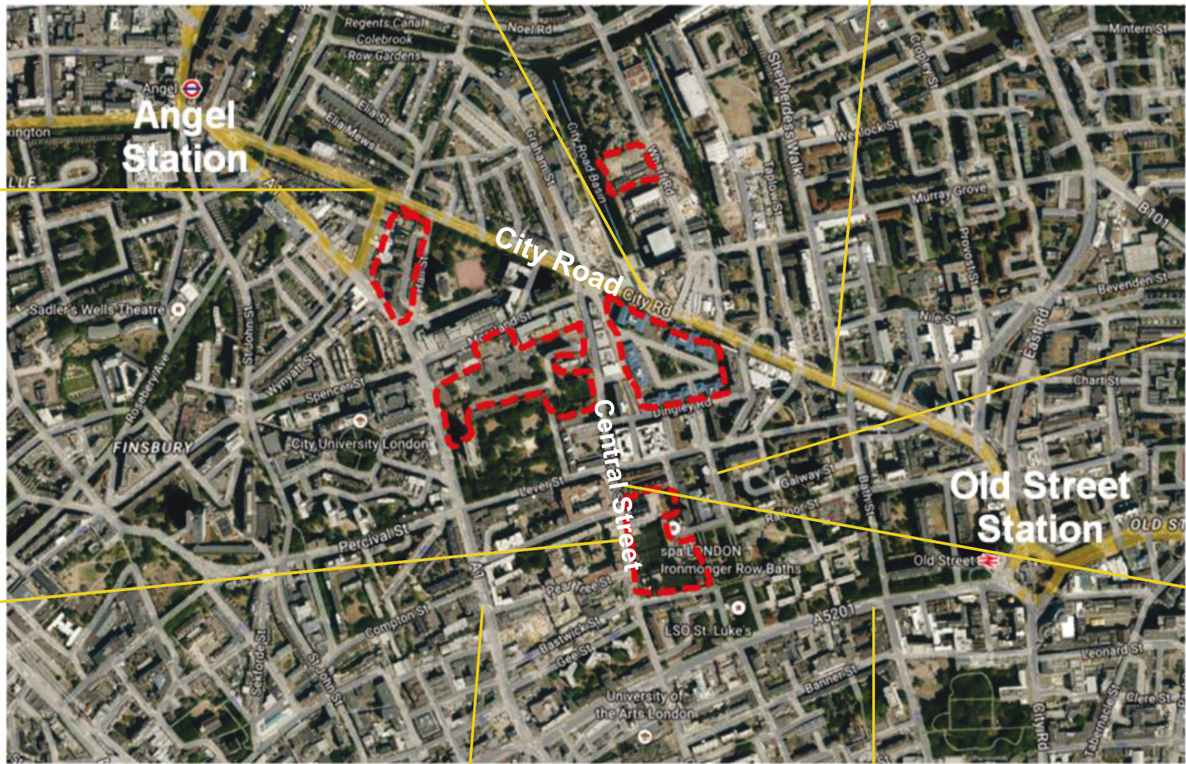
8.7 New plans for development in Finsbury

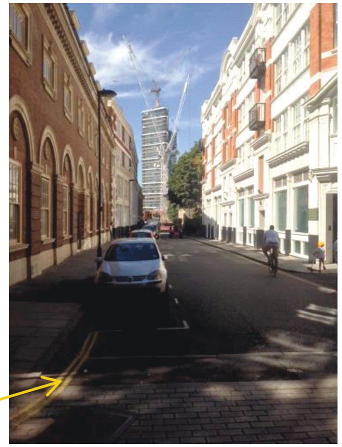
Due to the high demand for new housing and the strategic location of Finsbury, many new residential developments are planned to be developed in the area. Studies underpinning the Finsbury Local Plan show the precise spaces allocated for developments until 2020. Based on this document, the majority of residential developments are planned to be allocated on the northern side of the area close to the canal and City Road (see figure 8.5). The south part, close to Old Street, is mostly allocated for business related buildings to contribute to the new business hub in east London.

The focus of this study is on the area allocated for residential led development in the north of Finsbury. Based on this, the study uses the same spaces allocated in the Finsbury Local Plan for new residential development. The models in this study are designed for these designated spaces. In this way, the results of the inquiry by design testing are more likely to be close to the reality and the final findings of the research will be more robust.

In the next stage of the study in this chapter, the existing physical condition of the area is analysed in more detail based on the analytical framework of the research. In this way, the study will show to what extent different design qualities are delivered in the area. This study will provide an initial understanding that the process of increasing density through design may improve certain qualities in the area. In other words, the analysis is intended to show the opportunities and threats with regards to the process of densification and change in the urban form of Finsbury.

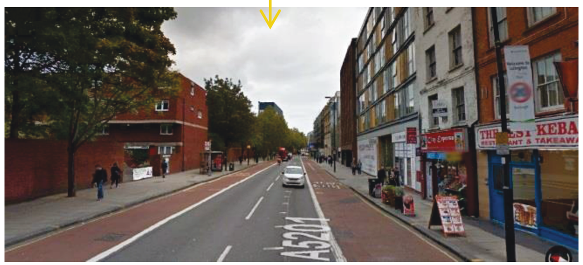






Source: Author

Figure 8.6: allocated sites for residential development in Finsbury (based on Finsbury Local Plan) and character of the exiting streets within the area



Source: Google Map

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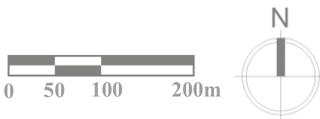


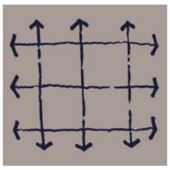
8.8 Local site analysis

In this part of the chapter the existing urban form and physical condition of the site is analysed based on the analytical framework developed in Chapter Five. The following table presents an overall analysis of the site based on the indicators of urban design qualities.

Table 8.1:
Analytical table for existing condition of the site for intensification

(See the main extended analytical table in chapter 5)

Urban Design Qualities	Indicator	Criteria		
		Low	medium	High
permeability	Average length of block			
	Existence of cul-de-sacs and dead ends			
Accessibility	Density gradient designed according to main transport and business nodes			
	Walkable distance to services			
Diversity	Allocation of non-residential uses			
	Proximity to main non-residential uses: Primary school			
	Proximity to main non-residential uses: secondary school			
	Proximity to main non-residential uses: medical Centre			
	Proximity to non-residential uses: main shopping area			
	Active edges produced and distribution of non-residential uses			
	Diversity in dwelling size			
Visual variety	Opportunity for personalization at the ground floor of buildings			
	Opportunity for vertical division of façade to improve diversity in visual experience			
Adaptability	Potentials for change of use in dwellings: access from building to public space			
	Potentials for gradual change of urban form			
	Opportunity for communal activities in semi open spaces in center of the blocks			
	Possibility for extension in buildings			
Biodiversity	Total Public green space per person			
	Total Communal green space per person			
	Connectivity of green spaces			
	Accessibility to green space (within walking distance of dwellings			
	Possibility for Variety of activities and character in green space			
	Opportunity for use of greenery on exposed surface of buildings			
	Opportunity for local food production (allotments)			
Environmental comfort	Receiving sunlight for all dwellings during the day			
	Receiving sunlight for all green open spaces during the day			
Resource efficiency	Average exposed surface of dwellings (for loss of energy)			
Legibility	legibility of public space network			
	Legibility through use of landmark buildings			
	Change of character of buildings and open spaces from centre to edge of neighbourhood			
	Varity of public spaces character within neighbourhood in terms of form, use and activities			
Character & Distinctiveness	Similarity of form and grain size in the urban layout to surrounding built environment			
	Respecting the existing height of buildings within the area			
	Distinctive characteristic of neighbourhood from surrounding areas			
Safety	Overall length of Active edges at ground level of streets			
	Clarity of public, communal and private space			
Privacy	Keeping appropriate back to back distance of dwellings			
	View from street to the house in ground floor			
	View on private gardens from other dwellings			



8.8.1 Permeability

As figure 8.6 shows, the site contains many irregular shapes and sizes of blocks. There are also many dead end roads in the site. This condition has reduced the connectivity of the street pattern. Designing any new development within the area should be based on the need to improve the existing layout by creating new connected streets and reducing the size of the large urban blocks. In this way, the traffic flow will be enhanced and different means of way finding will be visible.

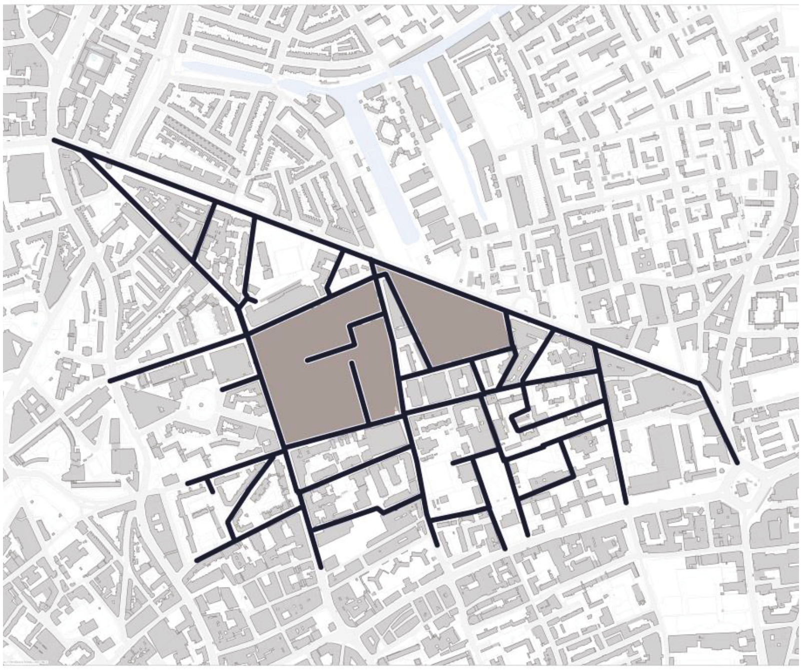
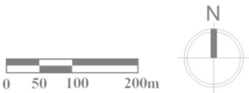
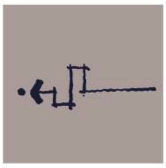


Figure 8.7:
Irregular size and shape of blocks and dead end roads made low level of connectivity in street network of the site
Source: Author





8.8.2 Accessibility

Accessibility is one of the major existing strengths of Finsbury. The site is located at edge of the central London. Being in such a location provides a high level of accessibility to many different services and facilities. The main reason for having the maximum acceptable residential density (according to London Housing Design Guide: GLA, 2010) is the proximity of different jobs and services to Finsbury and South Islington. Moreover, there is good public transport service within the area. Angel and Old Street tube stations are within walking distance from the site. City Road has several bus stops with bus routes to many different parts of central and outer London (figure 8.7). Many services such as offices, sport centres and educational facilities already exist within the site or in the surrounding area. Many new offices and jobs have also been allocated to the south part of Finsbury is the Finsbury Local Plan (2011). Overall, the site already has a good deal of potential to serve new residents and this has resulted in, to some extent, new high rise developments already taking shape in South Islington.

In order to ensure good accessibility in the new design scheme for the area, some primary issues must be considered. Based on the existing conditions of the site, it is worth considering that most of the access to public transport and therefore to other parts of London is from City Road and the tube stations at the two ends of this main road. Similar to the generic modelling process, it can be recommended to build a higher number of new houses close to City Road rather than in the southern part of the site. In this way, the number of people closer to public transport will be increased and hence, the overall accessibility of the neighbourhood will be improved.

Figure 8.8: Accessibility of the site to the Tube stations and main road with key bus routes.
Adapted from: Digimap

8.8.3 Diversity

A major part of the urban design quality of diversity is related to bringing different types of activities and usage together in an urban area. Finsbury is located close to the same highly business-led areas of London. Going outside the allocated site for design to the south, most of the buildings are purely non-residential leading on to Central London. A large number of buildings within the site are used for non-residential purposes, from offices to shops and sport centres. The Finsbury Local Plan has also allocated much of the space for new development to business-led buildings. This is particularly true in the southern part of Finsbury (figure 8.8). Most of the new residential buildings are planned to be located in the north part of Finsbury which is the area considered in the design process for this research. Therefore, despite a highly non-residential and mixed use type of urban form, the northern part of the area is more focused on residential use. This is in response to the high demand for accommodation close to these new business hubs.

While the focus of the design in this part of Finsbury is more on residential usage, it remains based on the Local Plan (2011) and recommendations from the previous parts of the research, so non-residential uses should also be added to the new scheme. Adding new non-residential uses such as shops and offices would improve the overall design quality of the neighbourhood. For example, having shops on the ground floor can create more active edges and more activities and commuting of residents within the area. The concentration of non-residential spaces will be on City Road which already has more activities and commuters, making it a more feasible location for new shops and other services.

The main non-residential building in the space designated for new development is the Moreland Primary School. According to the Finsbury Local Plan (2011) this site is being considered for a mix of a new building for the school as well as adding new residential buildings. One of the challenges related to the school site is that the building is located in the middle of a wide open space without any meaningful attachment to the surrounding buildings and streets. Part of the change in the new design scheme should be about designing the new school building in relation to the existing street pattern. The new buildings should be designed adjacent to the streets so that instead of the existing blank walls, the new school can bring new active edges to the surrounding streets, making a more vibrant streetscape. In this way, the design can contribute to the visual diversity of the streets by a slight relocation of the existing usage within the site.

As mentioned previously, the Finsbury area already has a highly diverse character. Many of the jobs and services necessary for a vibrant neighbourhood already exist there. However, it should be considered that increasing the density and the number of new residents may put pressure on some of the existing facilities. Therefore, it should be considered that, in such a high density scheme, it may be necessary to have further plans to better manage the existing facilities within the area. This can be done via increasing the number of hours during which buildings are used, or changing the use of buildings at different times of the day. As an example, schools can be used as community centres or sports fields in the evening. Also, for example, it is becoming common in this part of London to have cafes during the day to switches to a bar in the evening so that the building can be used for most of the day and night. Although such matters are not the direct focus of this research, these new management and planning ideas are necessary for high density schemes to work properly.

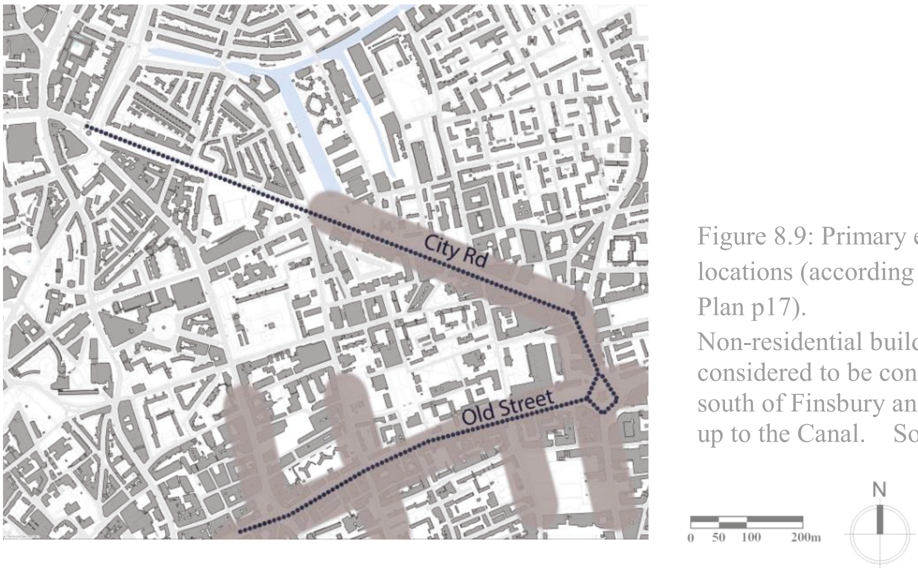
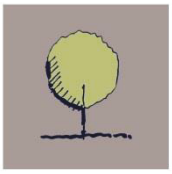


Figure 8.9: Primary employment locations (according to Finsbury Local Plan p17).
Non-residential buildings are largely considered to be concentrated at the south of Finsbury and in City road just up to the Canal. Source: Author



8.8.4 Biodiversity

Compared to the outer London neighbourhoods, Finsbury has a small proportion of green space. As appears in the site and the surrounding areas, the green spaces consist mostly of a few small pocket parks (figure 8.9). Some of these small green spaces are not properly overlooked by the surrounding buildings due to the irregular shape of the blocks and streets and open space patterns, although, in recent years, new activities such as playgrounds have been brought to the green spaces to make them safer and more active during the day. The potential areas for new development are so ‘pepper potted’ and separated that this does not suggest any potential for the future development of large green spaces.

It can be assumed that the lack of greenery within this site is due to the high pressure for new residential as well as non-residential development. Finsbury is very close to business hubs in east and central London. It also lies within walking distance from tube stations and bus stops which link the area to the other parts of central London. Therefore, there has been a trade-off of having less biodiversity in order to gain design qualities such as accessibility to jobs, services and other attractions and facilities within the City of London.

Increasing density to 200dph and 400dph at the site cannot obviously improve the biodiversity of the area. However, most of the new developments will replace existing low quality buildings or brownfield development and, therefore, will not harm the existing greenery of the site. New developments can improve the biodiversity of the area in ways other than increasing the green public space. Placing new buildings adjacent to the existing green area may improve safety and the use of the existing green space. Adding tree lines and front gardens to the new schemes can make further contributions to the greenery. Roof gardens and communal gardens can also provide greenery for smaller residences. Overall, new schemes may contribute to the quality of biodiversity not by significantly increasing the amount of green space but by making the small number of green spaces into more of a visual experience in the daily lives of residents.

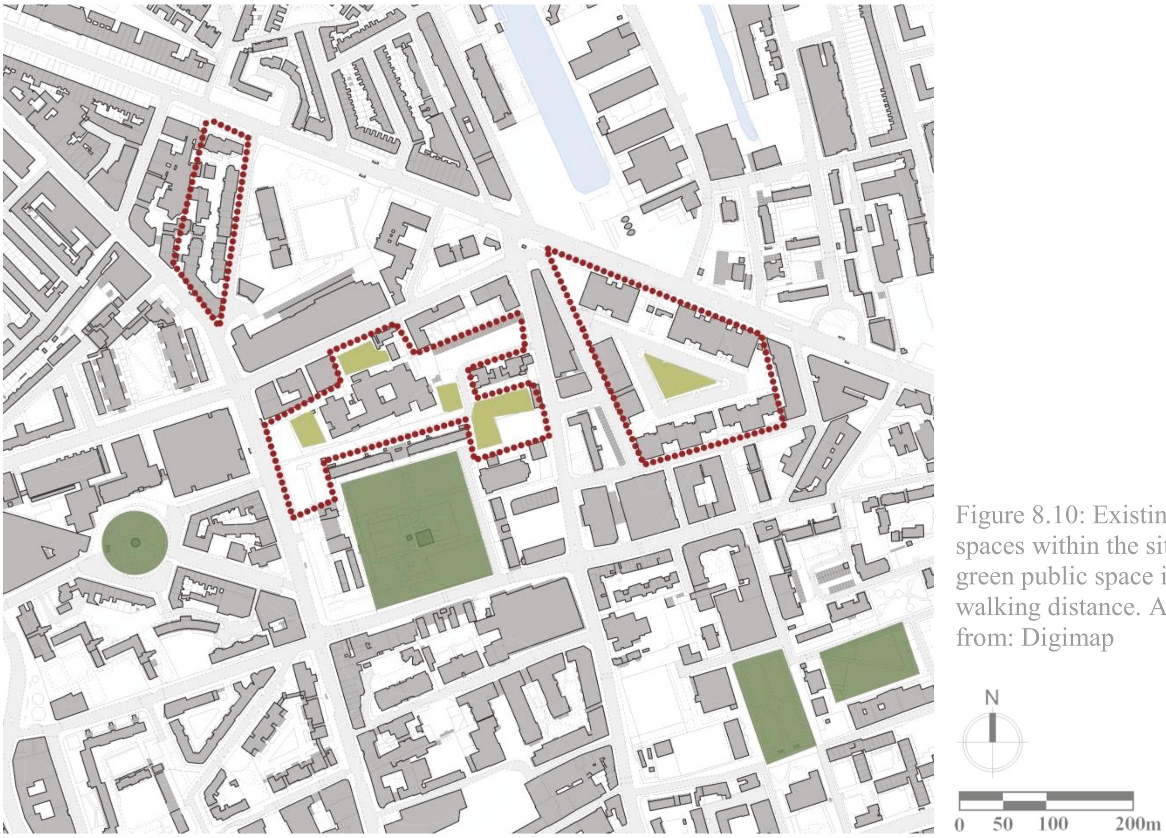
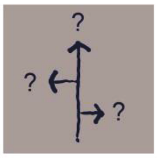


Figure 8.10: Existing green spaces within the site and green public space in walking distance. Adapted from: Digimap



8.8.5 Legibility

Legibility will be achieved via making more understandable street patterns and a more understandable urban layout so that way finding is easier for passers-by. In this area, the irregular shape of the blocks and the low levels of connectivity in the street patterns are some of the factors that makes it less legible. Moreover, the parking and vacant spaces has made the character of the streets less memorable. In such cases, providing a more connected street pattern and designing new buildings in the form of perimeter blocks would improve the enclosure of the streets which can help to make the streets more recognizable and make it easier for passers-by to find their way. Hence, improving the urban layout and adding new buildings adjacent to the existing or new roads would improve the legibility of the site.

On the other hand, as also suggested by Islington Urban Design Studies (IC, 2006), the area near the canal could have a unique high rise character and could play the role of a new landmark in the neighbourhood (figure 8.10). The generic modelling process showed that adding new high-rise buildings is inevitable when trying to increase the density of an area to the 400dph range. Therefore, this particular area next to the canal and City Road may be the first priority for high rise development. In this way, the new landmark may improve the overall legibility of the site and give a distinctive character to this particular location.

Figure 8.11: Opportunity area for a new high rise landmark and new public space next to the Canal. Adapted from: Digimap

8.8.6 Character

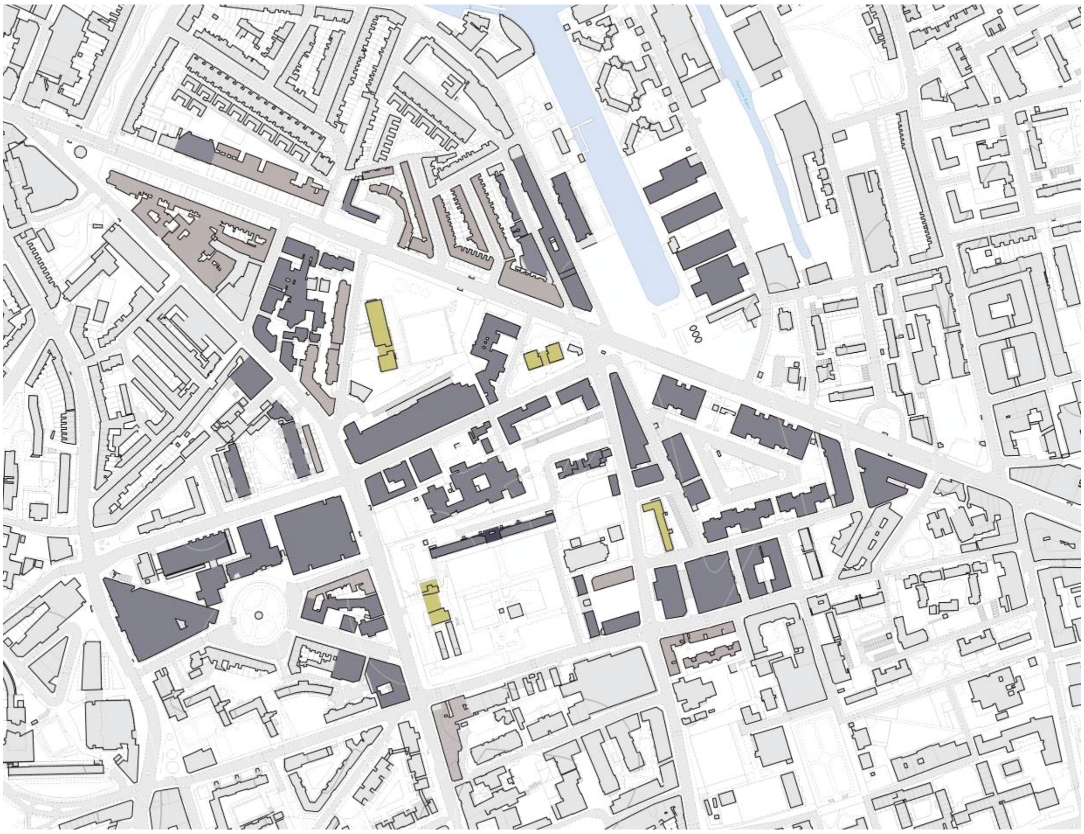
Generally in South Islington the buildings are of a mix character. Compared to some western areas of London such as Chelsea and Kensington which have a more cohesive historical character (figure 8.11), this area has a mixture of buildings from various periods, from Victorian and Georgian terraced houses to tower blocks and council estates from the post-war period to new high-rise towers developed in recent years. This makes for variety in the morphological character of the area. There is no common shape or size in the buildings or plots. In some parts, tower blocks exist in the middle of green open space and, in other parts, the open space is surrounded by perimeter blocks (figure 8.12). Furthermore, many spaces adjacent to roads are allocated for car parking which do not contribute to the overall character of the area. Such a mix of character has taken place over a long period of time. One main reason for such variety in character is because of the demographic ups and downs in Islington over the last two centuries. This demographic change includes a rise and fall in the local population during and after the industrial period as well as the destructions in Second World War and also urbanisation and counter urbanization in the post-war decades. Given these major changes in the number of residences and housing, the area does not have a cohesive form or consistent morphological characteristics.

Sloan Square, London

Common street character in West London; close to Victoria Station

Figure 8.12: Cohesive character of street scape in West London; Similarity in building type, allocation of building in periphery of the block and narrow plots have made a cohesive and yet diverse character for the public space. Source: Author

The un-cohesive character of the area has resulted in a variety in the form and character of new developments within the area in recent years. This condition has provided a unique opportunity for new highly dense developments in South Islington, and it is more acceptable to have such major change of the common urban characteristics of London within this area than in many other parts of the city. This is also because many vacant spaces and low quality buildings were meant to be demolished and rebuilt. Therefore, the mixed character, existing vacant spaces and the need for new housing in this area has provided opportunities for radical intervention in the existing urban form. As evidenced during recent years, many new high-rise buildings have been developed next to City Road and the Old Street roundabout and more are under construction.



Plot base/ small grain type

Large size plots and Block base type

Tower blocks in the middle of open space

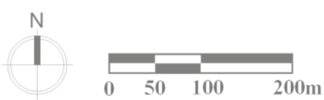


Figure 8.13: Mix morphological character of Finsbury. Figure shows the variety of urban form types within the area. Adapted from: Digimap

8.8.7 Safety

In terms of safety, the existing conflict in this area is between the unclear division of public and private space and the lack of surveillance of public space. Streets with solid walls (or even without walls) and the empty areas reduce surveillance of the public spaces. Introducing new buildings in the shape of perimeter blocks would improve the safety in the streets and also help make a clear separation between public spaces outside of the perimeter blocks and private open spaces inside the blocks.

Figure 8.14: Inactive edges of streets which reduce visual diversity and surveillance on streets.
Source:
Map: adapted from Digimap
Image: Author

8.8.8 Privacy

With regards to the matter of privacy, it is necessary to consider leaving an adequate distance between buildings particularly in relation to back to back distance. Although some urban blocks within the area are sufficiently large to create a proper distance between buildings, it should be considered that dividing these large blocks into smaller ones in order to increase permeability should not compromise the privacy of the new or existing dwellings. In some of the new developments within the area, because of the irregular or small size of allocated space for new development, the back to back distance of the buildings is very narrow which reduces the privacy of all the new dwellings.

8.9 Conclusion

This chapter has examined the place issues of the site selected for the inquiry by design testing in the research. The chapter has focused on the physical form and morphological characteristics of the Finsbury area in London. The site area was introduced, showing its location in the city of London. Based on the location and proximity of the site to Central London, the issue of the demand for new housing and increases in residential density were explored. The local plans for future developments in the area were reviewed and the space allocated for new housing developments was identified, and the exact site area for increasing housing density in the area was shown. In the next stage of the chapter, the existing physical form of the neighbourhood was analysed using the analytical framework of the research. The analysis revealed the main patterns of urban form and the degree to which different design qualities have been already delivered or need to be improved. Based on this, the existing opportunities and limitations for improving the design quality of the neighbourhood were identified. This finding will be used in Chapter 10 for the main design proposal to increase residential density in the site.

The evaluation of the existing urban form reveals that particular design qualities are delivered at a low level in the existing physical context of Finsbury. Therefore, it is necessary to consider improving these design qualities through the new development scheme for the area. In fact, additional housing on the allocated site for new residential development should improve these qualities. This can be achieved via a better designed urban layout, particularly by improving the connectivity of the street pattern and adding new buildings adjacent to the existing roads. Based on the studies in this chapter, qualities such as permeability, safety, visual diversity and biodiversity can be considerably improved by designing new houses in the allocated vacant or poor quality areas.

This analysis of the existing physical form a real location reveals the first main difference between the generic modelling and the local design parts of the research. The generic model started from nothing, with no existing physical context. The analysis therefore consisted of a comparison between the two newly developed models. However, from the starting point of the site analysis, the study has shown the potential for a new design to contribute to the existing design qualities in the neighbourhood. In other words, when the design scheme is developed even the first scheme with 200dph, it should show the degree to which the design qualities may be improved or compromised compared with the existing condition of the site. In other words, the analysis and comparison is not just between the generated models, but also between the existing shape of the site and the newly developed models with increased density.

This chapter finally covered the place issue in relation to the existing physical form of the area. Based on the discussion in the conceptual framework about localities (Chapter Four), before starting the process of design, it is necessary to also cover the people matters for the site. The next chapter focuses on the demands and preferences of local residents with regards to the issue of new housing in the Finsbury area. The outcome of these two chapters will then be used in Chapter 10 to make final densification proposals for the site.

Chapter Nine

Local design: Assessing People Matters in Finsbury

9.1 Introduction

The previous chapter explored the place matters of the site chosen for densification. This chapter explores the people matters of the locality, focusing on the issue of acceptability of a proposed design scheme by the local community. The aim of this chapter is to report the main concerns and attitudes of local users towards the housing design and increasing density within the Finsbury area. This chapter, as with Chapter Eight, covers part of the fifth objective of the research:

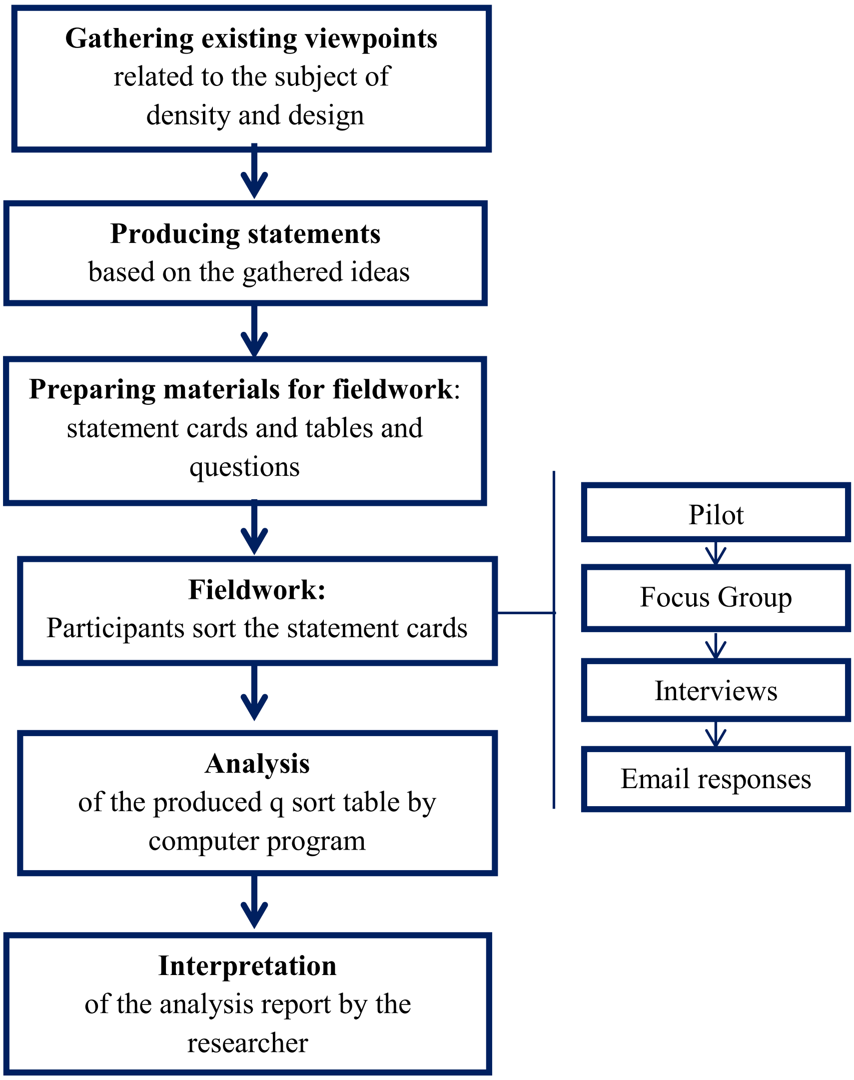
To test the theoretical propositions by applying the urban design principles to a realistic densification scheme for a local neighbourhood in London.

The focus of this chapter is on communicating with local users and bringing their feedback into the design process of the research. In order to receive the ideas and concerns of the local community on matters of design and density, the study used a specific research method called Q methodology introduced in Chapter Five. Since the method is relatively new in the field of built environment research and needs to be explained in detail, the decision was made to put the process of using the method and findings of this part into one chapter so as not to harm the overall structure of the thesis which is based mostly on the inquiry by design method. The chapter explains the process of using of Q methodology for research. First, the process of conducting the fieldwork and the interviews with local participants is explained. Then, the results of the fieldwork are analysed based on a unique computerised process. Finally, the findings based on the Q method analysis are shown. At the end, all the main findings are presented, in the form of design principles which are used in the rest of the study and in the design proposals presented in the next chapter.

9.2 Process of Q methodology in this study

In Chapter Five, the general procedure for carrying out the Q methodology was explained. In this chapter, the specific process involved in the Q method which was applied for this research is explained. Figure 9.1 shows the overall process of using Q methodology in this part of the research. The following part of the chapter gives a detailed explanation of the Q method process.

Figure 9.1: Q methodology process



9.3 Prior to the fieldwork

9.3.1 Gathering existing viewpoints and

In the first stage of doing Q methodology study, the main themes and ideas about the subject of the analysis should be gathered. For this study, these are the main themes discussed in the conceptual framework (Chapter Four) and the findings related to urban form and design qualities which were explored in previous chapters, Seven and Eight. These main themes were converted into a series of statements or design ideas.

9.3.2 Producing Statements and Q sort cards

For this study, initially, 50 statements were produced. The statements are the design ideas that should be considered when trying to change residential density in a design scheme. These statements come from three sources: first, by reviewing the main findings and design recommendations from the generic modelling in the previous chapter; secondly from reviewing the literature which talks about people's concerns and perceptions about higher density design; and thirdly, from the initial site analysis and design scheme for the Finsbury area and understanding the basic threats and opportunities of increasing the density in this neighbourhood. In order to separate the analysis and research method chapters, the discussion of the site analysis was described in the previous chapter, but it had an influence on producing the statements. These 50 initial statements covered all the subjects that may matter for making appropriate decision about increasing the density in the Finsbury area.

The 50 statements were then reduced to 26 main statements which were used for the field work (table 9.1 and Figure 9.1). At first, the 50 statements were categorised based on their relationship to each of the design qualities or morphological elements in the conceptual framework. It appeared that some of the statements were repeating the same subject about a design idea or design quality. Therefore, these repeated statements may make specific qualities more important in the study for no reason. Therefore, the statements which had similarities were reduced to one common statement. Table 9.2 shows the statements in relation to the design qualities of the framework.

It was also necessary to reduce the number of statements so that it would be easier and less time consuming for the participants to sort them. Moreover, as occurred during the field work, participants' attempts to participate in the sorting process depend on how many cards they should sort and how much written text is on the cards. It was therefore decided to reduce the number of cards as much as possible and also to minimise the written text.

Table 9.1: Q statements list

Statement 1	More houses close to the main streets, bus stops and tube stations to encourage walking instead of using cars
Statement 2	More work space (like offices) in walkable distance to residential buildings so that more residents can work in their own neighbourhood
Statement 3	More facilities and spaces for non-residential services such as sport, entertainment or health centre within the neighbourhood
Statement 4	Having straight and quick access to bus and tube stations and shops
Statement 5	Parking for all dwellings, close to their houses
Statement 6	More public green spaces within the neighbourhood
Statement 7	Designing communal garden rather than small private gardens to have communal activities like playing, chatting and gathering
Statement 8	Placing front gardens between street and buildings so that residents can contribute to the greenery of the streets
Statement 9	Having communal roof gardens for rest or planting
Statement 10	More tree-lines in the streets
Statement 11	Providing allotments within the neighbourhood and in walking distance to houses
Statement 12	Well connected street to have better traffic flow and easier navigation
Statement 13	More private residential roads with minimum passing of non-residents
Statement 14	Streets with many facing doors and windows to increase feeling of safety and visual surveillance on street
Statement 15	Having proper distance between the buildings to increase privacy of each house
Statement 16	Providing large rooms and living spaces inside the houses
Statement 17	Designing large size buildings containing around 20 residential flats
Statement 18	Designing smaller buildings for just few (4-6) residential flats
Statement 19	Variety of building shapes and forms in the streets
Statement 20	Having large concentrated stores in the main street
Statement 21	Having variety of small shops and services in street
Statement 22	Using central heating for the whole residential block to reduce energy costs
Statement 23	Designing few residential towers visible from long distance that can show the characteristic of the neighbourhood
Statement 24	Unique high rise character for the neighbourhood compare to the other areas of the city
Statement 25	Designing not more than 4 to 5 storey buildings so that all dwellings have close view to the street
Statement 26	Receiving direct sunlight for all dwellings at least for few hours of the day

Table 9.2: Relationship of Q statements to urban design qualities

Urban Design Quality	Related Statement
Permeability	12 Well connected street to have better traffic flow and easier navigation
	13 More private residential roads with minimum passing of non-residents
Accessibility	1 More houses close to the main streets, bus stops and tube stations to encourage walking instead of using cars
	4 Having straight and quick access to bus and tube stations and shops
Diversity	2 More work space (like offices) in walkable distance to residential buildings so that more residents can work in their own neighbourhood
	3 More facilities and spaces for non-residential services such as sport, entertainment or health centre within the neighbourhood
	5 Parking for all dwellings, close to their houses
	19 Variety of building shapes and forms in the streets
	20 Having large concentrated stores in the main street
	21 Having variety of small shops and services in street
Flexibility	7 Designing communal garden rather than small private gardens to have communal activities like playing, chatting and gathering
	16 Providing large rooms and living spaces inside the houses
	17 Designing large size buildings containing around 20 residential flats
	18 Designing smaller buildings for just few (4-6) residential flats
Biodiversity	6 More public green spaces within the neighbourhood
	8 Placing front gardens between street and buildings so that residents can contribute to the greenery of the streets
	9 Having communal roof gardens for rest or planting
	10 More tree-lines in the streets
	11 Providing allotments within the neighbourhood and in walking distance to houses
Environmental comfort	26 Receiving direct sunlight for all dwellings at least for few hours of the day
Resource Efficiency	22 Using central heating for the whole residential block to reduce energy costs
Legibility	23 Designing few residential towers visible from long distance that can show the characteristic of the neighbourhood
Character and Distinctiveness	24 Unique high rise character for the neighbourhood compare to the other areas of the city
Safety	14 Streets with many facing doors and windows to increase feeling of safety and visual surveillance on street
	25 Designing not more than 4 to 5 storey buildings so that all dwellings have close view to the street
Privacy	15 Having proper distance between the buildings to increase privacy of each house

Figure 9.2: Q Cards.; This figure shows all the cards together in a smaller size to explain the method. For the actual size of the cards, see Appendix Two

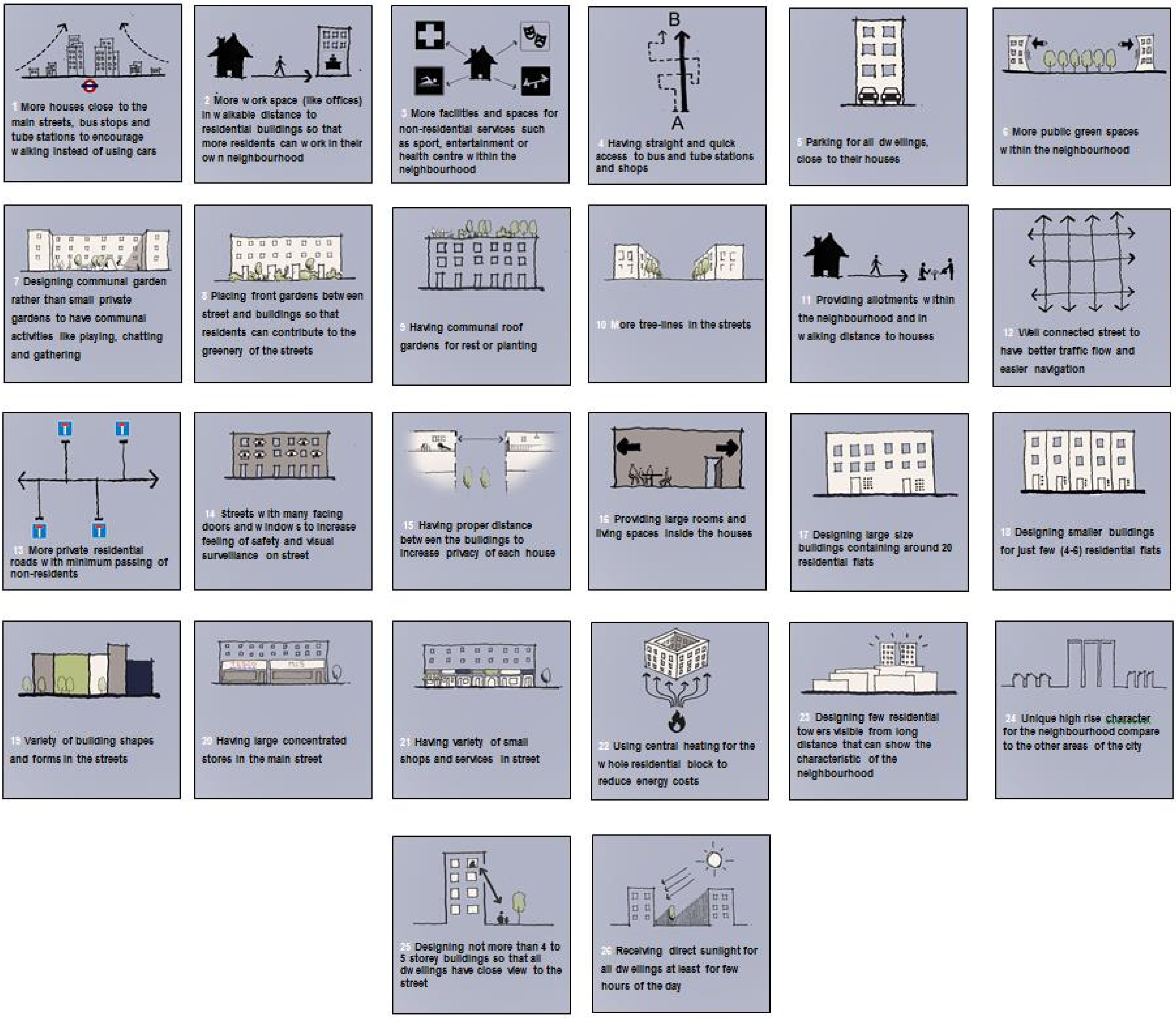


Figure 9.3: Q sorting Table (approximately half the size of the actual table used in the fieldwork.)

Least Favourable			No Opinion	Most Favourable		
-3	-2	-1	0	+1	+2	+3

During the production of the statement cards, the researcher felt that it was appropriate not to use the word ‘density’. Through the process of doing this research it appeared that there is a relatively negative perception about the notion of “density” or “high density”. This is why the literature, as discussed in Chapter One, tries to set out the benefits of higher density developments in the first place and reminds the reader of good examples of it. Nevertheless, avoiding this word in the statements was intended to prevent participants from prejudging the study. Hence, instead of mentioning “density”, design ideas which logically lead to higher density urban forms were suggested in the statements (see statements 1, 23 and 24 in table 9.1).

The statements were presented on individual cards with a graphical diagram. It was decided to have a mix of text and graphics on the cards because some design ideas can be more easily explained in a graphical way. It was possible to use photos instead of diagrams on each card; however, diagrams were tended to be preferable because these have more abstract characteristics and can point more precisely to the subject of the statement. Photos are also more likely to be interpreted in different ways by interviewees. For example, some irrelevant architectural details in the photo may attract the attention of the interviewee and influence their judgement. Therefore, diagrams instead of photos were used for the Q cards.

The Q sorting table (figure 9.3) was also produced with 26 boxes allowing participants to choose just two cards as their most and least favourable. This is one of the main features of Q methodology, and limits the choices for the highest and lowest scored cards so that participants choose these main cards with more consideration.

In addition to Q cards and the table, it was decided to have three main questions for the final semi-structured interview when the interviewee had finished sorting Q cards. The following are the three main instructions:

- Please explain why you have chosen specific cards as most favourable.
- Please explain why you have chosen specific cards as least favourable.
- Is there any other idea/comment you think should be considered for this study?

These questions simply reveal the main reasons and rationale behind the sorting tables, and the main concerns of the interviewees. The last question helps the researcher to identify other aspects of the subject which may be of importance for local users, but was not included in the Q statements. As it turned out, some interviewees made comments about individual statements as they were doing the sorting and some others had specific ideas to discuss at the end of the process. In other words, the statements and sorting process encouraged the interviewees to more actively participate in the research which may not have been the case by just asking a few questions in the form of a semi-structured interview.

9.4 Fieldwork

Fieldwork for the Q methodology involved a process of communicating with local users and professionals in the built environment familiar with the Finsbury area. Participants were introduced to the research subject and were asked to sort the Q cards on the table followed by a semi-structured interview.

Participation in the study involved the following four methods:

First, a pilot study was undertaken with four non-local participants including an urban designer, an architect, a planner and a non-professional participant. The pilot study with these participants was conducted both by email format and direct communication to see if both formats would work. Participants were asked to check if the Q statements and cards were completely understandable and if the subject and purpose of study was clear for them. The Q statements were then slightly adapted and the brief introduction to the research was cleared for the main fieldwork. The main changes to the statements were simplifications and shortening the text of the statements because the diagrams were clear enough by themselves.

Second, a focus group discussion was carried out. Eight local residents participated in the discussion. The participants were introduced to the main subject and purpose of the research and then each of them received a Q sorting table with a pack of 26 Q cards to sort on the table. After the sorting process, the researcher, acting as moderator, asked participants individually to explain why he/she had chosen specific cards as most favourable and also least favourable. Then, after the response, the moderator asked the other participants if they had any comments, agreement or disagreement with that response. Then, the same process took place with the next participant. During this process, discussion took place between participants. Then, at the end, they were asked if any other matter regarding residential development and design in their area might be worth considering. In this way, new comments outside of the Q card subjects were also added to the responses.

Planning a focus group discussion at this point of the fieldwork had significant benefits and a rationale. The focus group discussion was helpful because people could see other participants sorting and arguing, and the researcher could observe the reactions and responses of participants to each other's points of view. The sorting was completed by all participants and therefore no participant was left unheard as this is one of the potential drawbacks of focus group discussions (Denscombe, 2010). This focus group was also considered as part of a checking process, showing whether the interview process works properly so that individual interviews could be carried out in the next stage. Normally, individual interviews take more time so the focus group was carried out beforehand to quickly provide an overall point of view about the subject at the start of the fieldwork.

Thirdly, individual interviews were carried out with local residents and professionals. The process was the same as with the focus group comprising the sorting process and a final semi-structured interview. In many cases, participants commented on the cards during the sorting process not just at the end, because something new came to their mind during the process.

Fourthly, an email version of the same process was designed and sent to potential participants. The email contained an attachment file opened with common software such as PowerPoint and Keynote application. In this file, the research project was introduced and then the instructions for the Q sorting were explained. Participants were able to view all the Q cards and also the Q sorting table on a PowerPoint slide. Then, they could select each Q card individually and drag it to the preferred box on the sorting table. (The content of the email is included in Appendix One and the PowerPoint file is attached to the electronic version of the thesis.)

The email was sent to about 100 potential participants from local residents and also from professionals in different fields of built environment who were familiar with the neighbourhood. The email was sent to these residents and professionals who had been previously identified for the study and who were then asked to forward the email to other potential participants within the area. Hence, a snowballing process took place in order to expand the number of people who would receive the email. In some cases, participants also acted as gatekeepers forwarding the email to social groups, such as local friends, or professional groups, such as other staff in a related department or company.

9.4.1 Criteria for local participant selection

In this part, the rationale for choosing participants for the interviews and focus group discussion is explained. The main purpose of this part of study was to bring the locals' concerns and perceptions into the design decision process. Therefore, it was necessary to choose participants from the local context to be involved in the inquiry by design process. These participants can show which aspects of design regarding the notion of residential densification may have been neglected up to this point of the study. Moreover, locals can point out the design qualities which are more important to them so that the emphasis and direction of design decisions can be influenced by their opinion.

It was decided for this study to categorise the local participants into two main groups. The first group were the local residents who actually use the new housing; the second group were professionals in different fields of the built environment who are familiar with the local area and can inform the study about the possible consequences of different design decisions.

In both of these groups, the author tried to choose participants in such a way as to have more variety in age and gender so that different aspects of design and densification might be pointed out by them. Although the existing literature review for this study, both in general and also for this specific neighbourhood, has shown the main concerns of residents and experts with regards to notions of density and design, interviews can work as a back up to validate the existing knowledge as well as to adapt the design principles for a specific local neighbourhood.

9.4.2 Choice of local resident participants

Participants were chosen in such a way that the different demands and concerns of residents would be taken into account in the design. Based on the literature review (ex: Mulholland Research & Consulting (MRC), 2003; CABE, 2005a; CABE, 2005b; Howley, 2009), specific variables such as the resident's ethnicity, age range, family size and house ownership type can have an influence on their design preferences and requirements. These differences influence the type and size of houses that residents require and specific types of qualities which are important in their residential area. Also, the importance of different public spaces, services and jobs and accessibility to them may vary.

Although an attempt was made to recruit a variety of participants, the first point of contact for the interviews was with representatives of the residents on the council, given that these participants are familiar with the main concerns of local residents from different age ranges, household sizes or different type of house ownership. Therefore, the different concerns of these groups could be identified by interviewing the residents' representatives. It should be remembered that the interview is a supporting method at this stage to check the design concerns of locals and whether it is similar to the existing general literature about density, design and local perceptions as well as the local documentation of residents' design preferences.

9.4.3 Choice of participants among professionals in the built environment

Among the professional participants, the researcher also tried to recruit professionals with a variety of expertise who would be familiar with developments within the area or involved with the local planning authority. Again, these interviews provide supporting evidence to check the existing local documents (ex: IC, 2006 and 2013) which shows different aspects of design for this area which are recommended by different built environment experts.

The professionals were chosen from different groups of planners, urban designers, architects and real estate agents. Some of these participants were approached from Islington Planning Department and also from the Islington Design Review Panel. Moreover, local architecture companies and real estate agencies were sources for finding experts who are familiar with the local area.

9.4.4 Number of participants

The Q methodology study was completed by 40 participants. Table 9.3 shows the participants' profiles including their gender, age range, their method of response and whether they were residents or professionals in the built environment familiar with the local context.

While the Q methodology is quite a new method in social research, there are arguments about the acceptable number of participants (Eghbalighazijahani, 2013). As Watts and Stenner state (2012: 73) the main issue which should be borne in mind is that a higher number of residents does not directly mean a more accurate study. This is because, as Brown (1980) explains, Q methodology is for identifying and categorising significant perspectives or viewpoints about a subject to then compare them. In this case, even a small number of participants may be convenient for the study and may even show more significant differences between viewpoints. Therefore, the most important issue is not the number of participants, but having a diversity of view-points between the participants. Including participants who may show extreme points of view is the key ingredient for this method rather than the number of participants.

The Q methodology literature does however make recommendations regarding the adequate number of participants. Kline (1994) recommends that the number should be half the number of Q sort cards. So, for example, if using 30 statement cards, the recommendation is to include 15 participants. Watts and Stenner (2012) also recommended keeping the participant number lower than the Q sort cards. However, Eghbalighazijahani (2013) argues that the common idea of reducing the number of participants in Q methodology is not completely justified. Also, having a higher number of participants may also provide better data for other types of analysis other than Q factor analysis.

Regarding the final decision for the number of participants for this study, the guideline of Stainton Rogers (1995) was followed, stating that traditionally in the UK a range between 40 to 60 participants should be considered for Q methodology studies. This is also the final guideline from Watt and Stenner (2012) referring to Stainton Rogers (1995). Therefore, 40 participants were included in this study.

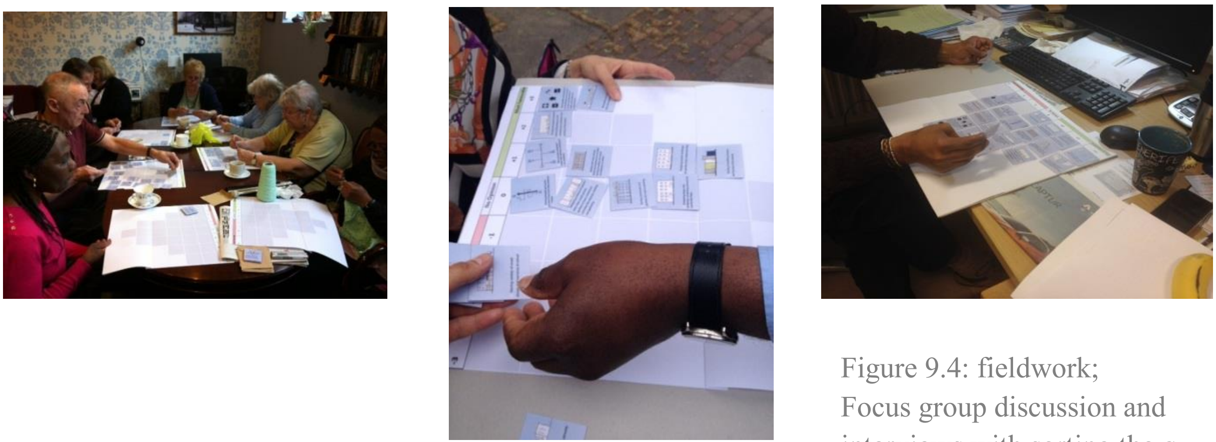


Figure 9.4: fieldwork;
Focus group discussion and interviews with sorting the q cards on table by the participants.
Source: Author

Participants Code	Response type	Age range	Gender	Resident / professional
Res1	F	35-50	M	Resident
Res2	F	+50	M	Resident
Res3	F	+50	F	Resident
Res4	F	35-50	F	Resident
Res5	F	+50	F	Resident
Res6	F	+50	F	Resident
Res7	F	+50	F	Resident
Res8	F	+50	F	Resident
Res9	I	35-50	F	Resident
Res10	I	+50	M	Resident/ Estate manager
Res11	I	18-35	M	Resident
Res12	I	18-35	F	Resident
Res13	I	35-50	M	Resident
Res14	I	18-35	M	Resident
Res15	I	18-35	F	Resident
Res16	I	+50	F	Resident
Res17	E	18-35	M	Resident
Res18	E	35-50	M	Resident
Res19	E	35-50	M	Resident
Res20	E	35-50	F	Resident
Res21	E	18-35	F	Resident
Res22	E	18-35	F	Resident
Res23	E	18-35	F	Resident
Res24	E	35-50	M	Resident
Res25	E	35-50	F	Resident
Res26	E	+50	M	Resident
Res27	E	18-35	F	Resident
Res28	E	+50	M	Resident
Res29	E	18-35	F	Resident
Res30		18-35	F	Resident
Pro1	I	18-35	M	Architect/Urban Designer
Pro2	I	18-35	M	Architect/Urban Designer
Pro3	I	18-35	M	Urban Designer/ Planner
Pro4	I	35-50	F	Architect
Pro5	I	18-35	M	Urban Designer
Pro6	E	18-35	F	Architectural Assistant
Pro7	E	35-50	F	Architect
Pro8	E	18-35	M	Urban Designer/ Planner
Pro9	E	18-35	F	Architect
Pro10	E	35-50	F	Architect
Pro11	E	18-35	M	Urban Planner

Table 9.3: Participants Profile

Notes:
Response Type:
F- Focus Group
I-Interview
E-Email
ET: Email and Telephone

Res: Resident
Pro: Professional in built environment

9.5 Analysis Process

Having carried out the fieldwork - involving interviews, the focus group discussion and receiving the email responses - the raw data for the Q methodology analysis was ready for analysis. These data included the sorting table of each individual participant plus his/her comments and responses to the questions at the end of the sorting procedure. These were analysed using both quantitative factor analysis – for the sorting tables – (Van Exel, 2005) and qualitative content analysis - coding the open ended responses of participants – (Cresswell, 2009; Denscombe, 2010; Silverman, 2005).

The content analysis helped the analysis procedure by showing the reasons behind each sorting table and by identifying aspects of the study which had not been included on the statement cards, but which were important for the participants. Content analysis is used parallel to factor analysis to produce a better interpretation of the statistical analysis. In this way the researcher can have an overall idea of what the most significant groups of people are with the same points of view. This background can help the researcher with the next steps of checking and judging the results of the factor analysis.

Factor analysis, or particularly Q factor analysis, is the main method in Q methodology. Factor analysis is a statistical method which explains variability among a large set of correlated variables. In Q factor analysis, the interrelated variables of the study (or participants' Q sorts) are reduced to a few representative variables. This process is done by finding dis/similarities between participants' responses (Jones, 2013). Each of these representative Q sorts is called a factor. In other words, a factor is a defining discourse that represents a cluster of Q sorts with similarities in their viewpoints. It is then easy to compare to what extent each participant Q sort has similarities or dissimilarities with each of the main discourses (factor).

As Van Exel (2005) states, factor analysis in Q method is a relatively technical and objective procedure and is done by computer programs. For the factor analysis in this study, PQMethod Software (Schmolk, 2014) was used. This is software specifically designed for Q methodology factor analysis (Coogan & Herrington, 2011) and has been used in other similar Q methodology studies (ex: Jones et al, 2011).

Use of the SPSS program for this study was considered at first, but finally it was decided to use the PQMthod software. Although SPSS may be a more advanced program for quantitative analysis, it has particular drawbacks. First, the common factor analysis (R factor

Analysis) has differences with the Q factor analysis produced by Stephenson and SPSS is normally designed for the common R factor analysis. Secondly, the Q factor analysis is a more direct and straightforward procedure in Q method analysis software such as PQMethod, while there are many different options to be chosen in the SPSS software which requires a more in depth understanding of mathematical procedures. Thirdly, most of the literature (ex: Coogan & Herrington, 2011; Jones et al, 2011) refer to specialised Q method software instead of SPSS and therefore it was easier to check the analysis procedure from the literature.

9.5.1 PQmethod software process

All the data from the fieldwork were input in the PQMethod software, then the factor analysis was carried out by the software and a final analysis report was produced. First, the information from the sorting table was put into the software; secondly, the data from each individual Q sort table produced by the participants were entered in the program; thirdly, principal component factor analysis was performed by the software, fourthly, the loaded factors were checked by the researcher and rotated by the software. Finally, the final Q analysis of the rotated factors was performed and the analysis report was produced.

The factor analysis and rotation of factors are explained in more detail below.

9.5.2 Factor analysis

After inputting all the data from the fieldwork (Q sort tables) the software performs factor analysis. Principal component factor analysis was used for this study as it is a more common and advanced type of factor analysis (Schmolck, 2015) and is used in other Q methodology studies such as that by Jones (2012). A seven-factor solution was chosen for this stage of the analysis as Brown (1980) suggests, but higher and lower numbers were also checked initially (see table 9.4).

These seven factors, as explained above, are the seven representative Q sorts produced by the software. The factor loading table (9.4) produced by the software shows to what extent individual Q sorts have similarities with each factor. The Q sorts with the highest similarities are flagged by X symbol.

9.5.3 Rotation of the factors

The four factors from the previous analysis were further rotated using varimax rotation to get to the final Q analysis. The eigenvalues and scree plots in all factors checked to choose the most significant ones showing a high degree of variance between Q sorts (Jones, 2012; Schmolck, 2015). More simply, these four factors are the ones which show the more significant and representative viewpoints of participants. The table of factors (table 9.4) was checked with the narrative responses of participants used for the content analysis in order to double check the significance of the chosen factors. Two factors were more similar to the residents' viewpoints (factor 1 and 3) and two were closer to the professionals' viewpoints (factor 2 and 6).

E:\PQMethod\pqrot.exe

		1	2	3	4	5	6	7
1	res1	-0.18	0.24	0.13	0.87 X	0.07	-0.01	-0.18
2	res2	0.01	0.15	0.22	0.10	0.43	0.53 X	-0.10
3	res3	-0.13	0.06	0.54 X	-0.45	0.05	-0.06	-0.11
4	res4	0.04	0.04	0.26	-0.29	0.19	-0.05	0.84 X
5	res5	-0.27	0.41	-0.05	-0.50	0.33	0.10	0.03
6	res6	-0.33	0.05	0.04	-0.33	0.45	-0.12	0.06
7	res7	-0.20	0.05	0.11	0.12	0.70 X	-0.17	0.17
8	res8	-0.02	0.14	0.45	0.31	0.19	0.24	0.10
9	res9	0.33	0.12	-0.02	0.25	-0.03	0.30	0.48
10	res10	0.84 X	0.09	-0.06	0.04	-0.15	0.23	0.04
11	res11	0.11	0.07	0.90 X	0.06	0.06	0.23	0.15
12	res12	0.62 X	-0.18	0.34	-0.15	0.32	-0.12	-0.22
13	res13	0.51	-0.02	0.22	-0.27	0.19	0.44	0.40
14	res14	0.20	0.01	0.01	0.10	0.79 X	0.35	0.18
15	res15	0.16	0.01	0.85 X	0.12	0.18	0.13	0.22
16	res16	0.80 X	-0.05	0.29	-0.12	0.05	0.26	0.08
17	res17	0.46	-0.08	0.55	-0.06	0.39	-0.15	-0.21
18	res18	0.57	0.08	0.26	-0.31	0.29	0.28	0.43
19	res19	-0.07	0.29	0.29	0.79 X	0.16	-0.08	0.06
20	res20	0.13	0.25	0.47	-0.07	0.20	-0.24	0.61
21	res21	0.27	-0.09	0.21	-0.07	0.73 X	0.38	0.26
22	res22	0.18	0.21	0.35	0.19	0.77 X	0.17	-0.00
23	res23	0.10	0.06	0.76 X	0.06	0.23	0.37	0.17
24	res24	-0.28	0.04	0.04	0.80 X	0.09	-0.11	-0.18
25	res25	-0.03	-0.05	0.05	-0.04	0.08	-0.02	0.92 X
26	res26	0.87 X	0.09	0.06	-0.16	-0.15	0.15	0.20
27	res27	0.22	0.11	0.85 X	0.14	-0.08	0.21	0.03
28	res28	0.54 X	0.14	0.11	0.32	0.27	0.00	-0.03
29	res29	0.13	0.13	0.88 X	0.10	0.09	0.23	0.12
30	PR01	0.14	0.38	-0.26	-0.06	0.39	0.45	-0.11
31	PR02	-0.05	0.87 X	0.13	0.24	-0.04	0.01	-0.02
32	PR03	0.15	0.24	0.21	-0.15	0.05	0.86 X	0.02
33	PR04	0.34	0.52	0.14	-0.15	0.18	0.22	0.29
34	PR05	0.26	0.22	0.31	-0.06	0.04	0.79 X	-0.04
35	PR06	0.49	0.55	0.19	-0.26	0.10	0.28	0.13
36	PR07	0.17	-0.04	0.35	-0.04	0.05	0.53 X	0.30
37	PR08	-0.05	0.89 X	-0.01	0.16	-0.03	0.18	-0.01
38	PR09	0.60	0.48	0.16	-0.20	0.13	0.29	0.05
39	PR010	0.17	0.85 X	0.16	0.21	0.12	0.17	0.05
40	PR011	0.33	0.23	0.35	0.06	0.06	0.77 X	-0.11

Table 9.4: table of factors

4 of these 7 factors were chosen and rotated (factors 1, 2, 3 and 6)

The x signs show significant (exemplar) q sorts for the factors.

Therefore, factor 1 and 3 are more related to residents' perspectives and factors 2 and 6 are closer to the professionals' point of view.

9.5.4 Q analysis of rotated factors

At the end, the program performs an analysis of the chosen rotated factors and produces an analysis report. This report (which has been added in a CD to the thesis) contains raw data and various tables of correlation between factors and correlations between factors and Q sorts. The key tables from the analysis report which are used for the analysis and findings in this study are presented in the following parts of the chapter. The interpretation of these tables also was carried out by the researcher and the findings based on them are reported in the following sections of this chapter. The following figure (9.4) shows how different parts of the analysis process for Q methodology was done either manually by the researcher or automatically by the PQMethod Software.

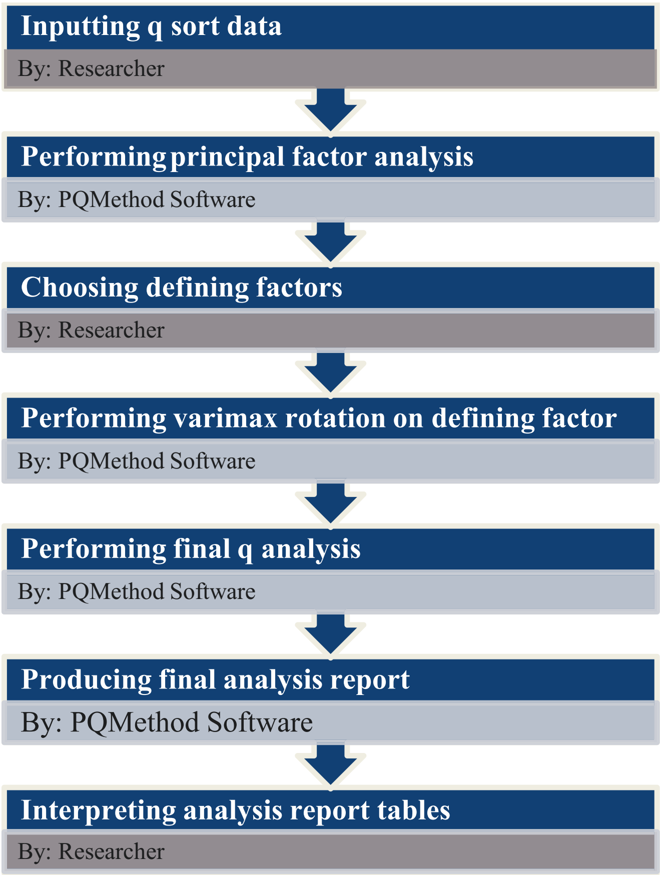


Figure 9.5: Process of Q methodology analysis carried out via PQMethod Software

9.6 Findings from the Q methodology

The previous sections showed the process of the Q method analysis. In this stage, these analytical results and tables are interpreted according to the focus of the research. The key tables generated by PQMethod software are presented throughout this chapter as evidence for the discussions.

As discussed, the main outcome of the Q method is to identify the significant points of view or discourses within the community about the subject of the study. Based on this, through the findings part of the chapter, these main discourses are explored and their main are introduced. In this research, the discourses show the different attitudes and points of view in relation to new housing in the Finsbury area. Finally, with these main discourses from local participants, the point of view of each group can be translated into design principles applicable to the inquiry by design process of the study.

The following is a table called a Factor Matrix Table (Jones, 2012) commonly presented in Q method studies as a starting point for introducing discourses. This table (9.5), Generated by PQMethod Software, highlights the representative participants in each of the discourses.

Factor matrix table, (table 9.5) presents the score of each Q sort (participants) within each of four discourses. This matrix shows how close each participant's point of view is to the discourse. The highest scores, distinguished by X, show the closest participants to that specific discourse.

Based on this table, it can be identified that discourses one and three are more likely to represent the points of view of residents because in these two groups (column one and three), most of the highlighted participants are from residents. In a similar way, it can be seen that discourses two and four are therefore closer to the professionals' perspective and represent their points of view.

In the following section, the main features of each discourse are explained and the design considerations for each discourse are established.

QSORT		1	2	3	4
1	res1	-0.1785	0.2411	0.1258	-0.0054
2	res2	0.0055	0.1477	0.2171	0.5299X
3	res3	-0.1301	0.0629	0.5429X	-0.0603
4	res4	0.0413	0.0383	0.2647	-0.0495
5	res5	-0.2684	0.4099	-0.0545	0.1047
6	res6	-0.3343	0.0458	0.0390	-0.1183
7	res7	-0.2010	0.0510	0.1144	-0.1697
8	res8	-0.0205	0.1409	0.4498	0.2418
9	res9	0.3253	0.1215	-0.0247	0.2955
10	res10	0.8374X	0.0870	-0.0600	0.2320
11	res11	0.1147	0.0728	0.9024X	0.2335
12	res12	0.6166X	-0.1823	0.3359	-0.1159
13	res13	0.5053	-0.0162	0.2152	0.4354
14	res14	0.1960	0.0076	0.0112	0.3489
15	res15	0.1571	0.0139	0.8510X	0.1332
16	res16	0.7958X	-0.0528	0.2902	0.2567
17	res17	0.4649	-0.0820	0.5526	-0.1490
18	res18	0.5722	0.0813	0.2589	0.2831
19	res19	-0.0679	0.2921	0.2886	-0.0790
20	res20	0.1320	0.2494	0.4707	-0.2428
21	res21	0.2705	-0.0856	0.2096	0.3765
22	res22	0.1815	0.2144	0.3453	0.1749
23	res23	0.0956	0.0593	0.7603X	0.3726
24	res24	-0.2803	0.0380	0.0423	-0.1067
25	res25	-0.0346	-0.0453	0.0497	-0.0249
26	res26	0.8746X	0.0856	0.0588	0.1525
27	res27	0.2214	0.1147	0.8491X	0.2073
28	res28	0.5390X	0.1427	0.1093	0.0005
29	res29	0.1305	0.1320	0.8770X	0.2348
30	PRO1	0.1430	0.3846	-0.2625	0.4504
31	PRO2	-0.0486	0.8651X	0.1308	0.0107
32	PRO3	0.1487	0.2412	0.2066	0.8550X
33	PRO4	0.3400	0.5174	0.1356	0.2199
34	PRO5	0.2625	0.2240	0.3083	0.7871X
35	PRO6	0.4922	0.5498	0.1876	0.2799
36	PRO7	0.1717	-0.0435	0.3494	0.5256X
37	PRO8	-0.0536	0.8939X	-0.0098	0.1836
38	PRO9	0.6042	0.4751	0.1594	0.2938
39	PRO10	0.1654	0.8527X	0.1583	0.1689
40	PRO11	0.3292	0.2340	0.3517	0.7700X
% expl.Var.		13	10	15	11

Table 9.5: Factor Matrix: Showing the factor loading for each discourse.
Xs Indicate a Defining or Exemplar Sort in each Discourse.

9.6.1 Discourse one: long-time residents (see table 9.6 and 9.7)

As has been said, this discourse mostly represents residents' views. This discourse is particularly related to older residents living in the area for a long period of time. Many of these residents have been living in the council estates. The overall preference of these participants is to keep the area as it is. In other words, they are less in favour of changes happening in the physical form of South Islington. Some of the interviewees in this group argued, based on their previous experiences, that the changes happening in the area do not benefit them. Therefore, they were slightly suspicious of the advantages of new developments for existing local residents.

This discourse has 13% variance of the whole participation and has the second highest variance within the discourses. Based on table 9.5, the defining Q sorts in this discourse were all from residents (res10, 12, 16, 26, 28). Therefore, this discourse shows a defining view point among the residents about this subject. Most of the defining Q sorts in this group are from older residents (over 50 years) within the area and ones who have lived in this neighbourhood for a long period of time. They mostly live on old council estates.

In Table 9.6, the Q cards are ranked based on the scores they received in discourse one. Also table 9.7 summarises the most important findings about this discourse.

The quality of privacy (card 15) is the most important issue for this group of residents. This is also significant because privacy is not as important in any other discourse. The idea of designing private roads (card 13) is one of the highest ranked cards in this discourse. This card is significant only in this discourse and in contrast of some other discourses. These cards show that the issue of privacy is very important for existing, older residents.

The issue of having more green spaces (cards 6 and 8) is also highly ranked in this discourse. However, this is not a very distinctive issue because all other discourses share the same attitude toward the green aspects of design. Overall, all discourses point out that green spaces should be increased within the area.

Members of this discourse show a negative attitude towards high rise and large buildings (cards 24 and 17). This is also a similar attitude within all discourses.

These key cards with the highest negative score show that generally participants do not prefer large grains in neighbourhood morphology. This is similar to the suggestions from the theoretical part of the study which showed that a large urban grain reduces the flexibility and adaptability of the urban form as well as visual diversity.

Overall, the main difference of this discourse from others is the emphasis on issues related to privacy. Part of the reason for this is that, as discussed earlier, this discourse consists of older residents who mostly live in estate tower blocks within the neighbourhood. Therefore, they may be used to the (morphological) characteristics of these tower blocks with wide open spaces and distances between towers and large open parking spaces. As an example, Res 4 mentions that newly developed high rise buildings have blocked the morning sunlight of her house. Moreover, Res16 mentions about the other new developments in the area and how neighbours can see inside each other's houses because of the short distance between the buildings.

Res10, who has one of the representative Q sorts in this discourse, explains some of the main reasons behind the residents' attitude in this discourse. As he explains, these residents have seen the process of change in the urban form and character of their neighbourhood; however, the benefits of these changes are not quite visible to them. They have seen the increase of density and character in the area but have not experienced an improvement in their quality of life. Particularly, they point out the struggle of making a sense of community because of the rapid changes in form and demography.

There also feel challenges in regards to having control of their neighbourhood. This is particularly about control of services, facilities and spaces. For example, res 10 stated about card 22 that central heating has some drawbacks in the area because people are not able to control the temperature or duration of the heating. Also, the cost of energy cannot be reduced because there is no control on the use of energy. The accept that new developments have brought new services and improved the existing ones such as the swimming pool and sport centre; but, the cost of the new facilities does not match the income of existing residents.

Although the council has tried to address such problems and resolve matters, there is still a gap between the residents in this discourse and the council's point of view about the value of new developments within the area.

It may therefore be necessary to have a process of more transparent negotiation between the council and existing residents where both sides inform each other about their problems and the way to solve them for future new developments. The research method for this study can be used to reveal the challenges and attitudes of locals and then to address them in design and negotiation with residents.

The findings from this discourse are sorted into two categories: First, the main recommendation relates to how designers can prioritise urban design principles based on the attitudes of this discourse; Secondly, the main subjects which should be addressed when explaining design proposals to members of this discourse.

Factor Scores , For Factor 1

No.	Statement	No.	Z-SCORES
15	15 Distance for privacy	15	1.948
6	6 Public green space	6	1.701
8	8 Front garden	8	1.634
13	13 Private streets	13	1.255
21	21 Small stores	21	0.826
9	9 Roof garden	9	0.794
14	14 Visual Surveillance	14	0.707
10	10 Tree-lines in street	10	0.445
18	18 Small buildings	18	0.373
23	23 Residential towers	23	0.214
26	26 Sunlight	26	0.181
5	5 Parking	5	0.066
19	19 Variety in shape	19	-0.106
7	7 Communal garden	7	-0.132
11	11 Allotments	11	-0.134
25	25 View Distance to street	25	-0.144
1	1 More house close to public transport	1	-0.339
3	3 Non-residential facilities	3	-0.417
2	2 Work space in walkable distance	2	-0.518
12	12 Connected streets	12	-0.601
4	4 Straight and quick access	4	-0.906
22	22 Central heating	22	-0.923
20	20 Large concentrated stores	20	-1.218
16	16 Large interior spaces	16	-1.281
24	24 Highrise Character	24	-1.411
17	17 Large buildings	17	-2.014

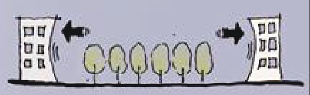
Table 9.6: Factor Scores for Discourse 1

Discourse 1: Resident-Led

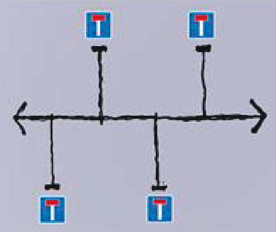
+ Most Favourable Cards

15 Having proper distance between the buildings to increase privacy of each house

8 Placing front gardens between street and buildings so that residents can contribute to the greenery of the streets

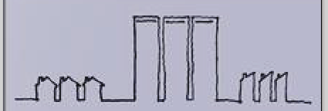


6 More public green spaces within the neighbourhood

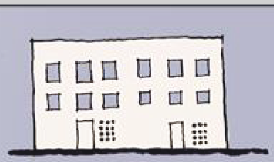


13 More private residential roads with minimum passing of non-residents

- Least Favourable Cards



24 Unique high rise character for the neighbourhood compare to the other areas of the city



17 Designing large size buildings containing around 20 residential flats

Table 9.7: Discourse 1 key features

Defining Q sorts:
Res10, Res26

Key features of members of this discourse:
Older and long-time residents
Some live on council estates

Key Attitudes
More green spaces
Keeping privacy
Not in favour of large or high-rise buildings
Keeping control of services and spaces

Main Considerations

For Design
- keeping and improving the quality of green spaces
- keeping a distance between buildings for privacy reasons
- providing small green spaces between buildings and the street
- Keeping small grains of buildings as much as possible with plot based typologies.

For Negotiating Design Proposals
- Inform the locality about the benefits of changes especially about more connected streets.
- Address the challenges of maintaining privacy and the considerations of this in the design proposal
- Show how green spaces are increased or improved through design
- Address the unavoidable need for high-rise design in some locations in the neighbourhood.

9.6.2 Discourse two: professionals with architectural expertise (see table 9.8 and 9.9)

This discourse represents more of a professional point of view. These professionals have relatively greater experience and they are focused on the architectural level of the built environment. In this case, some of the main focus of these participants was on detailed design issues such as front and back garden design. A significant point in this discourse is the attitude towards the relative separation of residential and business areas. It has been argued here that in a city like London with such high quality public transport, it is not necessary to focus on keeping living and work spaces together. However, this does not mean completely ignoring the concept of mixed use development, but instead producing a greater concentration of business use in particular areas of the city.

This discourse has 10% variance of the whole participants. Three defining Q sorts in this discourse are all from professionals (Pro2, Pro8 and Pro 10). Therefore, this discourse mostly represents the viewpoint of professionals. Overall discourses 1 and 3 represent the residents' points of view and discourses 2 and 4 represent the professionals' perspective. The architect profession group, shows a slightly higher score in discourse 2 than in discourse 4 but it is not significant.

Table 9.8 shows the most favourable cards in this discourse. Two themes are the most favourable here: greenery (cards 6, 8, 7) and connectivity (card 12). The attitude to having more green spaces is quite similar to the other discourses and shows communality of discourses. On the other hand, by some way, the connectivity of street patterns has the highest score in this discourse. Meanwhile, connectivity is commonly a middle ranking card in all other discourses. So the attitude to connectivity is the key separating feature of this discourse.

Reviewing the comments from the participants who are representative of this discourse shows the reasons behind choosing connectivity as the most favourable card. The participants pointed out some benefits of connective street patterns such as better access to other places and better traffic flow. Also Pro2 mentioned better "visibility" as one of the benefits of connective streets explaining that different route options and also services can be more visible. It can be assumed that there are some aspects and advantages of connected street patterns that are clearer for professionals than residents. Recognising this difference of knowledge or perspective can be helpful so that, in negotiating design proposals, the benefits of connected street patterns can be introduced to the residents.

The least favourable aspects for this discourse were walkable distance to work (card 2) and 'non-connective Private Street patterns' (card 13)

Since connectivity was one of the most important issues for this discourse, it was expected that private streets would be the least favourable card. The point here is that in both professional discourses (discourses 2 and 4) card 13 is one of the least favourable. The notion of street connectivity is also frequently supported by the urban design literature as discussed in Chapter Three about urban design qualities. However, conversely, 'non-connective street patterns' are one of the most favourable cards among older residents (discourse 1). This contradiction shows the necessity of negotiation between designers and local users about this specific design quality. It is necessary to discuss with the locality about the benefits of connected street patterns so that the design proposals may become more acceptable. It may also be necessary to make some compromises in design such as considering a larger size of urban blocks in order to reach agreement with local residents and maintain their privacy.

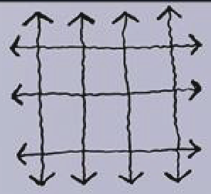
The other key feature of this discourse is that a 'walkable distance to work' (card 2) is the least favourable statement. This is the only discourse where this card has such a low score. During the discussion with members of this discourse, it was mentioned that even having a long journey to work is not a serious problem especially in London. Also, Pro2 pointed out that providing places which are business hubs separate from residential neighbourhoods can be a good idea. It can be concluded that having good public transport in London means that walkable distance to work is not a priority. However, this does not mean that members of this discourse are against the idea of living close to their workplace. As some participants mentioned, it just means that it does not matter compared to other design issues.

Factor Scores , For Factor 2			
No.	Statement	No.	Z-SCORES
12	12 Connected streets	12	1.689
8	8 Front garden	8	1.671
6	6 Public green space	6	1.614
7	7 Communal garden	7	1.243
26	26 Sunlight	26	0.816
4	4 Straight and quick access	4	0.622
1	1 More house close to public transport	1	0.622
22	22 Central heating	22	0.622
5	5 Parking	5	0.622
19	19 Variety in shape	19	0.502
10	10 Tree-lines in street	10	0.353
20	20 Large concentrated stores	20	0.194
14	14 Visual Surveillance	14	0.000
15	15 Distance for privacy	15	0.000
17	17 Large buildings	17	-0.176
25	25 View Distance to street	25	-0.194
16	16 Large interior spaces	16	-0.428
18	18 Small buildings	18	-0.622
11	11 Allotments	11	-0.622
3	3 Non-residential facilities	3	-0.639
24	24 High rise Character	24	-0.798
23	23 Residential towers	23	-1.049
21	21 Small stores	21	-1.243
9	9 Roof garden	9	-1.261
13	13 Private streets	13	-1.671
2	2 Work space in walkable distance	2	-1.865

Table 9.8: Factor Scores for Factor 2

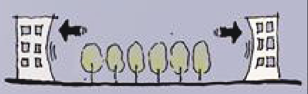
Discourse 2: Professional-led

+ Most Favourable Cards



12 Well connected street to have better traffic flow and easier navigation

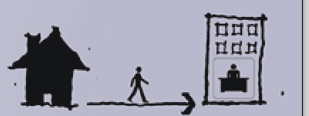
8 Placing front gardens between street and buildings so that residents can contribute to the greenery of the streets



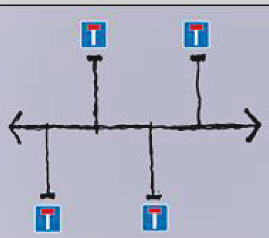
6 More public green spaces within the neighbourhood

7 Designing communal garden rather than small private gardens to have communal activities like playing, chatting and gathering

- Least Favourable Cards



2 More work space (like offices) in walkable distance to residential buildings so that more residents can work in their own neighbourhood



13 More private residential roads with minimum passing of non-residents

Defining Q sorts:
Pro2, Pro8, Pro10

Key features of members of this discourse:
More architects but not significantly so

Key Attitudes
Connected street patterns
More green spaces
Communal open spaces
Not in favour of proximity of work places

Main Considerations

For Design
- Increasing street connectivity and making smaller urban blocks
- keeping and improving the quality of green spaces
- allocating more communal (instead of private) open spaces

Table 9.9: Discourse 2 key features

9.6.3 Discourse three: younger and newer residents (see table 9.10 and 9.11)

Discourse three represents more of the younger and newer residents of the area. It is more common among these participants for them to be temporarily living in this area, just for a few years. These residents are more likely to be highly educated and to stay in the neighbourhood for the job and education opportunities within Finsbury or central London. While South Islington and Old Street are becoming new business hubs, there is a greater tendency for people to live close to these jobs. The Q sorts and analysis show that members of this discourse are more open to future changes in the area. In particular, the issue of the environmental sustainability of the city is discussed in the participants' responses. The participants are more accepting of the idea of increasing density specifically in order to reduce traffic and car dependency in the city.

Discourse 3 has a 15% variance of the total participants in the study, and so has the highest variance. This discourse mostly shows the points of view of the residents similar to discourse 1. However, the main defining Q sorts in this discourse are mostly found among the younger and newer residents of the neighbourhood who may even be temporarily living in London. Five out of the six defining Q sorts here are from participants in the 18-50 year old age range.

Again, like other discourses, the issue of public green space is the most important concern in this discourse. Moreover, statement 3 about being close to other facilities, is ranked the fifth highest statement while it is a middle ranked statement in all other discourses. This shows that the proximity of services and activities is an important issue for new and younger residents of the area.

Another distinctive factor of this discourse is the high ranking score for central heating (card 22). Taking the opposite view to the residents in discourse 1, it seems that younger residents are more in favour of central heating. It can be assumed that this is mostly because of the tendency to reduce energy consumption and higher concern about environmental matters among younger and higher educated citizens. On the other hand, older residents, as discussed, had some negative experiences with central heating in some cases.

The main issue which is useful for designers here is that such collective services, which can be more feasible in higher density areas, can reduce the control users feel in relation to their environment. Therefore, while it can be encouraged to provide such collective facilities, it is important to reduce these negative impacts as much as possible by increasing the flexibility and adaptability of the environment for users upon their sense of choice. This is not just about central heating, but also relates to any facilities provided in higher density schemes.

The other issue which appeared mostly during the discussions was that concerns about aesthetic issues are more common among professionals than residents. Res11 explained that she ignored some of the Q cards like card 19 because they are related to the aesthetic features of the urban form. However, this is also a case where a low score for card 19 may not mean a negative attitude, but just that the respondent sees this as lowest priority compared to other design issues.

Overall, discourse 3 of the resident-led discourses has more similarities to the professional discourses than discourse 1. This is because there are more similarities between the concerns of the professionals and the younger, higher educated residents than between the professionals and the older residents. Some of the main concepts which are of concern for higher density design, such as environmental sustainability, were mentioned by residents in this discourse (Res11, Res17). This similarity shows that it is possible to explain some of the necessary trade-offs and compromises of design qualities with members of this discourse, while pointing out the sustainability benefits of increasing density.

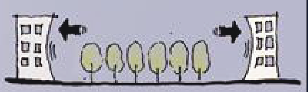
Factor Scores , For Factor 3

No.	Statement	No.	Z-SCORES
6	6 Public green space	6	1.818
1	1 More house close to public transport	1	1.705
18	18 Small buildings	18	1.373
7	7 Communal garden	7	1.288
22	22 Central heating	22	1.078
3	3 Non-residential facilities	3	0.732
21	21 Small stores	21	0.711
5	5 Parking	5	0.510
2	2 Work space in walkable distance	2	0.503
12	12 Connected streets	12	0.349
13	13 Private streets	13	0.170
14	14 Visual Surveillance	14	0.170
15	15 Distance for privacy	15	0.086
25	25 View Distance to street	25	-0.000
26	26 Sunlight	26	-0.199
11	11 Allotments	11	-0.216
10	10 Tree-lines in street	10	-0.446
8	8 Front garden	8	-0.531
16	16 Large interior spaces	16	-0.559
20	20 Large concentrated stores	20	-0.598
9	9 Roof garden	9	-0.854
4	4 Straight and quick access	4	-0.945
23	23 Residential towers	23	-1.418
17	17 Large buildings	17	-1.485
24	24 High rise Character	24	-1.593
19	19 Variety in shape	19	-1.650

Table 9.10: Factor Scores for Factor 3

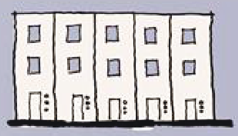
Discourse 3: Resident-led

+ Most Favourable Cards



6 More public green spaces within the neighbourhood

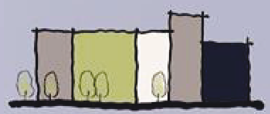
1 More houses close to the main streets, bus stops and tube stations to encourage walking instead of using cars



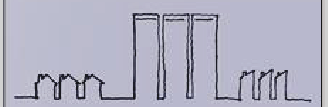
18 Designing smaller buildings for just few (4-6) residential flats

7 Designing communal garden rather than small private gardens to have communal activities like playing, chatting and gathering

- Least Favourable Cards



19 Variety of building shapes and forms in the streets



24 Unique high rise character for the neighbourhood compare to the other areas of the city

Table 9.11: Discourse 3 key features

Defining Q sorts:
Res11, Res29

Key features of members of this discourse:
Younger, newer and temporary residents
Mostly with a higher education level
Working in highly skilled businesses within London

Key Attitudes
More green space
Higher density close to public transport
Communal open spaces
Not in favour of large or high-rise buildings
Less concern about aesthetic matters

Main Considerations

For Design
- keeping and improving the quality of green spaces
- Having a density gradient with higher density closer to public transport or main streets.
- allocating more communal (instead of private) open spaces
- Keeping small grains of buildings as much as possible with plot based typologies.

For Negotiating Design Proposals
- Overall, there is more agreement between this discourse and professionals' point of view.
- Inform them about the environmental benefits of design decisions particularly when benefits are related to a larger scale than just the local neighbourhood.
- Show how green spaces are increased or improved through design
- Address the unavoidable need for high-rise design in some locations of the neighbourhood.

9.6.4 Discourse four: professionals with significant planning and design expertise (see table 9.12 and 9.13)

The analysis shows that the representative members of this discourse are more concerned with the larger scale planning and design of the neighbourhood. Issues related to the street scape and overall character of the area becomes more of concern in this discourse. Moreover, the statements related to the grain size of the urban form are of more concern to these participants.

Discourse 4 shapes 11% variance of the total participants in the study. This is a more professional led discourse because four out of five defining Q sorts are from professionals. It appears that the two highest scored and most defining participants in this discourse are experts in the field of urban design and planning (Pro3 and Pro5) and therefore this discourse is relatively, but not substantially, closer to the urban designers than the architects.

Similar to other discourses, the provision of more public green space is the first priority in this discourse. Similar to discourse 3 of the newer residents, statement 1 is one of the most favourable statements. This shows awareness both among designers and younger residents of the necessity of allocating higher densities close to public transport.

One notable distinction of this discourse is the high score of statement 25. This shows that within the professional participants, there is great concern about the relationship between the buildings and the street in order to make the neighbourhood safer and livelier.

Another considerable feature of this discourse is the emphasis on keeping the grain size small. This is because statement 18 about small buildings is one of the most favorable and statement 17 about large buildings is one of the least favorable. Similarly, in residents' discourses statement 18 is one of the most favorable (just discourse 3) and statement 17 is least favorable (just discourse 1); however, the emphasis on this matter is greater in this discourse.

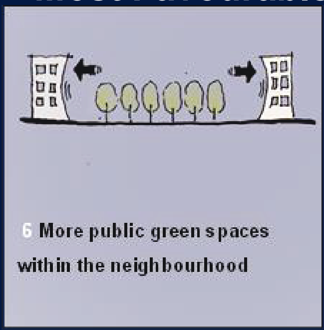
Factor Scores , For Factor 4

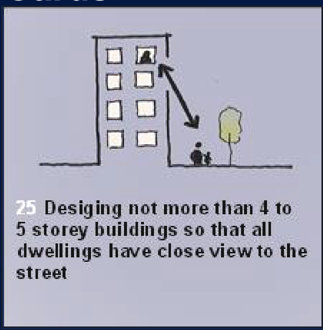
No.	Statement	No.	Z-SCORES
6	6 Public green space	6	1.840
1	1 More house close to public transport	1	1.735
25	25 View Distance to street	25	1.111
18	18 Small buildings	18	1.083
7	7 Communal garden	7	0.964
8	8 Front garden	8	0.875
19	19 Variety in shape	19	0.747
21	21 Small stores	21	0.614
10	10 Tree-lines in street	10	0.364
11	11 Allotments	11	0.352
9	9 Roof garden	9	0.303
12	12 Connected streets	12	0.205
14	14 Visual Surveillance	14	0.171
2	2 Work space in walkable distance	2	-0.067
23	23 Residential towers	23	-0.170
3	3 Non-residential facilities	3	-0.218
4	4 Straight and quick access	4	-0.223
16	16 Large interior spaces	16	-0.238
22	22 Central heating	22	-0.660
15	15 Distance for privacy	15	-0.669
26	26 Sunlight	26	-0.671
5	5 Parking	5	-0.975
20	20 Large concentrated stores	20	-1.283
13	13 Private streets	13	-1.589
17	17 Large buildings	17	-1.706
24	24 High rise Character	24	-1.896

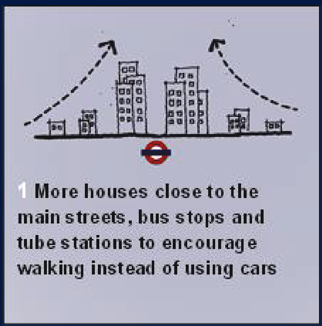
Table 9.12: Factor Scores for Factor 4

Discourse 4: Professional led

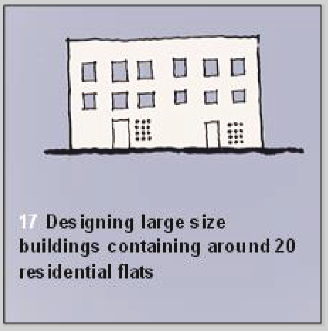
+ Most Favourable Cards







- Least Favourable Cards



Defining Q sorts:
Pro3, Pro5, Pro11

Key features of members of this discourse:
More urban designers/ planners but not significantly so

Key Attitudes
More green spaces
Maintaining privacy
Not in favour of large or high-rise buildings

Main Considerations

For Design
- keeping and improving the quality of green spaces
- Having a density gradient with higher density closer to public transport or main streets.
- Keeping the height of buildings around 5 storeys.
- Keeping small grains of buildings as much as possible with plot based typologies.

Table 9.13: Discourse 3 key features

9.6.5 Commonality between discourses

In this part, the main common themes and preferences within all the discourses will be explored. This is the overall result from the Q methodology and local participation in the research. The main purpose here is to show, in general, and not just in separate discourses, what the most important aspects are of designing for a locality. In other words, here the middle ground between all the different points of view has been identified. Reflecting on this communal view point, the result of the Q methodology study can be transferred to a communal design strategy for the neighbourhood. Then the tolerance of the different groups in the locality to this communal design strategy can be explored.

Commonality across all the discourses and participants is explored by identifying the most and least favourable statements and viewpoints among all participants, regardless of separate discourses. Table 9.14 shows the scoring for all statements by all participants. At the right of the table, the highest and lowest scored statements are shown. Following this table, figure 9.5 and 9.6 show these significantly high and low scored statements. In the following discussion, these general positive and negative attitudes towards different design aspects is explained. Based on these discussions, the potential design principles and recommendations for the main communal design strategy in the neighbourhood are discussed.

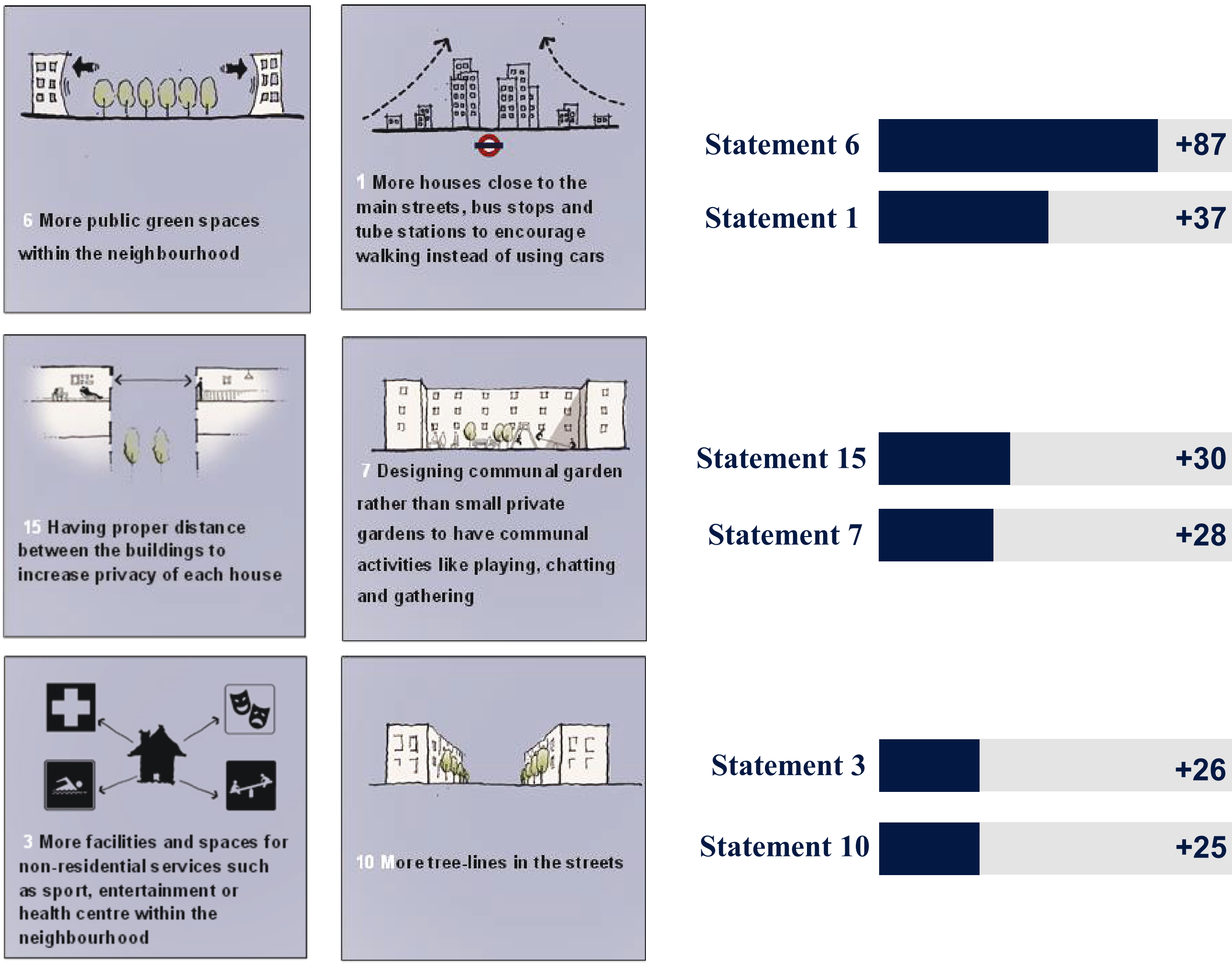
	RES1	RES2	RES3	RES4	RES5	RES6	RES7	RES8	RES9	RES10	RES11	RES12	RES13	RES14	RES15	RES16	RES17	RES18	RES19	RES20	RES21	RES22	RES23	RES24	RES25	RES26	RES27	RES28	RES29	PRO1	PRO2	PRO3	PRO4	PRO5	PRO6	PRO7	PRO8	PRO9	PRO1	PRO11	Sum
statement 1	0	2	3	0	1	1	1	1	-1	-1	3	0	0	1	2	1	1	0	0	0	1	2	3	1	0	-1	2	-1	3	1	1	3	1	2	-2	2	1	-1	1	3	37
statement 2	0	3	0	0	0	0	0	2	0	-2	1	0	2	1	1	0	1	2	0	0	1	1	1	0	1	-1	0	2	1	0	-3	-1	-1	-1	-2	3	-3	-2	-3	0	4
statement 3	1	0	0	2	0	2	3	-3	3	-1	1	1	-1	2	3	0	3	0	2	2	3	1	1	0	3	-1	0	-1	1	2	-2	0	1	-1	1	-1	-1	0	0	0	26
statement 4	2	3	-1	1	1	1	3	3	0	-1	-2	-2	-1	3	-1	-1	-2	-1	2	1	2	3	1	2	0	-2	-2	1	-2	2	1	-1	-1	0	0	0	1	1	1	-1	14
statement 5	-1	-2	1	-1	-1	3	2	2	-1	0	1	1	-1	0	1	0	1	-1	-1	-1	0	0	-1	-1	-1	0	1	0	1	-2	1	-2	-3	-1	-1	-1	1	-1	1	-1	-8
statement 6	3	2	-1	0	0	-1	2	3	3	3	3	1	3	3	3	3	1	3	3	0	3	3	3	2	0	2	3	3	3	2	3	3	3	3	3	1	2	2	3	3	87
statement 7	1	-1	2	1	0	-1	-3	2	0	0	2	-2	1	-1	2	0	-1	1	1	1	0	-1	2	0	1	0	2	0	2	1	2	2	1	2	2	1	2	1	2	1	28
statement 8	-1	2	1	-2	0	-1	-3	-2	2	2	-1	2	1	0	-1	2	2	1	-1	-2	-1	0	-1	-3	-2	3	0	2	-1	3	2	1	0	1	3	1	3	3	3	2	20
statement 9	-3	-2	-2	1	-2	-2	-2	-1	0	2	-1	2	3	2	-2	1	-2	2	-3	-1	2	0	-2	-1	0	1	-1	-2	-1	-1	-3	1	1	0	0	3	-2	0	-1	0	-16
statement 10	3	-1	1	-1	-1	-2	1	1	-1	0	-1	3	1	-1	-1	0	2	1	3	3	-1	2	-1	3	-1	1	-1	0	0	1	0	0	2	1	1	2	0	3	2	1	25
statement 11	-1	0	-1	1	-2	3	1	-1	2	-1	0	0	2	1	0	-1	0	1	-1	-1	1	-1	1	-1	2	1	-1	-1	-1	-1	-1	1	-2	1	0	-1	-1	0	-1	0	-3
statement 12	2	1	-3	0	-3	0	0	1	2	0	1	-1	-2	-1	0	-2	-1	-2	2	0	-2	-1	0	1	0	-1	1	0	1	-3	3	0	2	0	0	0	3	0	2	1	1
statement 13	1	-3	-2	0	-3	-2	-2	-1	1	2	0	0	-1	-3	1	2	0	-1	1	0	-2	-3	0	1	1	2	1	2	0	-3	-2	-3	-3	-2	-3	-1	-3	-2	-3	-2	-35
statement 14	-1	1	2	2	-2	-3	0	1	1	1	0	-1	0	-1	0	1	0	0	-1	2	-1	-1	0	-1	3	2	1	-1	0	0	0	0	0	0	1	2	0	1	0	0	8
statement 15	-3	0	3	3	2	1	1	0	1	3	0	1	1	1	0	3	1	3	-2	3	1	1	0	-2	2	3	0	3	0	0	0	-1	3	-1	1	-2	0	1	0	-1	30
statement 16	-2	0	2	3	2	0	1	1	0	-3	-1	1	0	-1	-1	-1	0	0	-3	1	-1	-1	-1	-3	1	-2	-1	-3	-1	-1	0	0	0	0	0	1	-1	0	-1	-2	-17
statement 17	0	-3	0	-1	1	2	-2	-3	0	-3	-2	-2	-2	-3	-2	-3	-2	-2	0	-1	-3	-3	-2	2	-1	-3	-3	-3	-3	-2	0	-2	0	-3	-1	-2	0	-2	-1	-3	-63
statement 18	0	1	-1	-1	1	0	-1	0	1	1	2	0	0	0	2	2	0	0	0	1	0	1	2	0	-2	0	3	-2	2	-1	-1	1	0	3	2	0	-1	2	-1	2	18
statement 19	0	0	-2	-2	3	1	-1	-2	1	1	-3	-3	-1	0	-3	-1	-3	-1	-2	-3	0	-2	-3	0	0	0	-2	1	-2	3	0	2	0	1	-1	-1	2	-1	0	1	-23
statement 20	2	-1	-1	-2	-1	-1	-1	0	-2	-2	-1	2	-3	2	-1	-2	2	-3	1	-2	0	2	-2	3	-2	-3	0	1	-1	-2	1	-2	-2	-2	-3	-2	0	-3	0	-2	-33
statement 21	-2	1	1	-1	0	2	0	-1	-3	1	1	3	1	0	1	1	3	1	-2	-1	2	0	2	-2	-3	1	1	1	1	0	-2	1	1	1	2	0	-2	2	-2	1	11
statement 22	1	1	1	0	2	-1	0	0	-2	-2	2	-1	0	-2	1	-2	-1	0	1	1	-1	0	1	1	-1	-1	2	1	2	0	1	-1	-1	-2	0	0	1	-1	1	-1	0
statement 23	0	0	0	-3	-1	-3	-1	0	-1	1	-2	-1	-2	-2	-2	1	-1	-2	-1	-3	-2	-2	-1	0	-3	0	-3	-1	-3	1	-1	0	-1	0	-1	-3	-2	0	-2	0	-47
statement 24	1	-1	0	-3	-1	0	2	-2	-3	-1	-3	-3	-3	-2	-3	-3	-3	-3	0	-2	-3	-2	-3	1	-1	-2	-2	-2	-2	1	-1	-3	-2	-3	-2	-3	-1	-3	-2	-3	-71
statement 25	-1	-1	0	1	1	1	-1	0	-1	0	0	0	0	0	0	-1	0	-1	1	0	0	0	0	-1	1	0	0	0	0	-1	-1	2	-1	2	-1	1	0	-1	0	2	0
statement 26	-2	-2	-3	2	3	0	0	-1	-2	0	0	-1	2	1	0	0	-1	2	0	2	1	1	0	-2	2	1	-1	0	0	0	2	-1	2	-1	1	0	1	1	1	-1	7
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 9.14: Q sort scores for all participants

Commonality in the most favourable statements

As figure 9.5 shows, the provision of more green spaces within the area is one of the most preferred themes (cards 6, 7 and 10). Increasing public green spaces is appreciated more than all other design aspects (card 6). This is because this area is very close to central London and lacks parks and green spaces which are more likely to be found in other residential areas of outer London. In addition, other ways of increasing greenery within the streets and also in communal spaces are favoured (card 7 and 10). In other words, greenery is such a major concern that any means of enhancing it is appreciated by local users. Therefore, it is necessary to consider increasing green spaces when proposing a design strategy for the area.

Figure 9.6: Commonality in all discourses (Most Favourable cards)



Based on these responses, the first priority for any new development within the area is to enhance and increase the amount green spaces. Therefore, through the design process, in the first place, it is important to see if it is possible to add new parks or public green spaces to the area or expand the existing ones. However, it appears that the pressure and demand for new housing developments within the area may limit the options for significant change in the amount of public green spaces. This has been attempted in recent years and some new green spaces have been added to the neighbourhood. As explained in the morphological analysis of the neighbourhood, there are many vacant or parking spaces which are allocated for new development and most of them are not sufficiently large to accommodate a new park for the area. Since the design process for this research is a way of understanding the consequences of increasing density, then adding large new parks to the area may not be feasible. On the other hand, it is necessary to increase and enhance the quality of green open spaces even in higher density design schemes.

In this case, it is necessary to consider the design principles which help to make the most of all opportunities to increase the neighbourhood's greenery. As figure 9.5 shows, increasing treelines in the street is also one of the design ideas favoured by residents. Likewise, using urban block typologies with communal gardens can provide semi-public spaces which can be used regularly by residents. Furthermore, in high density schemes, roof gardens can be new available spaces for greenery. Although there are doubts among some participants about the usability, maintenance and control of roof gardens, the result of the generic modelling and secondary case studies show that these problems can be resolved in order to make the most of the open spaces available in high density schemes. The roof gardens can be visible via changes to the highest buildings and also these spaces are becoming more common in new residential developments in London. Therefore, it is necessary to use all possible options for greenery in the density schemes for the area.

The second most important theme relates to the concepts of accessibility and proximity. Figure 9.5 shows that the majority of participants agree with the importance of increasing density based on proximity to public transport (card 1). This shows that better accessibility, which is one of the main targets of the concept of densification and compact urban form within the literature, is also of importance for the local users. Access to other facilities and services is also an important issue (card 3). However, there were a variety of comments on this, which point out that having quick and easy access to public transport may solve the problem of accessing many of the facilities within the neighbourhood. In other words, in the case of London, easy access to public transport is a much more important issue than proximity and availability of services in the local area. However, ensuring a mix of use within a neighbourhood and providing local services should still be considered in the design schemes.

The main design recommendation with regards to the notion of proximity relates to choosing suitable locations for densification. It is preferable to locate the highest number of new dwellings close to the main streets and public transport. Therefore, similar to the generic modelling, it is preferred to have a density gradient with urban blocks with the highest density close to the main streets, with the density reducing as one moves farther away from the centre. Also, the ground floors of the buildings in these main streets are more likely to be used for local non-residential use.

The other issue which is of concern to the locality is that of privacy. It appears that privacy is much more important for older and long-time residents (discourse 1), but overall, card 15 about the distance between buildings has one of the highest scores. Based on this finding, it is necessary to consider the minimum appropriate distance between buildings in new developments. This target can be achieved by keeping the size of the urban blocks sufficiently large to facilitate adequate back to back distance between buildings.

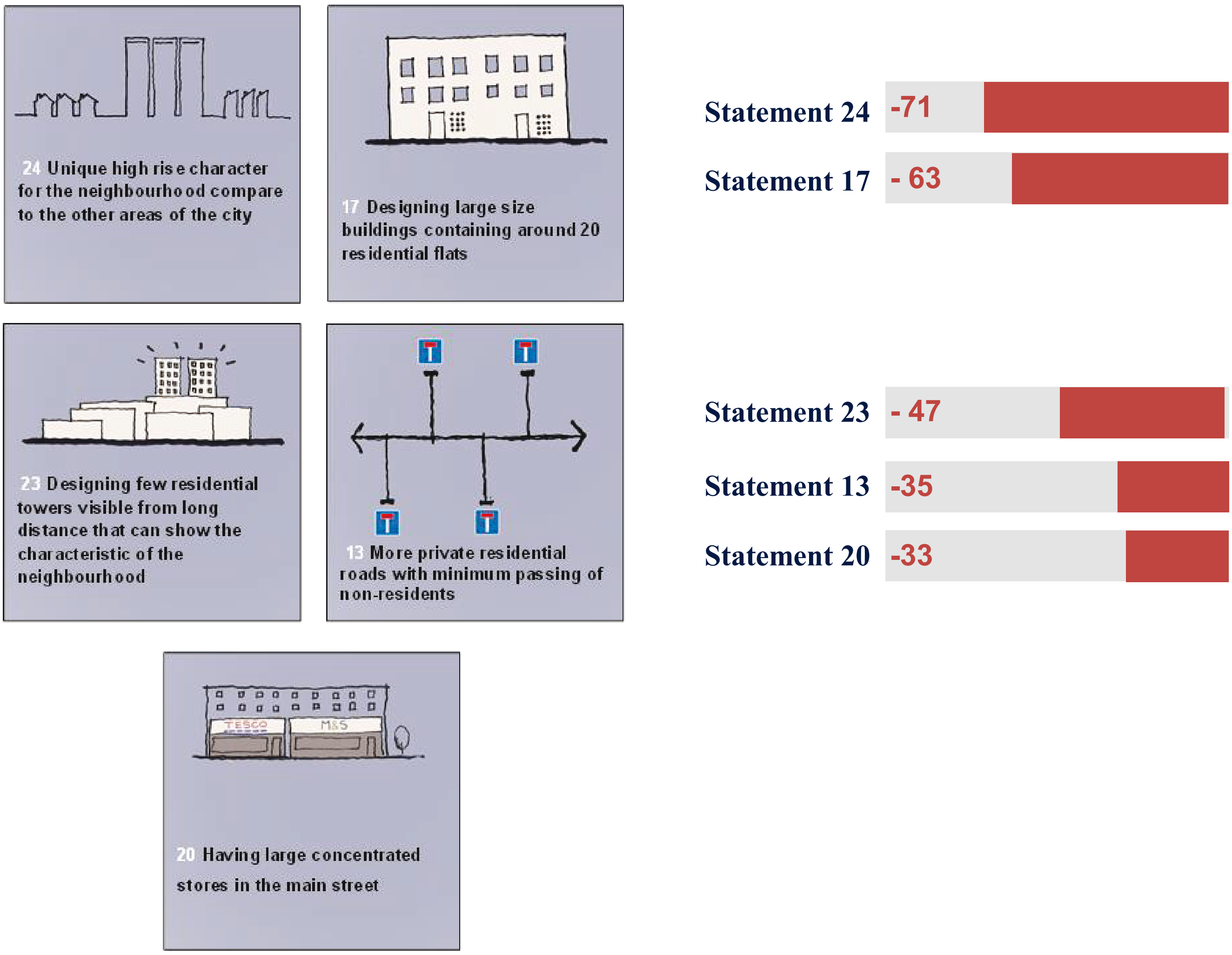
Card 7 is the next most highly ranked statement, recommending communal open spaces instead of individual back gardens. This is aligned with the results from the theoretical framework and generic modelling which emphasize the benefits of communal spaces in high density schemes. It appears that users also recognise the fact that, in such high density urban forms, communal spaces can be more useful than private open spaces which may be highly overlooked and may not provide for a high degree of privacy. Many of the communal activities and social interactions of the neighbours can take place in these open spaces which are semi- public. These can be spaces which are used just by residents of an urban block and, therefore, there are more possibilities for interaction between the neighbours than in a public space which is accessible even to non-locals.

Based on these responses, it is beneficial to design such communal spaces within the neighbourhood. In this way, the open spaces of the area can be of maximum value. Such communal spaces may be more flexible for different types of communal activities and can be better maintained and managed than divided private open spaces. Urban block typology 2 (plot based urban blocks with communal gardens) from the generic modelling can be recommended here to include such communal spaces in the scheme. This typology can still provide other factors such as having small buildings which is recommended in most of the discourses. Using such a typology, many of the open spaces within the new scheme can become flexible communal spaces which can be used for various activities and occasions.

Communality in the least favourable statements

As statements 24 and 23 show, a high rise urban form and character is one of the least favourable design ideas. It can be assumed that this is partly because of the experiences of high rise buildings in post war developments which have gradually been demolished in the UK. As discussed in the discourses, new high-rise buildings within London are not liked, mostly because of the problems of overshadowing and overlooking other dwellings. Hence, this finding validates the result of the literature review pointing out the negative attitude towards high rise buildings in the UK context.

Figure 9.7: Commonality in all discourses (Least Favourable cards)



Despite such negative attitudes to high- rise developments, as was found in the generic modelling, it is inevitable that high rise urban forms will be necessary to some extent when aiming to increase the density of an area. However, it is possible to give priority to other options before increasing the height of buildings. First, it is possible to increase the depth and footprint of buildings. In this scenario, as discussed within the design principles of the previous chapters, adequate back to back distance between buildings should be provided so as to maintain the privacy of the dwellings. The depth of the buildings should not be as much as to sacrifice receiving natural light for the middle part of the building. As appears in figure 9.6 statement 24, a whole neighbourhood characterised as high rise has many more negative points than just constructing a few high rise buildings. Therefore, in the next stage, as an option, high rise buildings can be located just in specific locations of the neighbourhood, preferably close to public transport. In this way, the new high density form should consist of a mix of high and mid-rise dwellings. Other than the design, what is important here is the negotiation with local users about the issue of high rise design. It is important to persuade those in the locality about the inevitability of high rise urban forms if we want to increase the density to a certain degree.

The next least favourable statement is about large buildings (card 17). As also appeared in the discourses, there is relatively overall agreement across all participants regarding the preference for smaller buildings rather than large ones. This is one of the findings of the fieldwork which validates the theoretical argument of the research about keeping a small grain size in urban forms. This shows that even the local users understand the benefits of smaller buildings. This may partly be due to the fact that such buildings are closer to the character of traditional terraced housing which is common in London. For residents, it is about having control and flexibility over their own space, because it would be easier to make agreements with other residents regarding any alterations to the building when there are a smaller number of neighbours involved. Based on this result, the design recommendation here, similar to the generic modelling, is to have more plot based types of development to keep the grain size small. In this way, the overall urban form can have more flexibility for future changes, and can also be closer in character to the existing terraced housing around the neighbourhood.

The idea of designing cul de sacs and private roads has not been generally appreciated by participants. Card 13 about private roads follows exactly after card 12 about connected streets and flow of traffic. This was intentionally organised to inform the participants about the two sides of this choice - private or connected streets. As the results show, there is a negative attitude towards the less well connected street pattern. Only residents in discourse one hgave high scores to this card, but overall, this is still one of the lowest scored cards.

Based on this result, it is recommended to keep and enhance connected street patterns within the area. This can be achieved by proposing new roads and also keeping the block size similar to the generic modelling optimum size of perimeter block. It will also be necessary to inform the local residents, particularly people with a discourse one view point, about the negative impacts of private roads in terms of reducing traffic flow, possible polarization and separation of the different social groups within the neighbourhood (see discussion about quality of permeability; CH3; Section3.5.1).

Statement 20, covering the provision of large stores, also has one of the lowest scores. In the interview process, this card was located next to card 21 about small stores to clarify for the participants the different options in terms of the size and variety of non-residential use. It can be said that concentrated large non-residential spaces are not favoured by local residents. This also emphasizes the issue of keeping plot based and small grain urban forms not only for dwellings but also for other uses. In this way, more local and independent jobs may be produced in the area; there would also be more flexibility for change of use in such smaller buildings. Furthermore, such small grains at street level can enhance the visual variety of the area.

The following table (9.15) shows the main design recommendations based on the above discussion. It illustrates the principles which can be used to satisfy the majority of local preferences regarding new developments within the area:

Principles Based on Most Favourable statements
- Increasing green spaces as much as possible. Better use of all possible space such as communal spaces, roof gardens and tree-lined streets.
- Designing adequate distance between buildings to maintain privacy.
- Designing communal gardens instead of divided private back gardens.
- Putting priority on increasing density close to public transport and the main streets.
- Designing mixed use urban forms, particularly next to public transport and main streets.
Principles Based on Least Favourable statements
- Giving priority to increasing the footprint of buildings rather than their height in order to increase density.
- When high rise design is inevitable, adding just a few high rise buildings instead of changing the character of the whole area.
- Plot based urban form is much more preferred than block based typologies.
- Keeping connected street patterns and avoiding very large urban blocks.
- Using plot based urban forms is preferred even for mixed- use urban blocks.

Table 9.15: Main design principles according to the commonality of response across all participants

9.7 Overall findings of the Q methodology

In this chapter, the main considerations and preferences of local users and professionals were deducted. These preferences influence densification design schemes for the neighbourhood. Using the Q methodology and morphological analysis of the site, there is greater clarity about the applicability of the generic modelling principles to the Finsbury area. The process of place and people analysis has influenced the results of the study in the following ways:

First, this process has been used as a tool to check the validity of the design principles recommended by the generic modelling. In terms of the morphological analysis, this process shows the types of limitations and opportunities which may arise from the existing local morphology while working on a specific site. Such limitations and opportunities show that some of the optimum standards and recommendations from the previous abstract modelling may need to be compromised in order to fit the specifications of the site. Moreover, based on the feedback from the research participants, some of the previous principles have been validated and the degree of agreement between local users and the urban design literature has been identified.

Secondly, a significant result of this study is that it shows the need for prioritisation of the design principles. While there is always a challenge in making trade-offs between design qualities in any design scheme, this process shows how it is possible to prioritise the design principles according to local users' preferences.

9.8 Conclusion

This chapter has covered the "people matters" involved in the local design process. The Q methodology was used to take the local communities' concerns into account for the inquiry by design study. The process of using Q method for this research was explained showing the process before, during and after the fieldwork. The Q method helped to enable the participants to prioritise different design aspects and to have more involvement in the process of making trade-offs and decision making that is normally carried out by designers. The process of the fieldwork was explained including the focus group discussion, interviews and email responses. This process involved the sorting of Q cards based on participants' preferences and priorities and then having questions and answers with regards to the sorted cards.

In the next stage, the results of the field work were analysed using both a computerised process and content analysis of the interviews. The results of the analysis helped in identifying the major points of view and discourses in the local community with regards to the matter of housing design and increased density. Finally, the commonality between these discourses was explored in order to arrive at a consensus about the design principles which can be proposed in this chapter and to be used to develop design schemes in the next chapter.

As discussed in Chapter Four, design is a process of decision making and trade-offs between qualities. Therefore, the designer should prioritise qualities and be willing to sacrifice particular qualities others. Here, the Q methodology can be considerably helpful throughout research related to design. This is because the Q method allows the participant to see all these design matters together and prioritise them. Moreover, the Q method allows people to see the detailed design issues and to think about them rather than just answering questions through interviews. Therefore, the Q method can make a significant contribution to design related research.

From another point of view, while the process of design involves making trade-offs between qualities, designers have different choices of urban form types to use in their schemes. Each of these choices gives priority to particular design qualities instead of others. In this case, the results of the Q method can help the designers to make these choices according to the preferences of the local users to create a more valid rationale for their design decisions.

The Q method has enabled the research to identify the major discourses and points of view regarding the issue of housing density in this locality. Overall, despite identifying different viewpoints in the final result, there was still significant commonality between all the participants' responses. There were also significant similarities between the professionals' and residents' points of view. These results were aligned with some of the results from the literature review. For example, the theoretical part of the research showed the threat of losing a small grain type of morphology and the negative consequences of this situation. Similarly, the Q method study showed that the cards relating to small grain types of urban form were the more favourably received. The discussion with participants showed that these preferences are also related to the design qualities which are of concern in this study. Here, small grains were preferred due to their visual diversity and the fact that they give control and flexibility to residents to make alterations to buildings, spaces and their life style. The Q method has therefore validated the importance of some of the design qualities for local users in the Finsbury case.

Chapter Ten

Local Design; Design process and Assessment of Design Schemes

10.1 Introduction

This is the last chapter presenting the inquiry by design process and the testing part of the research. In the two previous chapters, the people and place matters of a locality were explored. In this chapter, the results of the previous investigations are used to propose final, revised design schemes to increase housing density in the Finsbury area. These are based on the design principles developed in the research process, and the aim is to evaluate the schemes. In this way, at the end of this chapter, the research will show to what extent the design qualities were improved or compromised through the process of densification on a real site. This chapter, align with to Chapter Eight and Nine, covers the fifth objective of the research:

To test the theoretical propositions via applying the urban design principles on a realistic densification scheme for a local neighbourhood in London.

The chapter has three main parts. The first explains the design process and the rationale behind this process. Different design possibilities are explored and finally, a step by step method is proposed to increase the density in the design schemes. The design proposals are presented in a similar way to the generic modelling part of the thesis, but for this specific locality in two ranges of density which are 200dph and 400dph. In the second part of the chapter, the design schemes are analysed in a similar way to the generic models and are based on the unified analytical framework developed in Chapter Five. All the design qualities are again discussed in this stage and the degree to which they may have been improved or compromised are discussed. In the third part, different design alternatives are proposed for the site to see whether there might be a variety of options in order to deliver design qualities based on local users' preferences. These alternatives show the impact of emphasizing a particular design quality and compromising on others in order to explore the issue of trade-offs between design qualities. In this part, similar to the previous inquiry by design stages of the thesis, these design alternatives are evaluated based on the analytical framework of the research. At the end, this chapter provides a more practical and realistic understanding of how changes of density influence the design qualities of an actual neighbourhood.

10.2 Design process

10.2.1 Basic Design Scheme

Initially, the design process started after the site analysis and before the Q methodology. Based on the analysis of the existing conditions of the site with regards to its urban form, morphological characteristics and the potential for delivering design qualities, a basic design scheme was developed. This design scheme (figure 10.1) was developed according to the inquiry by design method of the research at two ranges of density: 200dph and 400dph. The scheme incorporated the overall design layout including mass and shape of the buildings and open spaces for further alterations. This basic scheme allowed the author to understand the obstacles and opportunities for design as a first step before communicating with local participants. In fact, it also helped to develop the Q methodology cards in a more practical way, suggesting an initial understanding of how the character of the neighbourhood might change in both the 200dph and 400dph proposals.

Basic considerations, according to the findings from previous chapters, were used for preparation of this scheme. For this scheme, the standards and bases identified from the generic modelling were used. The standards related to the size of the buildings and the proportion of one, two, three and four bedroom houses (according to London Housing Standards (GLA, 2010) embedded in the plot ratio rates were used (see CH6: Generic Modelling method). The ideal depth of residential buildings (12m) based on the literature review (English Partnership, 2007, Bentley, 1985) was also considered for the proposal. As pointed out in the chapter on the site's morphological analysis, delivery of many of the qualities depends on the layout of the design. Therefore, the author tried to design new buildings in such a way as to create new perimeter blocks with a mixture of new and existing buildings within the site. In this way, qualities such as safety, surveillance of the streets, enclosure and defined streetscapes and connected street patterns were improved in the neighbourhood.

Based on the site specifications in the Finsbury Local Plan (2011), other than the residential buildings, the only major building which needed to be redesigned within the site was the Moreland Primary School. The school was designed in the shape of a courtyard building instead of the existing concentrated form in the middle of an open space. In this way, the adjacent roads could have more active edges, open spaces could be used more efficiently and new residential buildings could more easily be added to the wide open spaces.

With an overall new layout, mass and shape of buildings at the site, the basic scheme could be turned into the actual scheme for the 200dph and 400dph target densities. The rest of the design process from this stage onwards was completed after the analysis of the Q methodology. Having gathered the responses of local users, the results show that specific design qualities and principles are much more important than others based on local concerns. While many of the principles related to the various design qualities had already been developed from the generic modelling, here, the priorities and trade-offs between these qualities became the most important consideration for further development of the densification schemes. Therefore, the process of design became a step by step procedure which started with the 200dph design scheme and then increased the density in a particular manner to reach the next density target in the 400dph scheme.

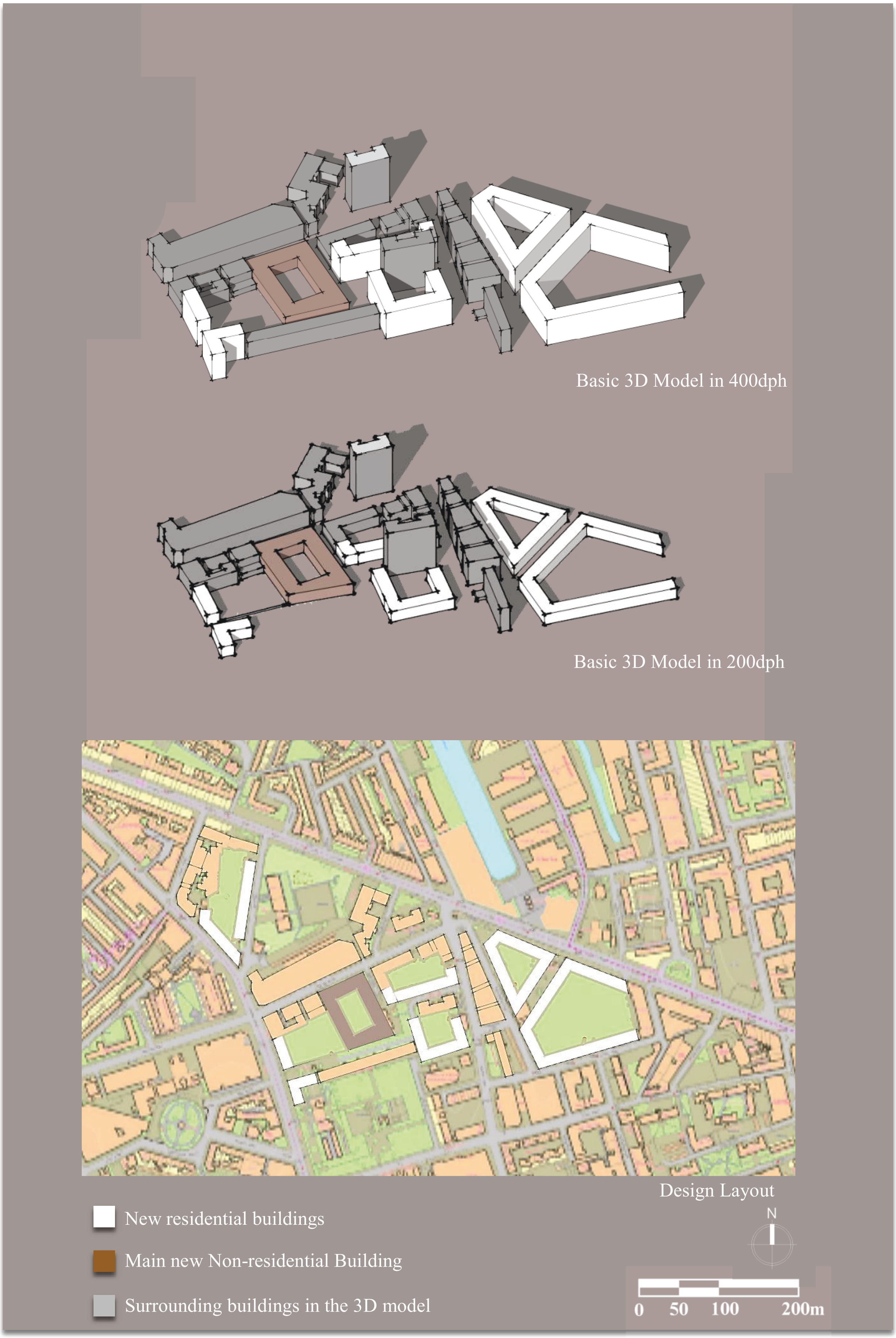


Figure 10.1: Basic Design scheme. map source: Digimap

10.2.2 200dph design scheme

(For better visual presentation, the figures showing the process of design are separated from the text and illustrated in figures 10.3 to 10.9: from pages 272 to 278)

Evolving from the basic design scheme, the 200dph design scheme (figure 10.4) was developed in more detail. Similar to the generic modelling, the scheme attempts to preserve the plot based morphology as much as possible in the newly designed blocks. In this way, the overall grain size remains small within the neighbourhood, including plots and buildings. As a result, many of design qualities can be delivered, such as visual diversity and adaptability for future changes. According to the analysis and studies in the theoretical part of the generic design, the Type 2 urban blocks with plot bases and communal gardens could deliver the highest level of design qualities. Most of the new urban blocks in the 200dph are delivered from this urban block type. The depth of the buildings was kept to 12m and the height of the buildings remained between four and five storeys.

In the next stages, the density was gradually increased to reach the 400dph target.

10.2.3 Step one: increasing the depth of the buildings:

In the first step towards increasing the density, the depth of the buildings was increased from 12m to 16m (figure 10.5). This is based on the English Partnership (2007) guidance which states that 16m is the maximum acceptable depth for a residential building before it starts to lose the qualities of natural sunlight and ventilation. The depth of the buildings was increased from the back, going further into the communal garden. However, it was decided not to exceed the depth in cases which might harm the back to back distance between dwellings and, hence, threaten the quality of privacy.

The starting point of design was by increasing the depth instead of increasing the height. The height had already reached four to five floors in the 200dph scheme. Increasing this height further, as explained previously, would reduce the connection of windows/buildings to the street and would also result in the buildings starting to have high-rise characteristics, which was not well received by the locals because, most commonly, residential areas in London, even in high density areas, do not have buildings which are higher than four to five storeys. A further increase in height would also gradually reduce the direct sunlight for ground floor dwellings and in some open spaces. Therefore, in the first step, priority was given to increasing the depth and footprint of the buildings. (Figure 10.3 to 10.7 shows the step by step change of the design model)

10.2.4 Step two: increasing the height with setbacks

In the second step, the height of the buildings was increased to two storeys with a setback from the street (figure 10.6). In this way, the density of the scheme was significantly increased, but the new additional storey was not very visible from the street. This solution might save the mid-rise character of the design proposal while reaching 270dph density. This type of development with setbacks is becoming more common in new developments in London as well as within Finsbury. This process has been chosen because the least favourable design idea for the locality, according to the Q methodology chapter, was a completely high rise character for the neighbourhood. Hence, the increase in height has taken place within the scheme in a step by step manner.

Figure 10.2: Building in in Finsbury with setbacks in fifth floor. Source: Author

10.2.5 Step three: Additional residential towers

In this step, two residential towers were added to blocks adjacent to City Road in front of the canal (figure 10.7). In this way, the overall morphology of the previous step has been maintained. The design scheme still contains mostly perimeter blocks, with a plot based and small grain character and communal gardens at the core of the blocks (urban block type 2). Only two blocks on the main road have a hybrid form and are mixed with an additional high rise tower.

Adding two tower blocks means that most of the streets within the neighbourhood have the same character as in the 200dph scheme, and the towers only change the view of City Road, making a new landmark for the whole Finsbury area and more defined edges for the public spaces around the canal. These landmarks would improve the legibility of the whole neighbourhood, while the character of the area has not been totally turned into a high rise development. Moreover, the problem of overshadowing was reduced by this solution because the overall scheme stayed at mid-rise height and the towers are located in the north of the site next to the open spaces around the canal and City Road. The overshadowing problem of the other buildings has thus been reduced to a minimum.

As the figure shows, the scheme has reached the 400dph target density by adding these two tower blocks to the scheme, and it is not necessary to change the urban form type to a block based type or large grain morphologies as suggested by the generic modelling.

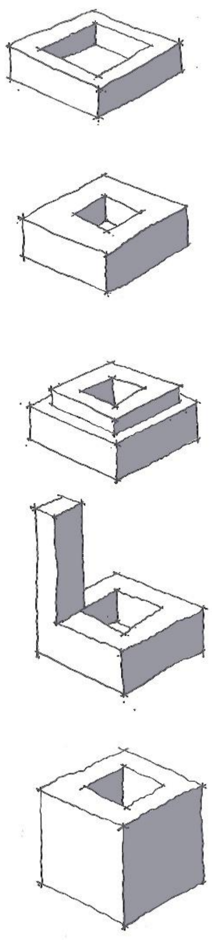
10.2.6 Step four: Adding non-residential uses

In the fourth and last step, new non-residential spaces were also added to the design scheme (Final 400dph scheme: figure 10.9). As shown by the Q methodology study, shops and services close to residential buildings was one of the favoured choices, particularly among younger and newer participants. Moreover, adding such new houses to the neighbourhood would make the new non-residential spaces more viable and feasible because of the increase in local demand for services such as shops. These mixed use spaces have been allocated according to the recommendations of the Finsbury Local Plan (2011) and in these places and urban blocks which were recommended for such new mixed use developments.

Although these spaces were added to the scheme, the major non-residential developments in Finsbury will be developed in the south part of the area, as explained in the local site analysis. The north is mostly allocated for residential developments owing to the fact that good services are already available in this part of London with good accessibility to public transport and, hence, to other opportunities, jobs and services in central and inner London. Therefore, adding non-residential spaces, despite bringing closer access to some shops and services, have mostly added to qualities such as active streetscapes and having more vibrant and active public spaces with a good flow of pedestrians.

As has been said, additional mixed use spaces were allocated to spaces which were also suggested by the Finsbury Local Plan (IC, 2011) and Islington Urban Design Guide (IC, 2006). These spaces are located mostly on City Road, which is the main street in the area and, to a lesser degree, in Central Street which is similar to a local main street. Non-residential spaces have been allocated to the ground and first floors of buildings adjacent to these roads to have more active edges at street level. Adding these two extra floors to the buildings means that the number of floors in some parts of these urban blocks has reached about seven or eight floors. As was illustrated in the examples and analysis in previous chapters (the conceptual framework and generic modelling) the character of buildings changes most at this height level to larger size plots. Therefore, the character of the buildings and plots in City Road has changed slightly to a larger grain size to add these new non-residential spaces. However, the entire block has not changed to a large grain character (urban block type 3); rather, the design of the blocks has remained a mixture of large and small plots so that the advantages of a plot based typology have been maintained as much as possible.

Figure 10.3: Design Process
According to Principles and priorities identified by Q method analysis. Source: Author



Keeping perimeter block with 12m depth of buildings and 4 to 5 stories height

Increasing depth of Buildings

Increasing height to 6 or 7 stories with setbacks

Adding individual towers to the perimeter block

Total high rise character

Figure 10.4: 200dph scheme

Net Density :	200dph
Plot Ratio :	1.5
Footprint of buildings :	14245sqm
Total floor space :	65089.5sqm

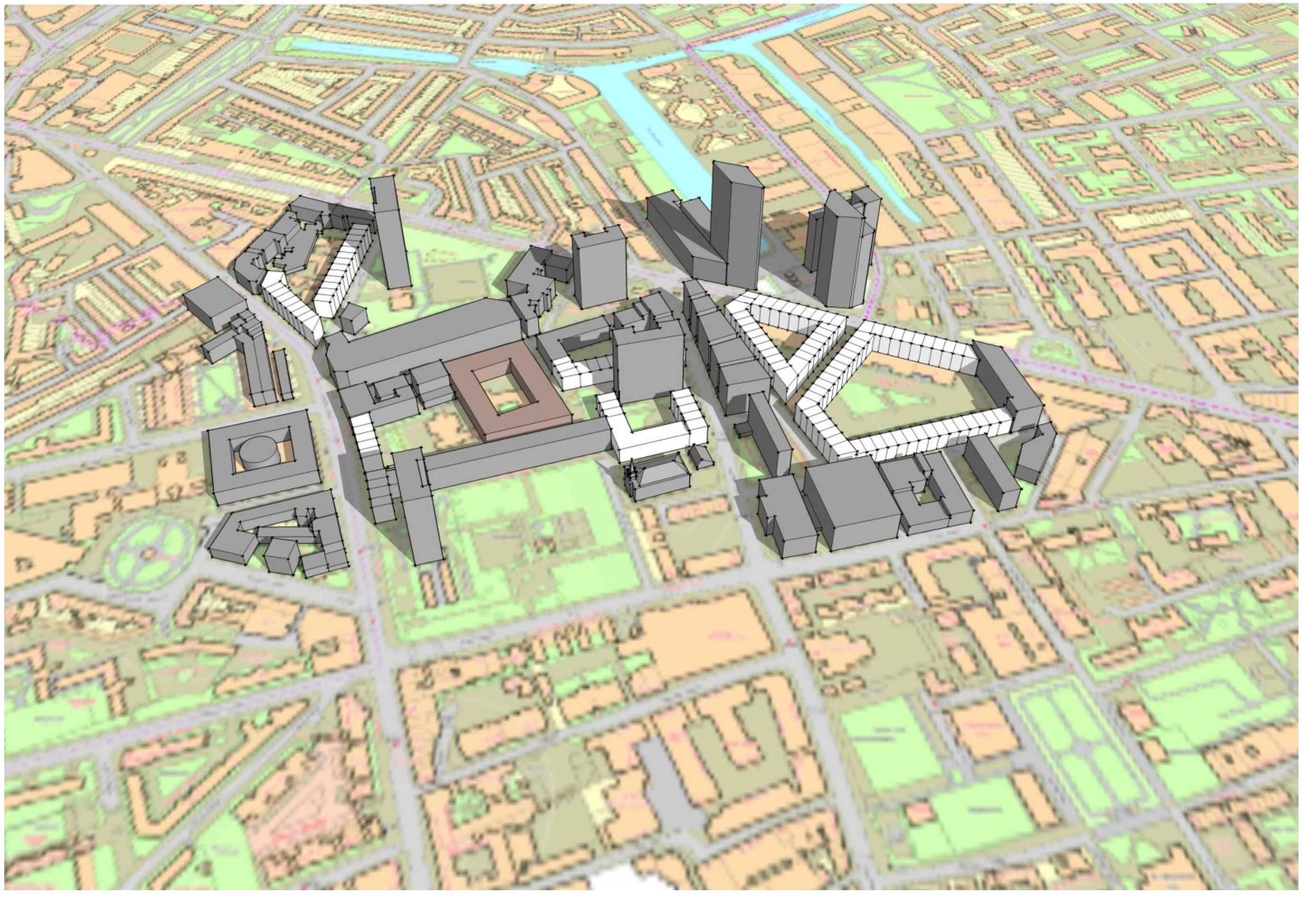


Figure 10.5: Increasing Depth of buildings

Net Density :	270dph
Plot Ratio :	2.01
Footprint of buildings :	17511sqm
Added floor space :	22465.5sqm
Total floor space :	87555sqm

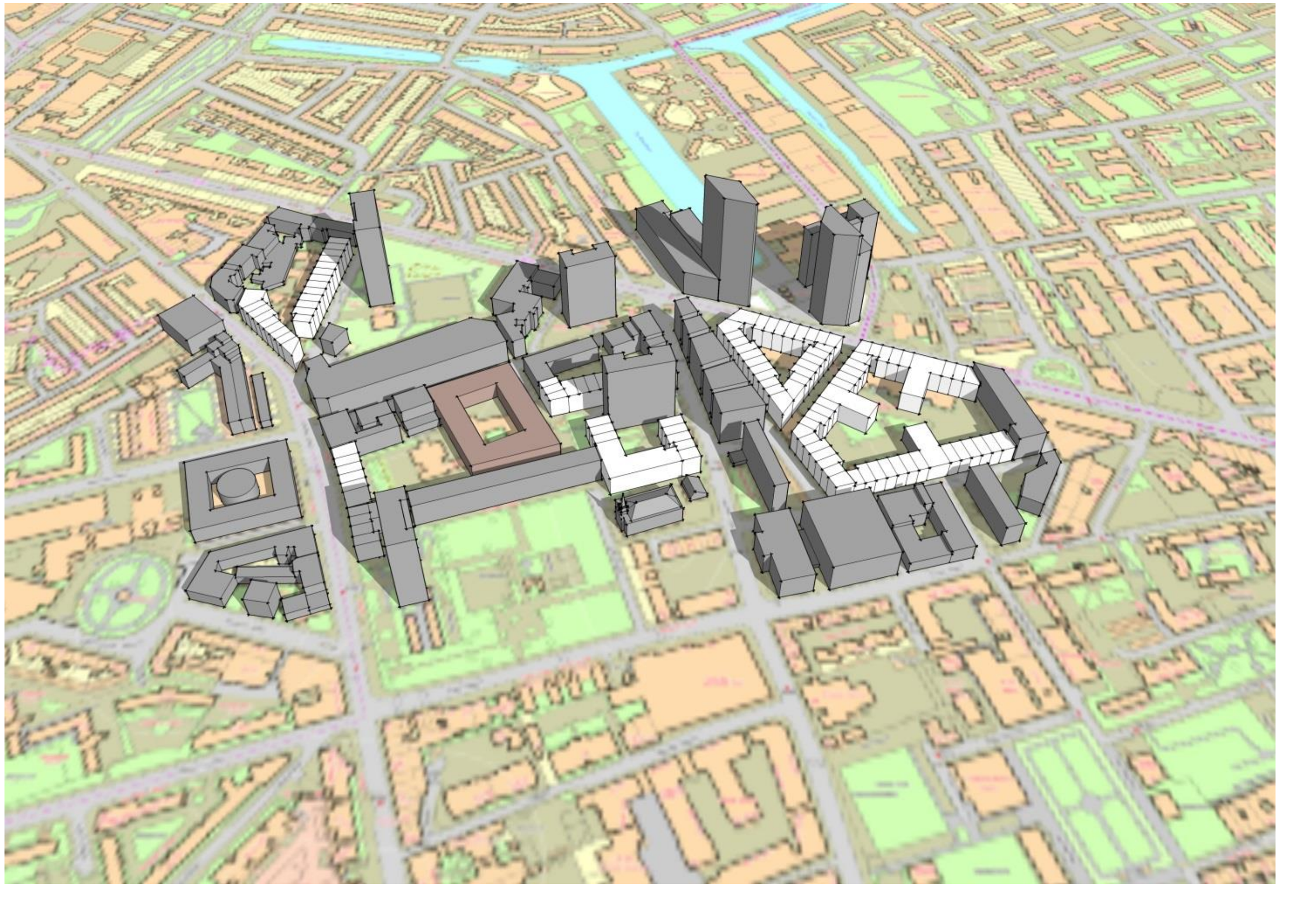


Figure 10.6: Adding 6th and 7th floor with set backs

Net Density :	350dph
Plot Ratio :	2.65
Footprint of buildings :	17511sqm (same)
Added floor space :	27732sqm
Total floor space :	115287sqm

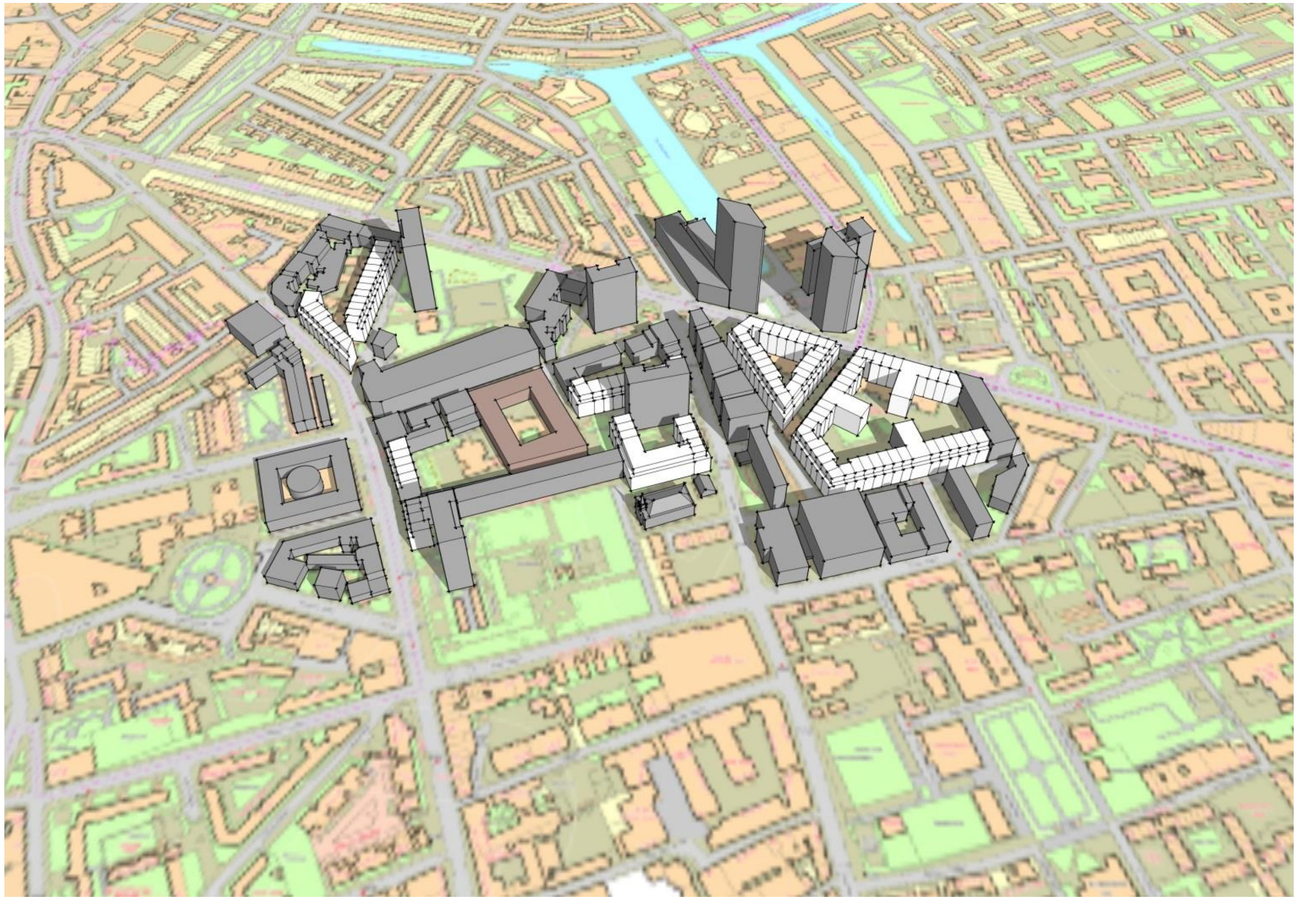
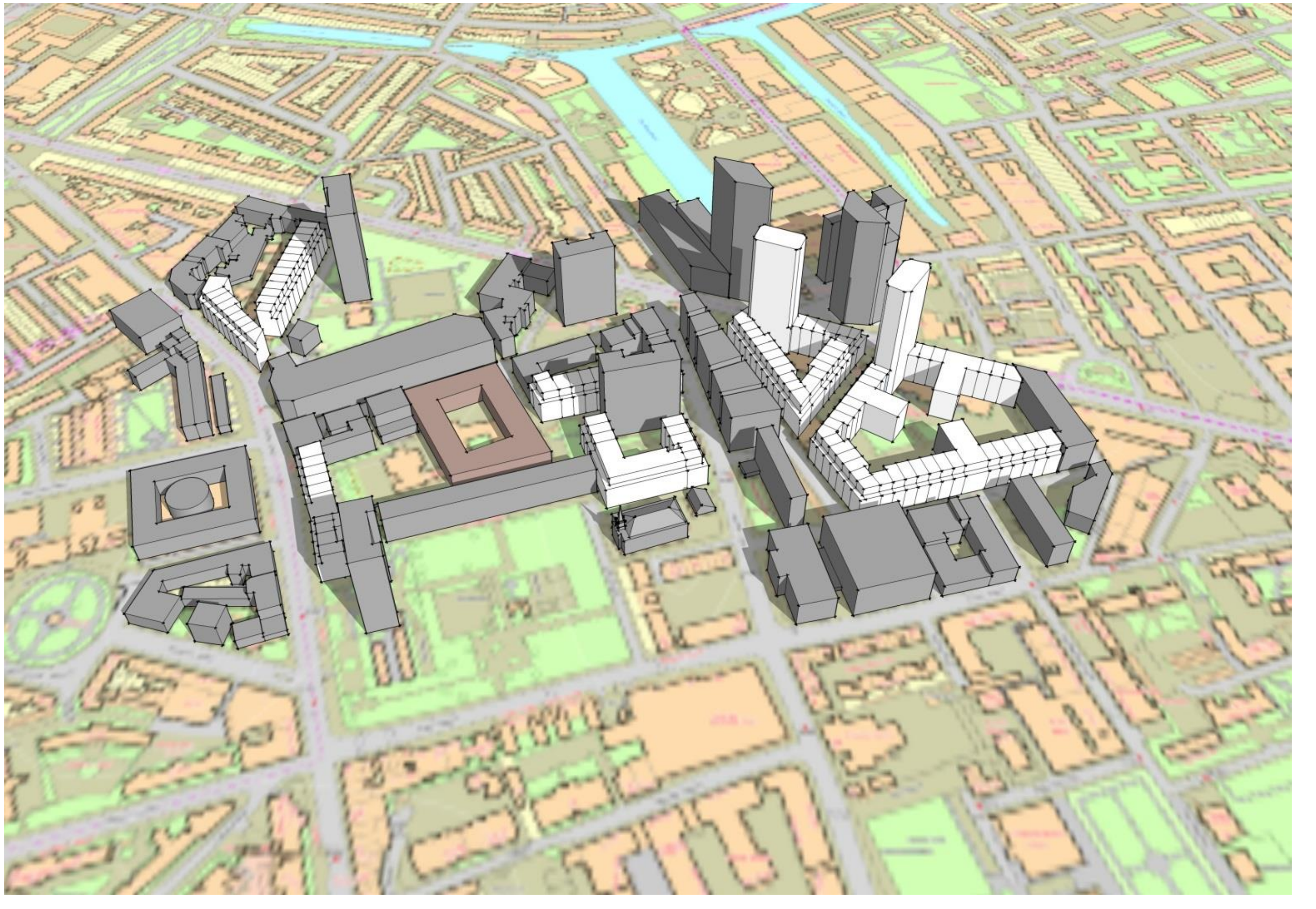


Figure 10.7: Adding residential towers

Net Density :	400dph
Plot Ratio :	3.14
Footprint of buildings :	17511sqm (same)
Added floor space :	20967sqm
Total floor space :	136254sqm



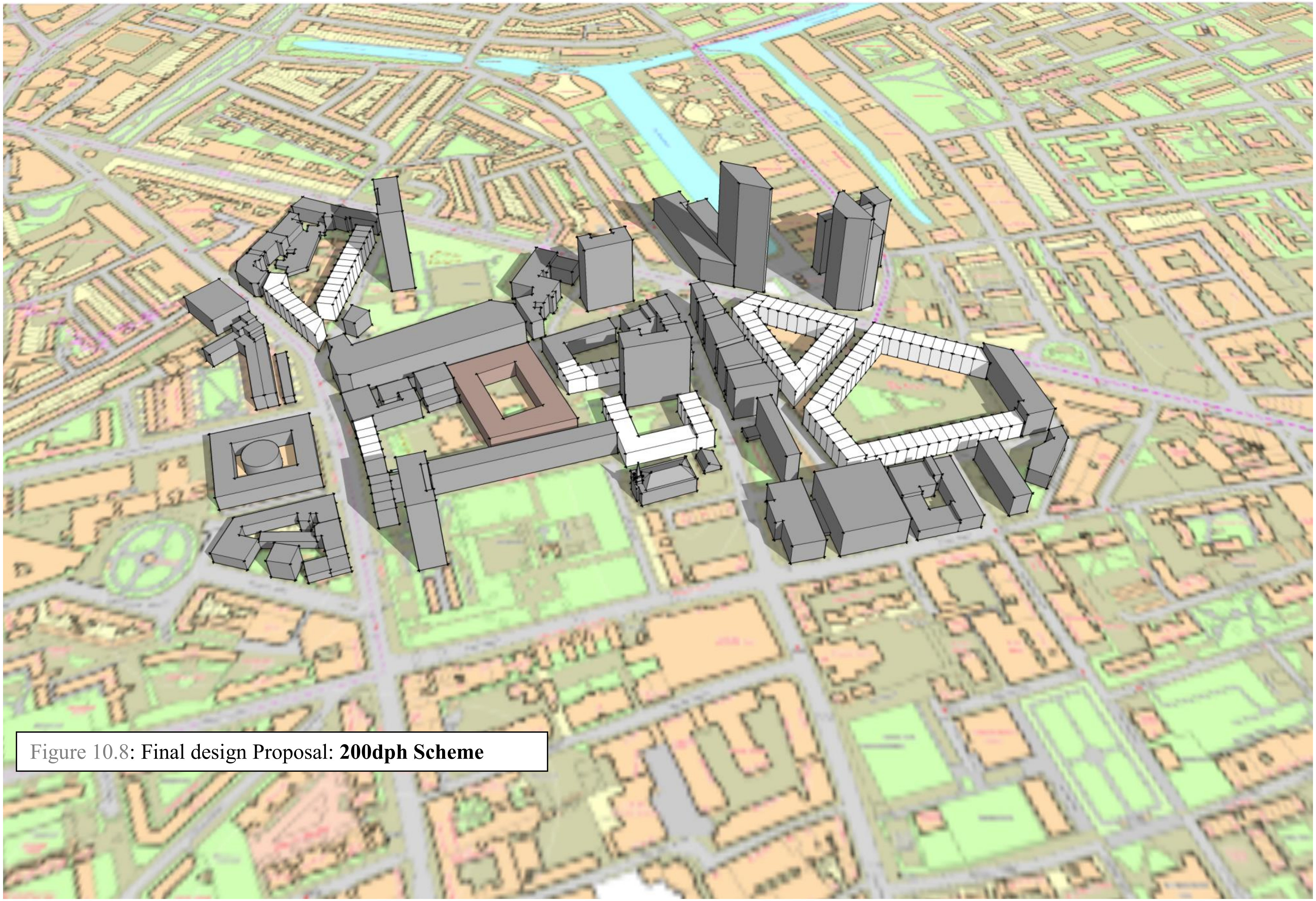


Figure 10.8: Final design Proposal: **200dph Scheme**

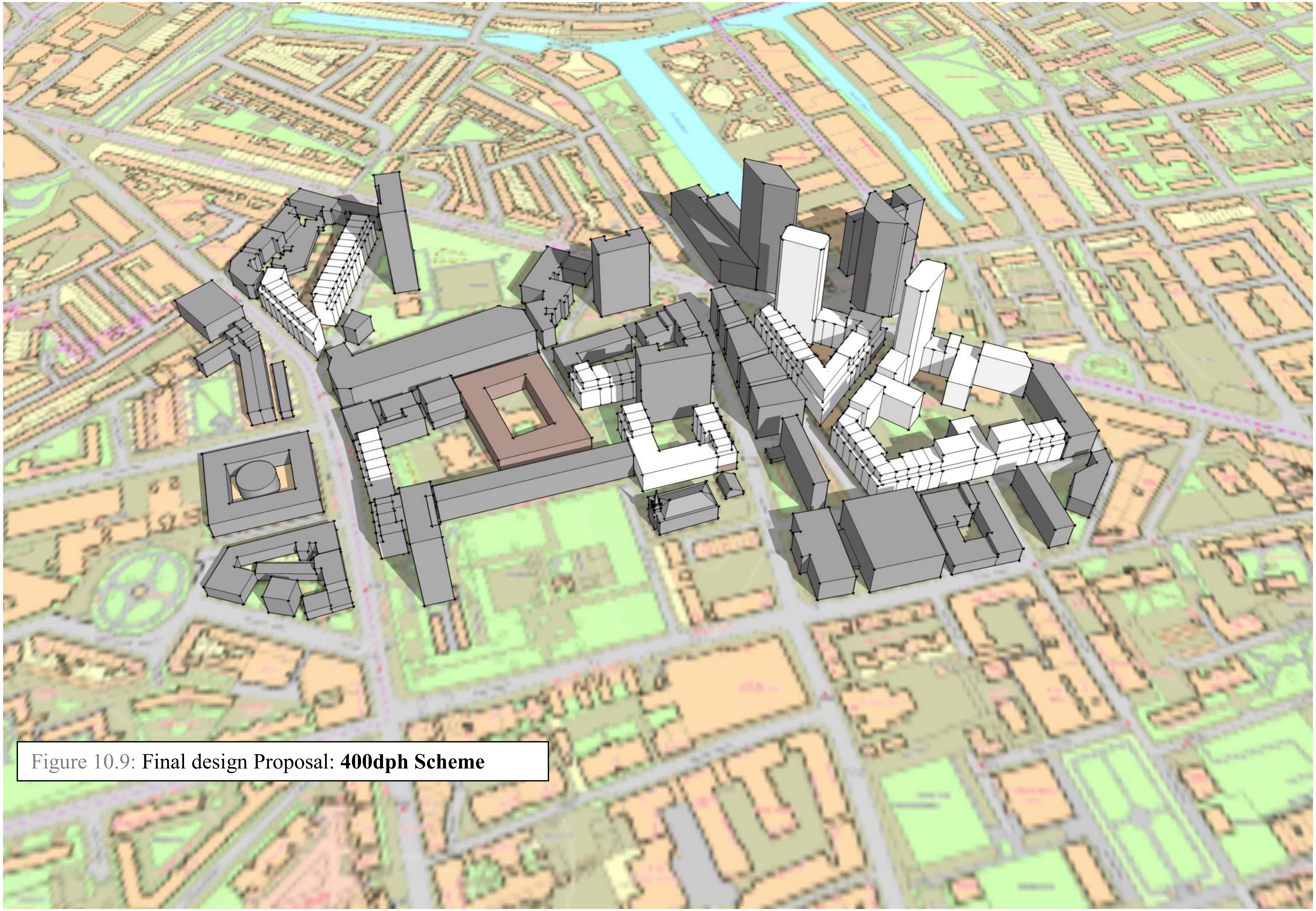


Figure 10.9: Final design Proposal: **400dph Scheme**

The following three pages chow a detail design of one of the blocks in 400dph scheme. Such detail design goes to the architectural level and can have variety of character. This detail design is developed merely for the convenient of showing and clarifying some of the design aspects which are discussed in the following analysis section of the chapter.

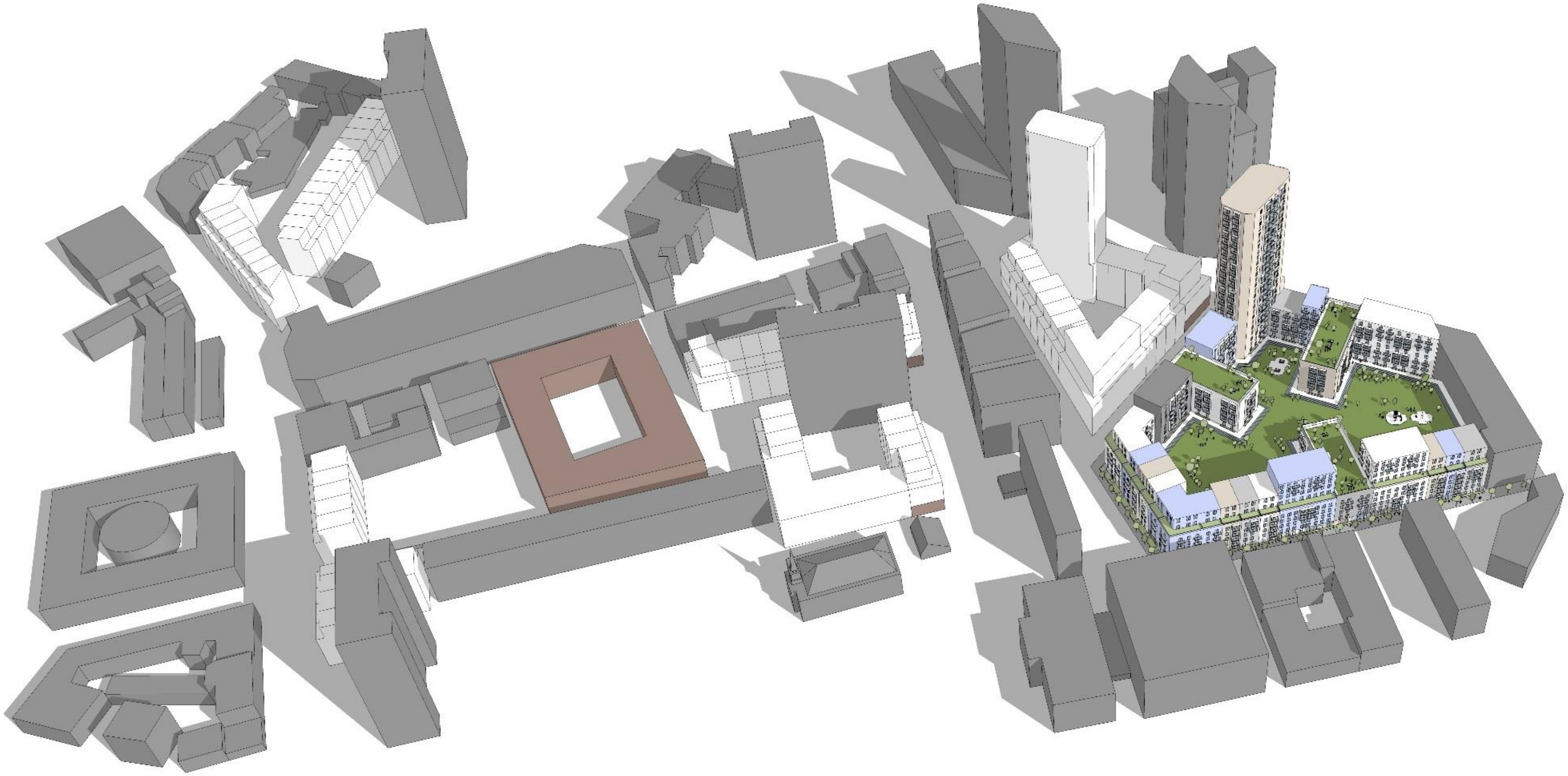


Figure 10.10: Detail Design of an urban block: location of the block within the site.

Figure 10.11: Detail Design; Perspective 1

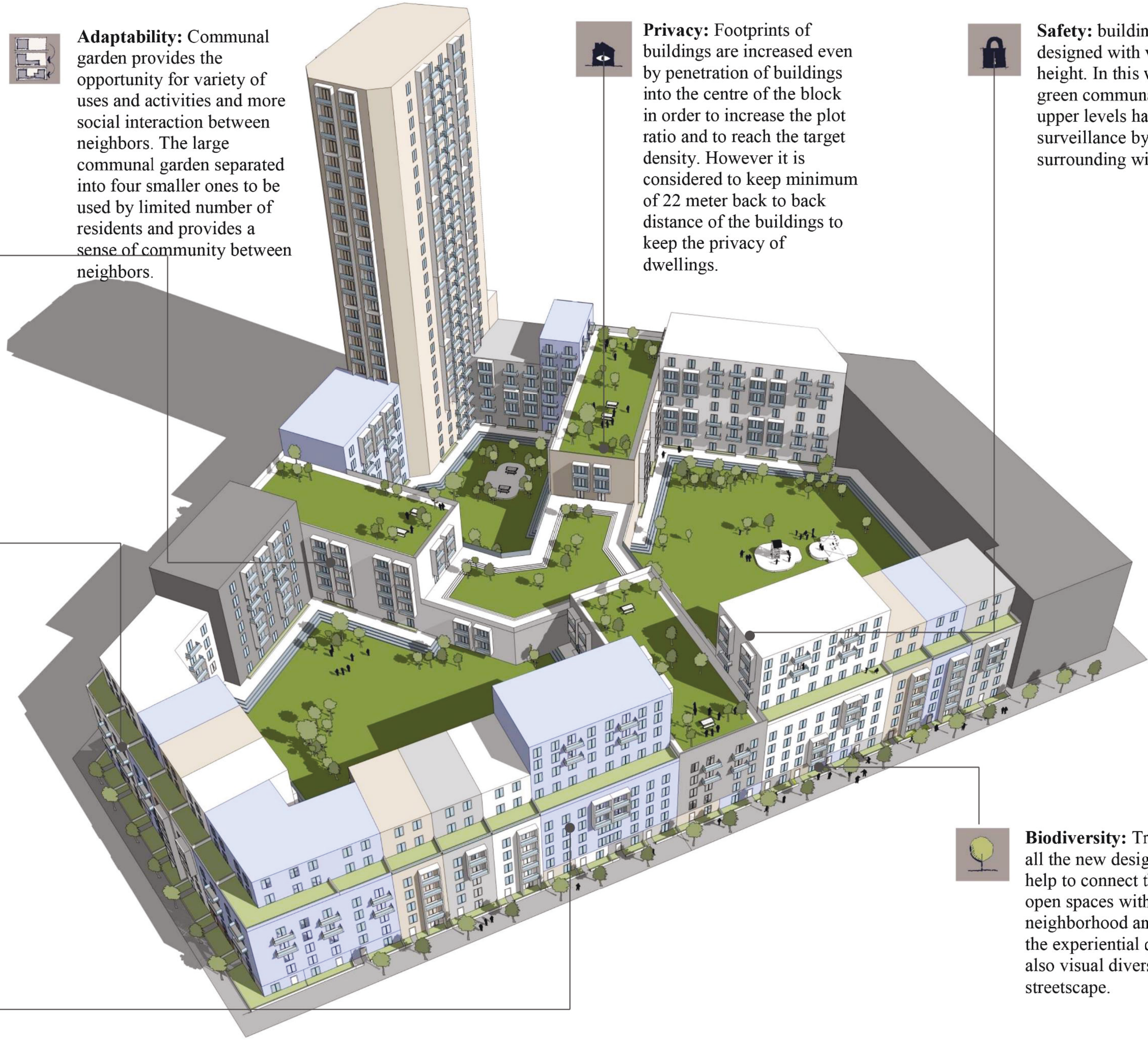
Privacy: a small green space with 1 to 1.5 meter depth is designed for the ground floor windows. This gap space helps to have better privacy for the dwellings in the ground level of the communal garden.

Adaptability: Communal garden provides the opportunity for variety of uses and activities and more social interaction between neighbors. The large communal garden separated into four smaller ones to be used by limited number of residents and provides a sense of community between neighbors.

Privacy: Footprints of buildings are increased even by penetration of buildings into the centre of the block in order to increase the plot ratio and to reach the target density. However it is considered to keep minimum of 22 meter back to back distance of the buildings to keep the privacy of dwellings.

Safety: buildings are designed with variety of height. In this way the green communal spaces in upper levels have also surveillance by the surrounding windows.

Visual Diversity and **Privacy:** front gardens are designed in all residential streets. even just 1 meter depth of front garden can provide a small green space and opportunity for personalization of the building and improving visual variety in the street. Moreover such gap between street and building can



Diversity & Adaptability: even in the large size plots the ground floor is divided to two or three individual houses. In this way the ground level houses can bring more visual variety to the street level. Moreover these ground level houses can be more flexible for change to non-residential uses because they have separate and independent entrance door from the other part of the building.

Biodiversity: Tree lines in all the new designed streets help to connect the green open spaces within the neighborhood and improve the experiential quality and also visual diversity of the streetscape.

Figure 10.12: Detail Design; Perspective 2

Diversity: Ground and first floor is used for non-residential uses making active edge for the main street.

Character: setbacks in the fifth floor and in the tower help to keep a mid-rise character of the area from the street view.

Diversity, Adaptability: Even in the large size blocks the ground floor is divided to small size shops to improve the diversity and adaptability for variety of small stores and local jobs.

Safety: Use of balconies in higher floors help to have more surveillance on public spaces and also provide a minimum private open space for all dwellings

10.3 Local design analysis

The design proposals for densification at the Finsbury site, at this stage, are analysed. The analysis process is similar to that used for the generic modelling and is based on the analytical framework of the research. As with the generic modelling analysis, the urban design qualities and their indicators are checked out in relation to the local scheme. The relationship between these design quality changes and changes in urban form patterns and residential typologies are explored. Finally, this analysis shows to what extent the results of this analysis are similar to generic modelling and what other new findings may be found as a result of designing based on a real site.

The analysis process is based on both the 200dph and 400dph design schemes. The extent to which each design quality and element of urban form changes in each of these schemes has been explored. Such analysis shapes how much the process of densification from the existing site to 200dph to the maximum of 400dph may influence the delivery of various design qualities.

Similar to the previous analysis, this analysis is explained separately for each urban design quality, and any major changes in the delivery of the design qualities is explained. The results of the analysis will be shown in two different categories. The first category relates to the findings about improvements and compromises to design qualities, and the second category relates to the proposed recommendations of this research based on the results of the analysis. These recommendations show how each of the design qualities can be achieved in the densification process and related design schemes.

The following contains separate analysis of each design quality of the design schemes:

Table 10.1: Analytical table for **200dph** design scheme for residential densification in Finsbury

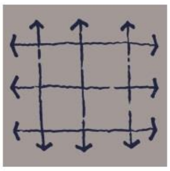
(See the main extended analytical table in chapter 5)

Urban Design Qualities	Indicator	Criteria: Low	medium	High
permeability	Average length of block			
	Existence of cul-de-sacs and dead ends			
Accessibility	Density gradient designed according to main transport and business nodes			
	Walkable distance to services			
Diversity	Allocation of non-residential uses			
	Proximity to main non-residential uses: Primary school			
	Proximity to main non-residential uses: secondary school			
	Proximity to main non-residential uses: medical Centre			
	Proximity to non-residential uses: main shopping area			
	Active edges produced and distribution of non-residential uses			
	Diversity in dwelling size			
Visual variety	Opportunity for personalization at the ground floor of buildings			
	Opportunity for vertical division of façade to improve diversity in visual experience			
Adaptability	Potentials for change of use in dwellings: access from building to public space			
	Potentials for gradual change of urban form			
	Opportunity for communal activities in semi open spaces in centre of the blocks			
	Possibility for extension in buildings			
Biodiversity	Total Public green space per person			
	Total Communal green space per person			
	Connectivity of green spaces			
	Accessibility to green space (within walking distance of dwellings			
	Possibility for Variety of activities and character in green space			
	Opportunity for use of greenery on exposed surface of buildings			
	Opportunity for local food production (allotments)			
Environmental comfort	Receiving sunlight for all dwellings during the day			
	Receiving sunlight for all green open spaces during the day			
Resource efficiency	Average exposed surface of dwellings (for loss of energy)			
Legibility	legibility of public space network			
	Legibility through use of landmark buildings			
	Change of character of buildings and open spaces from centre to edge of neighbourhood			
	Varity of public spaces character within neighbourhood in terms of form, use and activities			
Character & Distinctiveness	Similarity of form and grain size in the urban layout to surrounding built environment			
	Respecting the existing height of buildings within the area			
	Distinctive characteristic of neighbourhood from surrounding areas			
Safety	Overall length of Active edges at ground level of streets			
	Clarity of public, communal and private space			
Privacy	Keeping appropriate back to back distance of dwellings			
	View from street to the house in ground floor			
	View on private gardens from other dwellings			

Table 10.2: Analytical table for **400dph** design scheme for residential densification in Finsbury

(See the main extended analytical table in chapter 5)

Urban Design Qualities	Indicator	Criteria: Low	Criteria: medium	Criteria: High
permeability	Average length of block			
	Existence of cul-de-sacs and dead ends			
Accessibility	Density gradient designed according to main transport and business nodes			
	Walkable distance to services			
Diversity	Allocation of non-residential uses			
	Proximity to main non-residential uses: Primary school			
	Proximity to main non-residential uses: secondary school			
	Proximity to main non-residential uses: medical Centre			
	Proximity to non-residential uses: main shopping area			
	Active edges produced and distribution of non-residential uses			
	Diversity in dwelling size			
Visual variety	Opportunity for personalization at the ground floor of buildings			
	Opportunity for vertical division of façade to improve diversity in visual experience			
Adaptability	Potentials for change of use in dwellings: access from building to public space			
	Potentials for gradual change of urban form			
	Opportunity for communal activities in semi open spaces in centre of the blocks			
	Possibility for extension in buildings			
Biodiversity	Total Public green space per person			
	Total Communal green space per person			
	Connectivity of green spaces			
	Accessibility to green space (within walking distance of dwellings			
	Possibility for Variety of activities and character in green space			
	Opportunity for use of greenery on exposed surface of buildings			
	Opportunity for local food production (allotments)			
Environmental comfort	Receiving sunlight for all dwellings during the day			
	Receiving sunlight for all green open spaces during the day			
Resource efficiency	Average exposed surface of dwellings (for loss of energy)			
Legibility	legibility of public space network			
	Legibility through use of landmark buildings			
	Change of character of buildings and open spaces from centre to edge of neighbourhood			
	Varity of public spaces character within neighbourhood in terms of form, use and activities			
Character & Distinctiveness	Similarity of form and grain size in the urban layout to surrounding built environment			
	Respecting the existing height of buildings within the area			
	Distinctive characteristic of neighbourhood from surrounding areas			
Safety	Overall length of Active edges at ground level of streets			
	Clarity of public, communal and private space			
Privacy	Keeping appropriate back to back distance of dwellings			
	View from street to the house in ground floor			
	View on private gardens from other dwellings			

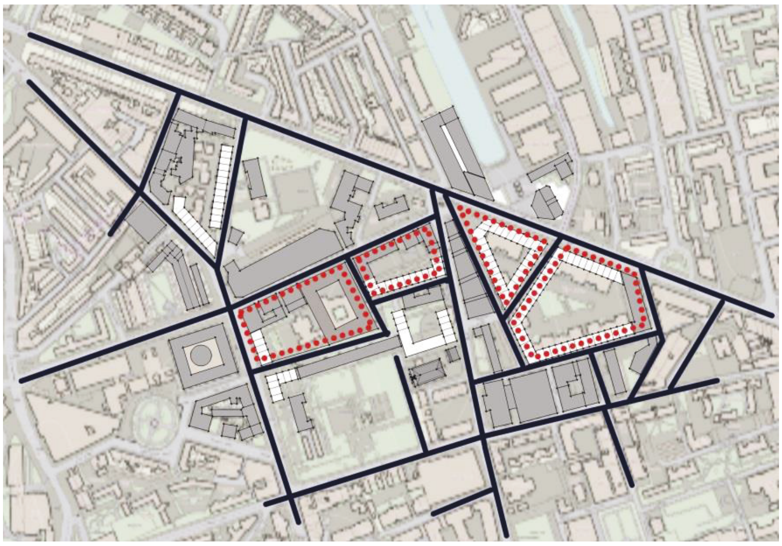


10.3.1 Permeability

As discussed previously, permeability is about connected street patterns and the flow of traffic. The 200dph scheme shows significant improvements in the connectivity of the streets (figure 10.13). Although open spaces are reduced to make way for new residential buildings, the scheme still has better connected streets than the previous condition of the site. This is particularly true near the school where there are dead end roads. New streets that are connected to each other in this area have made better connections within the overall street pattern. Introducing smaller blocks on the City Road has also improved the connectivity of the area.

Despite the increase in connectivity in the 200dph scheme, the 400dph scheme has the same street patterns and therefore no significant changes can be seen in the quality of permeability. It can be said that a new design for the area and new perimeter blocks in the scheme is the main reason for increased permeability. Therefore, new developments are the main reasons why this design quality has improved, not the densification by itself. In other words, introducing appropriately sized perimeter blocks has improved the connectivity. After making these decisions on the layout of the scheme, it can be concluded that increasing the density would not directly change this aspect of design quality.

Based on these results it can be recommended that for such densification schemes it is necessary to consider an appropriate design layout. It is important to protect the perimeter block form and to keep the size of these perimeter blocks close to the size recommended in the urban design literature which is around 100 meters on each side. This size of block can provide some other qualities as well such as privacy (distance between buildings), biodiversity (enough space for greenery within the block) and adaptability (usable size of open spaces for communal activities inside the block). While having such a layout and street pattern, then increases in density can be achieved by increases in the depth and height of the buildings as explained in the design process.



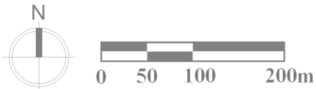
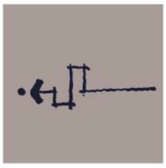


Figure 10.13:
Designing smaller urban blocks and increasing permeability of the site and connectivity of street network. Adapted from Digimap



10.3.2 Accessibility

As discussed in the previous chapters, accessibility in this study means proximity of residential buildings to public transport and services which are commonly located close to the main street. In this case, looking from a city scale to this design proposal, increasing density within Finsbury can be a rational choice because of the proximity of this area to two Underground stations and many services and jobs, because the area is at the edge of central London. Therefore, looking at the big picture, densification of Finsbury should contribute to the overall accessibility within London and is the optimum choice of densification.

In addition, at the neighbourhood level, considering the 200dph scheme, adding new houses which are commonly within walking distance to Angel Underground station, the town centre and City Road can provide new housing with a good level of accessibility. In fact, one of the main advantages of the area for new residents is this accessibility which is already provided in the area.

In 400dph scheme, the new additional houses are mostly located in the urban blocks adjacent to City Road which has the shortest and most direct access to the Underground, and many of the local bus routes. Therefore, the increase of density in this scheme (compare to the 200dph scheme) has improved the accessibility because of allocating a larger number of houses closer to the main services.

The first major recommendation is that increasing density should be correlated to the existing potential of the neighbourhood, particularly the accessibility potential city scale increase of density. At the neighbourhood scale, similar to the generic modelling, it is recommended that the density gradient should be designed based on the proximity to services and public transport. In other words, higher density urban blocks should be allocated close to the main streets and transport hubs. In this particular site, the central part for densification is exactly the same area which promotes a high rise character within the neighbourhood. The intersection between City Road and the canal already has a high-rise character and therefore concentrating the density would support this new character. However, in other cases, there might be a serious conflict, and any large increase of density in central areas might harm the existing character of the neighbourhood. This is one of the cases where other solutions may need to be considered. The ideal accessibility level cannot always be achieved when it may harm the character. Therefore, it can be recommended that, in such cases, the target density is compromised and other urban form typologies should be used.

103.3 Diversity

The main issue related to diversity is the amount of non-residential floor space allocated in the scheme, the location and relationship of mixed use developments to the residential public spaces and residential buildings and the place and type of activities happening within the neighbourhood as a result of mixed use developments. In addition, visual diversity is discussed as a related subcategory.

Overall, according to the local plan, most of the areas that have been used for new development in schemes are allocated for residential led developments. The majority of the additional floor space is therefore purely residential except for the ground floors in City Road and close to the canal (figure 10.15). This is because this area is surrounded by a lot of non-residential buildings. To the north east of the site is Angel town centre, to the south west is the Old Street roundabout and the total south of the area is adjacent to the business hubs of central London. Even within the site, there are many buildings with non-residential uses such as offices, hotels, and sport and education centres. Therefore, according to the needs and targets in the Finsbury Local Plan (2011) the spaces allocated for new developments are predominantly set aside for residential buildings. It can be said that even though mixed use development is delivered in the design schemes, the level of diversity is so high in this area of London that increasing diversity is not a high priority for this new development.

In the 200dph scheme, new non-residential floor space has been allocated in the main street within the site and next to the canal. As other local studies have also pointed out (IC, 2006) this area works as a new activity hub within the City Road making a new node and hub in the neighbourhood. The existing high rise towers on the north side of City Road are residential and have more of a mixed use character around the canal which has the potential to make a more active and vibrant public space around the canal. Moreover, these new developments should improve the safety of public spaces near the canal by bringing more activities and a greater flow of pedestrians.

Keeping the school with a new form in the scheme can also help to make better use of the open spaces both for the school and for the residential buildings added around the school. The new form of school brings more active edges to the adjacent streets and potentially increases the safety and visual diversity of these streets.

Overall, more new buildings in vacant spaces will improve the enclosure and visual diversity of the streets. Using the plot based typology of the buildings in the 200dph scheme also brings more visual experiences because of the increase in the number of entrances and connections between the street and the buildings.

In the 400dph scheme, the blocks adjacent to City Road and the canal are for non-residential uses and therefore it can be said that the same degree of activities and diversity can be delivered in this scheme. The final form and layout of the scheme shows that, if a significantly higher amount of mixed use was the target of scheme, then the whole typology and form of buildings would have to be changed. As shown, it has been attempted to retain the plot based typology for most of the area in 400dph scheme. The change of form to high rise towers and large plots next to the City Road shows that the density is on the threshold of changing the typology completely, to large and high-rise buildings. Consequently, if more non-residential floor space were to be added to the scheme it is inevitable that this would change the urban form pattern.

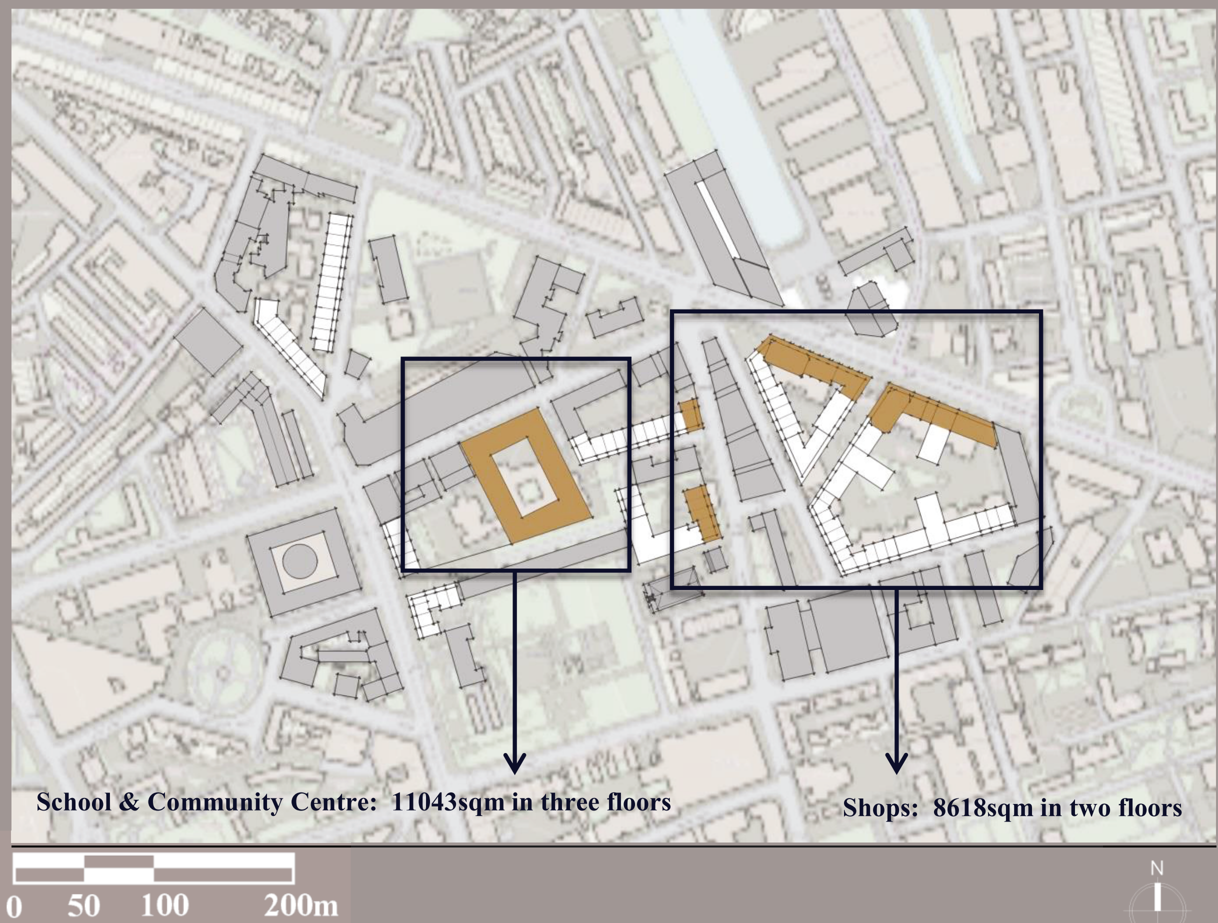
One of the main findings of this inquiry by design research is that it shows in the density range of 400dph that there is a threshold of losing some of the more acceptable urban form patterns such as plot based mid-rise buildings. This also appeared in the generic model, as few central blocks were used solely for non-residential space and therefore many of the residential blocks were designed in high rise block base form. From this process of design and analysis, it would be said that a density range of 400dph can be appropriate in locations where non-residential space and services already exist to a large degree. Otherwise, the new development will inevitably contain more of the urban types 3 and 4 with large buildings and high rise characteristics. Using such urban form types consequently brings conflict in relation to overshadowing and a lack of flexibility for future changes and alteration in the shape of the neighbourhood.

The other issue related to the 400dph scheme is that an increase in the size of the plots in City Road may reduce the visual diversity, although it has been attempted to keep the size of plots small. However, it can be recommended that, even in large shops and other activities, a small proportion of the facades facing the streets should be allocated for individual services (figure 10.14). In this way, the street is likely to have a more vibrant and diverse appearance.

Due to copyright reasons, the image has been removed in the online version of thesis.

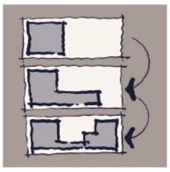
Due to copyright reasons, the image has been removed in the online version of thesis.

Figure 10.14: Debenhams store in Oxford City Centre: the store has a small entrance in facing the corner of the street in ground level; but, inside the urban block, the store has majority of the block in three levels.
In this way the street level is filled with variety of smaller shops and services.
Source: Left: Author. Right: http://www.alamy.com/stock-photo/debenhams-shop.html



Total residential floor space :	136254sqm
Total non-residential fool space :	19661sqm
Mixed Use Ratio :	14%

Figure 10.15:
Mixed use space in the 400dph design scheme (for more detail illustration of the character of non-residential ground levels see figure 10.12).



10.3.4 Adaptability

Based on the discussion in Chapter Three, one of the main indicators of the quality of adaptability is how much the urban form can change over a long period of time. The possibility of change is strongly related to grain size in the urban form. Through the 200dph scheme, it has been attempted to keep a small grain size as much as possible by using plot based urban form patterns (figure 10.16). In this way, individual buildings have a greater possibility of changing and adapting over time without much impact on the adjacent buildings. Therefore, the target for adaptability of urban form has been delivered to a high degree by the 200dph scheme.

In the 400dph scheme, the plot based urban form has to be compromised due to the larger grain and also non-residential uses in higher density locations of the site. A hybrid urban form, such as the one introduced in the generic modelling chapter, was used so that the majority of the urban form retains a plot based/ small grain character. Generally similar to the generic modelling, it appears that losing the plot based urban form type is inevitable in the 400dph density range; but the step by step process of the design and the increase in density has helped to reduce the number of urban blocks with a large grain and a low level of flexibility.

The other indicator related to adaptability is the potential of open spaces to accommodate various types of activities. It was seen that size and the level to which private open spaces are overlooked can influence the potential of using such spaces. All the back gardens in the scheme are overlooked by buildings of at least five floors. Using private gardens in such schemes leaves most of the residents with no personal open space. Therefore, it has been decided to use the urban form type 2 used in the generic modelling with the form of small plots and central communal gardens. These communal gardens have more flexibility for different types of activities such as playing, resting, meeting and social interaction. A greater number of residents can use these spaces compared with having a few private gardens for ground floor residents. Since such communal gardens can be provided in both the 200dph and 400dph schemes, it can be stated that open spaces with flexibility of use can be delivered in both ranges of density.

With regards to the issue of buildings, as discussed in previous chapters, the ideal depth of residential buildings is between 12 to 16 meters, in order to provide appropriate sizes for habitable rooms as well as proper ventilation and natural light. In the 200dph scheme the depth of the buildings remained at 12m for all new urban blocks. The increase of depth in the 400dph scheme was limited to 16m. In this way, the adaptability of habitable rooms within the residential buildings has been kept within the recommended measures in both ranges of density.

As a recommendation regarding the issue of adaptability, it is worth considering certain priorities in the process of design. Normally, morphological elements such as street patterns and the shape of blocks last for a longer period of time than elements such as plots and buildings. It is therefore important, while designing, to consider the fact that decisions about the size of blocks and street patterns are less adaptable to future changes than elements such as plots and buildings. While making trade-offs during the process of design, it is worth setting priorities for the ideal size and shape of street patterns instead of buildings. In other words, it is recommended to design the layout of the streets and blocks, and then deal with matters related to the size of plots and buildings. In this way, the longer lasting elements would not be sacrificed for elements which change more quickly over a period of time.

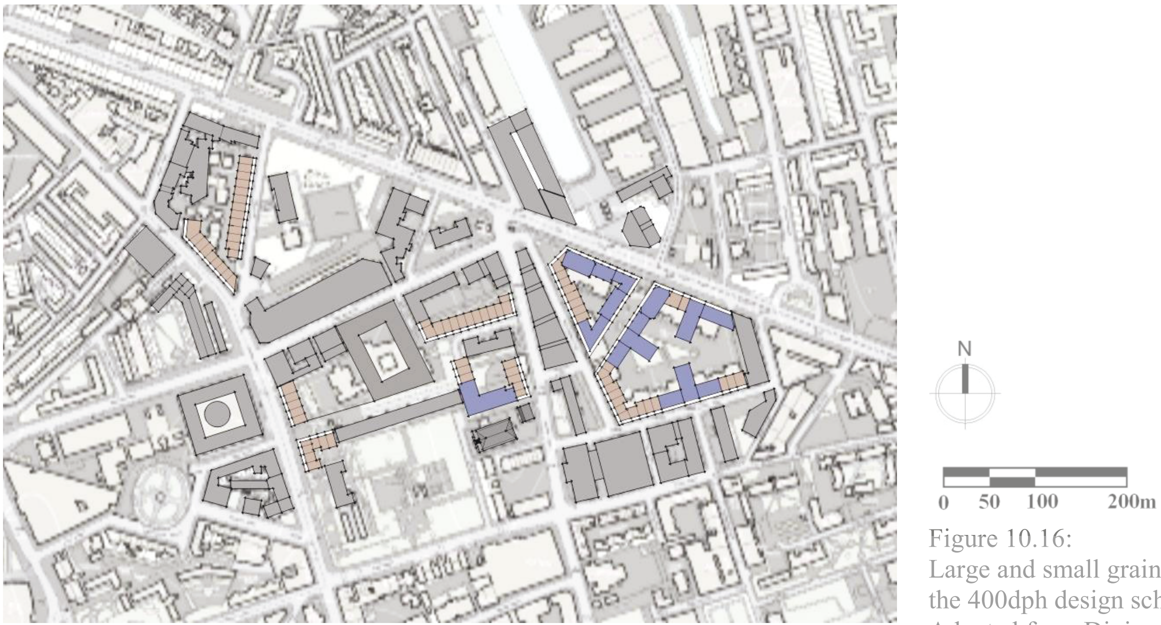
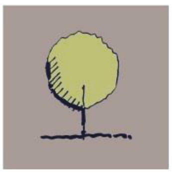


Figure 10.16:
Large and small grains in the 400dph design scheme
Adapted from Digimap



10.3.5 Biodiversity

The site area allocated for the new development in this study contains mostly parking and wasted open space and old, very low density buildings. Any new development will not reduce the amount of green space within the area. In fact, since any new development involves allocating green space for front or back gardens or between buildings, inevitably the amount of green space will increase. According to this, the 200dph scheme has brought new green spaces in the shape of tree-lined existing and new streets, front gardens and communal gardens (figure 10.17). It is also recommended that roofs are designed as green roofs to support the greenery and overall drainage system of the neighbourhood.

Overall, the schemes contribute to drainage of the area. This is because of the slight increase in the number of green spaces on the allocated sites. This is again because of the existing condition of the site which does not contain major green spaces to absorb rain water. The important objective for the drainage in high density schemes is to cover most of the rooftops and communal spaces with green and absorbent materials.

In the 400dph scheme, the same green spaces in the streets and communal gardens exist. However, an increase in the depth and height of the buildings has reduced the amount of green spaces in terms of communal gardens, and the amount of sunlight that such green spaces can receive. On the other hand, providing more variety in the height of the buildings and the size of the plots brings the opportunity to design roof gardens on large buildings (figure 10.17). Such roof gardens work as additional communal spaces. Therefore, despite some reduction in green space at ground level, the overall amount of green space has not significantly changed from the 200dph scheme.

The other significant issue in relation to biodiversity is that, despite the favourability of increasing public green space (according to the Q method study), no more green public space has been added to the neighbourhood. This is because most of the allocated sites for the new developments were so small and separated that turning them into green public space would not significantly change the amount of green space within this neighbourhood. Adding new buildings instead of green space has also significantly improved the urban form layout, making better enclosure for streets and improving the safety and surveillance of the area. As the final 400 dph scheme shows, if some of the allocated spaces were used purely for public green space, then the only way to reach the target density would be just to design high rise buildings when, as mentioned before, a totally high rise development was the least favourable Q card among participants.

It can be said that, despite neglecting the concept of increased public green space, both schemes have produced a better connection and experience of green space for residents. This experience has resulted from putting in new green spaces such as communal gardens and front gardens in places which are used daily by residents, and therefore the green spaces are more visible and more connected to the daily activities and travel of the users.

Figure 10.17: Different types of green space in the design schemes. Adapted from Digimap

10.3.6 Environmental Comfort

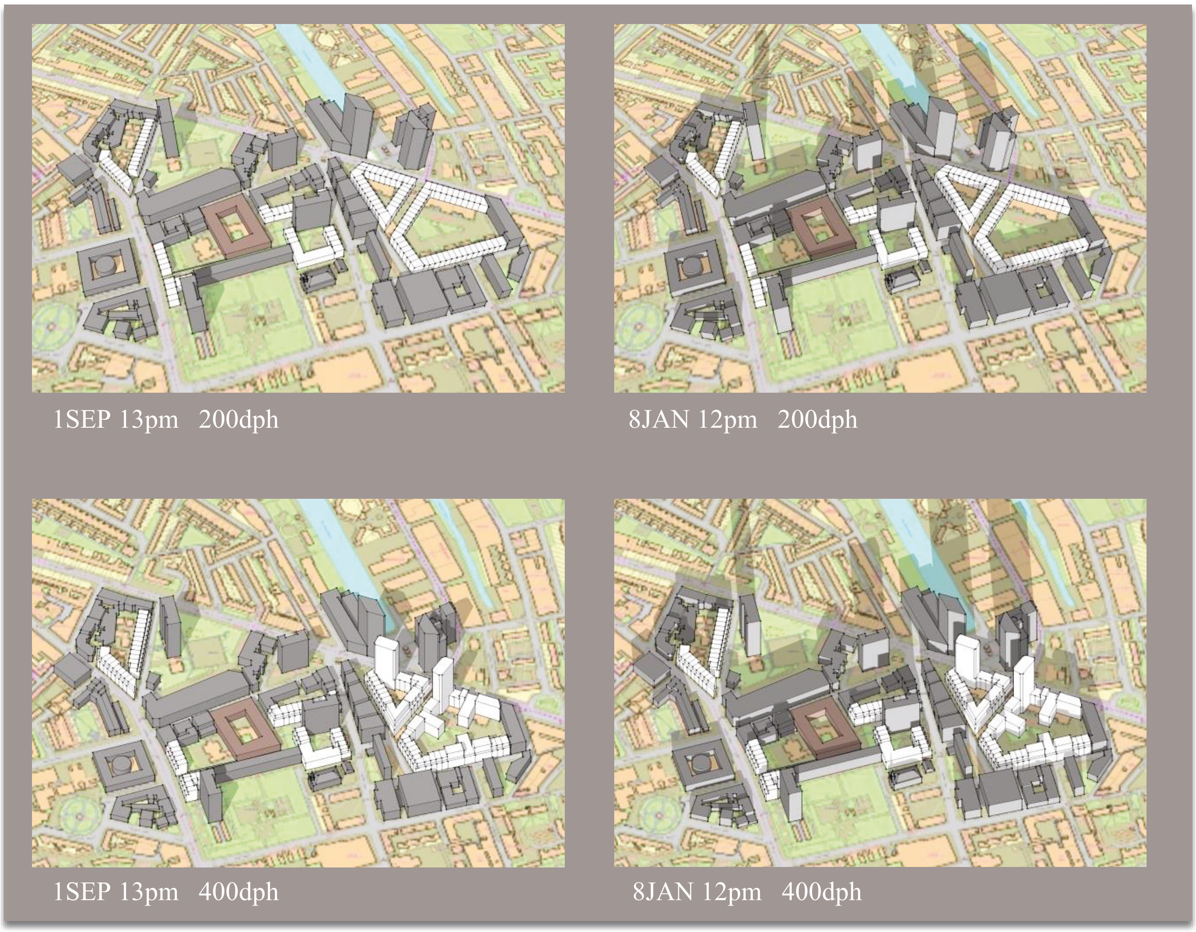
The main indicator of environmental comfort which is discussed in this study relates to sunlight and overshadowing. In the 200dph scheme, relatively all new buildings receive direct sunlight for a few hours a day. This is due to correctly sized urban blocks and the depth and height of buildings according to the standards identified in the generic modelling. However, increasing the density to the 400dph scheme, while still giving each dwelling at least a few hours of direct sunlight, provides significantly less sunlight than the 200dph scheme, particularly in the smaller urban blocks. Some of the surrounding buildings obviously receive less sunlight because they are overshadowed by new developments.

In addition, as illustrated in the shadow analysis diagram (figure 10.18), the overshadowing problem is on the threshold of becoming significant, meaning that many of the dwellings within the neighbourhood would not have any direct sunlight on a daily basis. The matter of receiving sunlight has been seriously considered during the design process, determining the height of the buildings and positioning the high rise towers. However, one of the advantages of this area is that, based on the local plan, most of the non-residential buildings are located in other parts of the neighbourhood and there is a good provision of existing services within the neighbourhood. This means that a significant increase in the floor space of non-residential buildings may result in taller buildings, and may obstruct sunlight for many of the dwellings.

In terms of recommendations related to environmental comfort, it can be said that serious consideration is necessary regarding the height of buildings. As appears in many examples of new developments in London, high rise buildings and urban blocks are mostly located next to an edge such as a river, canal or railway line. Hence, increasing the height of the buildings would not overshadow surrounding dwellings. High-rise blocks can be designed in such locations with less of an overshadowing problem.

It can be recommended to reduce the height of the buildings and/or place greater priority on first increasing the depth of the buildings. Other possible recommendations would be to vary the height of the buildings and check the overshadowing conditions of the design scheme.

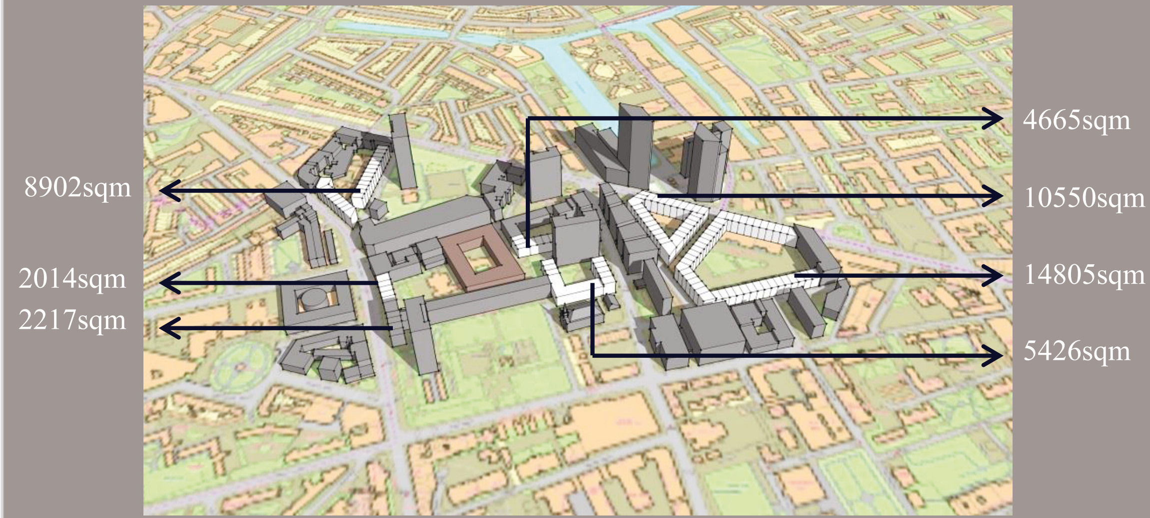
Figure 10.18: Shadow analysis of two schemes. In 200dph scheme most of the new dwellings receive at least few hours of direct sunlight during low sun angel days of winter.
In 400dph scheme, during winter, some of the ground floor buildings and communal gardens cannot receive any sunlight.



10.3.7 Energy efficiency

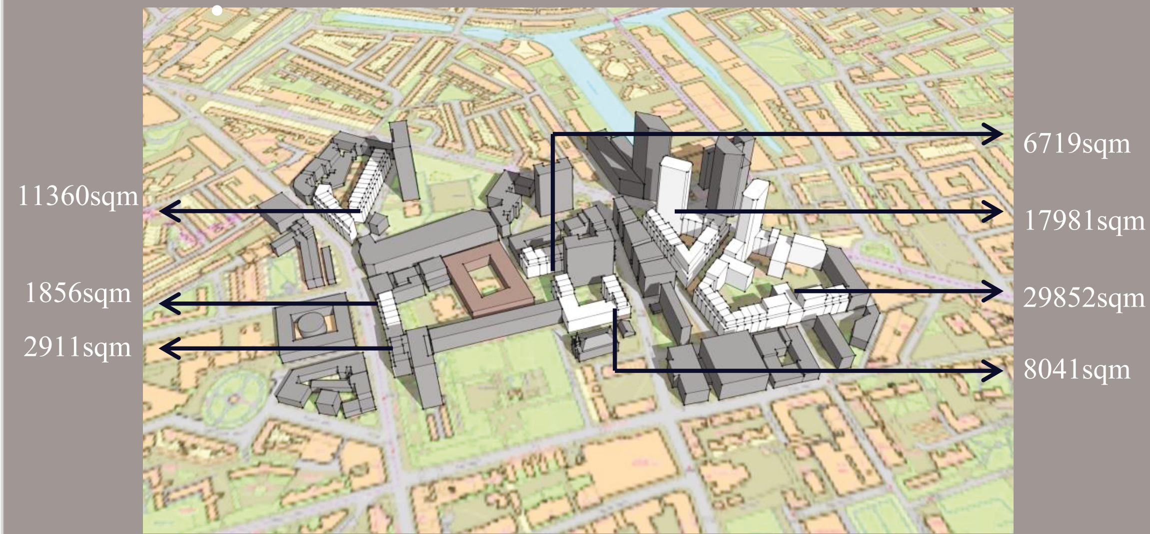
As discussed in the theoretical part of the thesis, the energy efficiency concerns of this research are related to the issue of reducing energy loss from exposed surface of buildings. Increasing the density from 200dph to 400dph has reduced the ratio of the volume of the building to exposed surfaces and therefore reduces energy loss (figure 10.19). However, the use of tower blocks in the 400dph scheme has increased the amount of exposed surface. It can be argued that the major change in the quality of energy efficiency in high density developments is related more to the choice of typology than to the exact number of dwellings added to the neighbourhood. The major changes in the amount of exposed surfaces happen when the typologies of buildings change from detached and semi-detached forms to multi storey flats. However, a slight change of form with regards to the depth and height of apartment buildings does not significantly change their energy efficiency. In medium to high rise urban forms, the energy efficiency is more likely to be related to architectural dimensions such as choice of materials and also to the quality of construction.

Such highly dense developments bring more opportunities for the use of central heating which reduces the energy consumption and cost. However, as discussed, there are concerns among residents about their ability to control the duration and amount of energy use in individual dwellings. While an increase in density can provide combined use of services such as central heating, it is helpful to give the residents the ability to control their use of these services.



200dph scheme exposed surfaces

- Total Exposed surface: 48572
- Number of dwellings: 860
- Average exposed surface of each dwelling: **56** sqm per dwelling



400dph scheme exposed surfaces

- Total Exposed surface: 78720
- Number of dwellings: 1720
- Average exposed surface of each dwelling: **45** sqm per dwelling

Figure 10.19: Comparing exposed surface of the buildings in two schemes

10.3.8 Legibility

An increase in density to 200dph results in a more legible layout for the neighbourhood. As explained in the permeability section, new perimeter blocks are designed in the 200dph scheme. These blocks provide a clear definition of public and private open spaces within the area. Improving the connectivity of the streets and making more regular shaped blocks have made more visible choices for traffic flow and way finding.

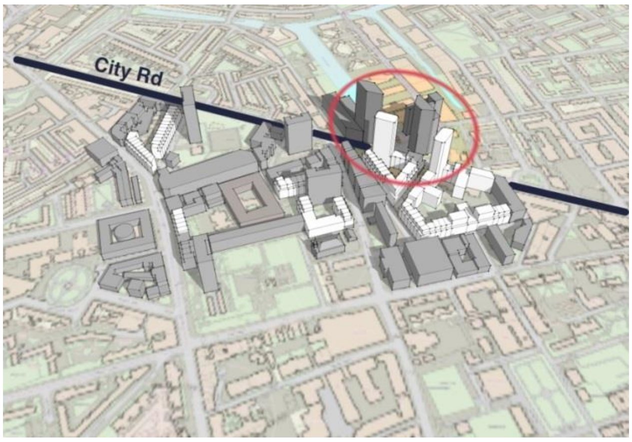


Figure 10.20: Developing a new Node and Landmark next to the Canal

In the 400dph scheme, additional residential towers in City Road work as landmarks for the neighbourhood. These new towers help commuters to find directions more easily and also represent a new centre near the canal. While non-residential use areas are located right next to the canal, the new landmark towers represent a new core of activities and services within the neighbourhood. In terms of recommendations, it can be said that, if it is necessary to build high rise towers in order to reach the target density, it is better to choose a location close to the main street, transport hub, shopping centres or new key facilities. In this way, it is easier for residents to find such key services within the neighbourhood.

10.3.9 Character

It was explained in Chapter Eight that Finsbury has a mixed character (see: CH8: 8.8.6). This is because of the historical changes in the development and demography of the area. Therefore, there is more potential to introduce new types of form and character in this area compared to historical parts of London which have a more cohesive character. Despite this mixed character, the design process has tried to retain key elements of the existing common character which exists in some parts of the neighbourhood and is also common in most other parts of London.

In the 200 dph scheme, the overall attempt was to protect the plot-based and small grain typology of the buildings. This is the common typology which can be found in many other neighbourhoods of London and also within this neighbourhood, such as in the older buildings along City Road. One of the significant characteristics of Britain's urban morphology is the use of such small size plots with multi storey buildings. This is a unique character which even takes place in high density areas in London. On the other hand, as was shown in the chapter on urban form, many of the other high density cities in Europe, such as Paris and Barcelona have larger plots in high density areas. Therefore, the small plot typology for the 200dph scheme is saved and also density is increased in a step by step manner with the priority of saving the plot based character for as long as possible.

In the 400dph scheme, in most parts of the area the plot based character has been preserved. In the process of step by step increasing the density (discussed in this section 10.2) the change from plot based to block based character has been used as a last resort solution. The use of setbacks and two individual towers were in response to the idea of saving the plot based, mid-rise character of the streets. This design process shows that, to a large extent, it is still possible to retain the existing character of neighbourhoods in London even in 400dph schemes. The most important recommendation for designers in this matter is to understand the common characteristics of the neighbourhood and the city in terms of repeated morphological patterns. Then, by having a step by step process of design and densification many of the existing morphological patterns can be preserved even in high density redevelopments.

10.3.10 Safety

As explained in the site analysis chapter, the existing condition of the site has some safety problems. This is because of the several wide open spaces which are vacant or allocated for parking spaces adjacent to the streets. In such cases, there is not enough surveillance on streets (see: CH8: 8.8.7).

Increasing the density to 200dph has involved making new buildings adjacent to these streets and improving the extent to which public spaces are overlooked. While most of these new buildings shape perimeter blocks, there is a clear separation of public and private spaces which also improves safety.

An increase in density with better connectivity of the streets (see permeability) can make the flow of traffic better and make all public spaces more active. This scenario can help the surveillance and feeling of safety within the neighbourhood.

In the 400dph scheme, another aspect of safety becomes more important. For this scheme, more high rise and block based urban form patterns are introduced. One of the dangers of such typologies is the increase in the number of residents using the same building and entrance. This condition makes the communal areas within the buildings more like quasi-public spaces because of the number of residents and increases the possibility of crime. Lawson (2012) demonstrates that one of the main problems with tower blocks and higher rates of crime in these building forms is that such communal areas work as public spaces but without convenient surveillance of the public streets. The Q method analysis showed that users are significantly in favour of smaller buildings with entrances for fewer residents. Given this situation, the feeling of safety in the 400 dph scheme is slightly reduced in the large buildings and tower blocks.

Based on this, it is important to provide more surveillance within the larger buildings and more security at the entrance to the buildings. It can be recommended to have separate entrances for different parts of the building even if the whole building exists on one large plot.

Another recommendation is to make more entrances from the communal garden inside of the block instead of the street. In this way, there would be more surveillance of people entering the buildings and also there would be more opportunity for meetings and social interaction within the communal open space which is likely to improve the overall safety of the neighbourhood.

A further recommendation is to have greater surveillance of all communal open spaces. This is also important on roof gardens which, in high density areas, are more likely to be used by a larger number of people. Changes in heights of buildings can help to place windows overlooking the roof gardens and improve their safety (see figure 10.11).

In general, many of such safety challenges can be solved if the plot based patterns of urban form were used and the number of residents in individual buildings was reduced. Therefore, increasing the density from 200dph to 400dph would create particular conflicts and this is because it becomes necessary to change the form to large size plots or totally block based urban forms.

10.3.11 Privacy

One indicator for privacy is the distance between buildings. In the 200 dph scheme, the size of the blocks and depth of buildings were designed in such a way that the back to back distance between the houses is more than 22 meters which is recommended by Bentley et al (1985) and By Design (2000). In the 400 dph scheme, the size of the blocks provides the opportunity to increase the depth of the buildings without losing the privacy distance. However, in some corners of non-regular shaped blocks, the back to back distance and hence privacy is compromised. This is one of the cases where losing the ideal size and shape of the blocks in the generic models changes in response to the local site limitations and, as a result, one of the design qualities has been slightly compromised.

The other privacy matter relates to the location of private open spaces. As discussed in the theoretical part of the research, private gardens are less common in high density areas due to problem of overlooking from high-rise adjacent buildings. Here again in both the 200dph and 400dph schemes, back gardens being overlooked is a common drawback. Therefore, residential block typologies 2 and 3 with communal gardens are predominantly used in the scheme. This position is also validated by the Q methodology because the design of communal gardens was one of the highest scored Q statements. In other words, lack of privacy in open spaces results in residents preferring more semi-public open spaces within the area. This decision would be beneficial for most of the residents and brings more equality to use of open spaces.

As has been demonstrated in previous chapters, privacy is important for local users and particularly older residents. The design process here shows that the design of the layout, size and shape of urban blocks is a very important consideration in order to achieve the design quality of privacy in higher density areas. Although the site may have some limitations, it is important to keep regular shaped blocks with 90 degree corners. The layout of the blocks should also be designed considering back to back distances of the buildings for further expansion and increases in the depth of buildings.

10.4 Alternative design schemes

In the previous part of this chapter, two design schemes were developed for a 200 dph and 400 dph target density range. As analysis of the schemes shows, both in the generic modelling and at the real site, the 200 dph scheme can deliver most of the qualities which are of the focus of this study. Most of the challenges and compromises in design qualities take place in the 400 dph density range because of the radical change in urban form, the height of the buildings and typologies which are used for this design scheme.

In this section, different design alternatives are investigated to see if they deliver these different design qualities more successfully. The sole focus of the design in this section is the 400 dph target density. In this section, three design alternatives are proposed. The difference between the design alternatives is the changing emphasis on different urban qualities. In each of the alternative schemes, a specific quality becomes the main focus and improving this specific quality results in a significant compromise in the other design qualities of the scheme.

Such a process of developing different alternatives can help the designer understand whether the best possible option is proposed for a particular site. Having different alternative design schemes may be a useful tool when negotiating with local residents. These schemes show the consequences of making different types of design decisions and how emphasizing specific qualities, which are also of concern to local residents, changes the form and quality of the neighbourhood.

10.4.1 Proposing different alternatives

The results of the Q methodology analysis were used to propose three design alternatives. The Q method analysis shows the main preferences of the local users. Therefore, the results of this analysis can help to develop different alternatives based on the key local concerns.

The result of the Q method analysis shows that the card which was viewed most favourably by local users is card 6 which is about having more green space within the neighbourhood (see Figure 9.5 in Chapter 9). Conversely, card 24 which is about the neighbourhood being provided with a high rise character was the most unfavourable card (Figure 9.6 in Chapter 9). As these two cards represent the most important concerns for the local community, the main focus of the design alternatives centred on these two cards.

Throughout the design process, it was seen that there is a conflict between these two key cards which is actually one of the key conflicts in high-rise development schemes. Figure 10.21 shows this conflict in a general way. There are two major approaches to the process of design and densification. One way is to reduce the footprint of the buildings and include more green space. The consequence of this is that the design scheme will inevitably have more of a high rise character. The second approach is to increase the footprint of the buildings and reduce their height. However, in this case, the amount of green space at ground level will be reduced. Therefore, as the figure shows, these two key concerns of local users cannot be delivered together and emphasizing one results in compromising the other.

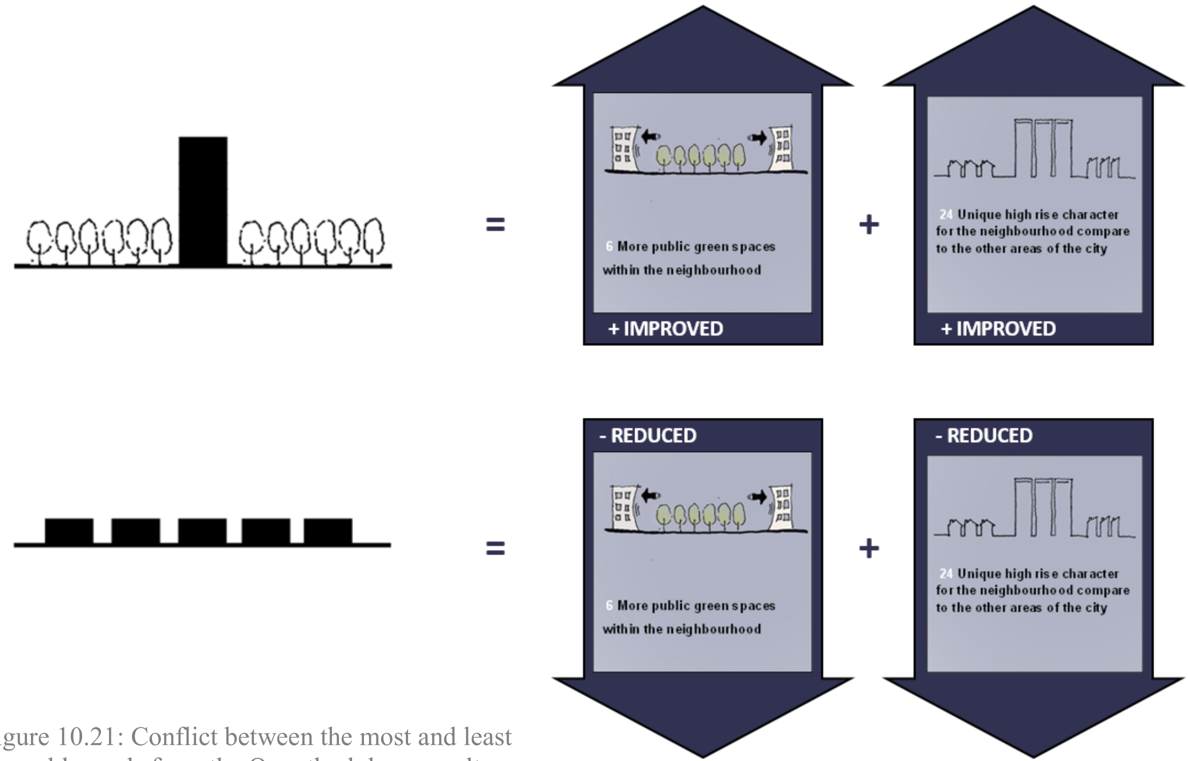
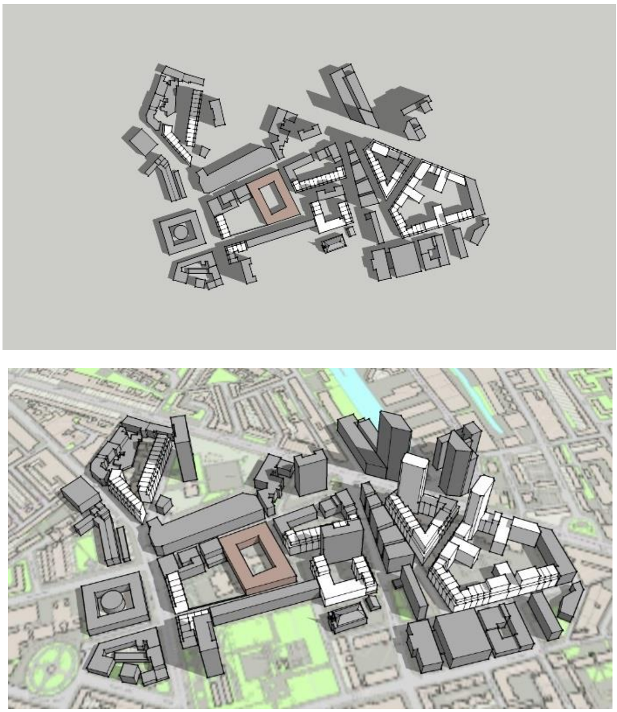


Figure 10.21: Conflict between the most and least favorable cards from the Q methodology results. Achieving one of the key preferences (card 6: more green space) results in a failure to achieve the other main preference (Card 24: no high-rise character) of the local users. Source: Author

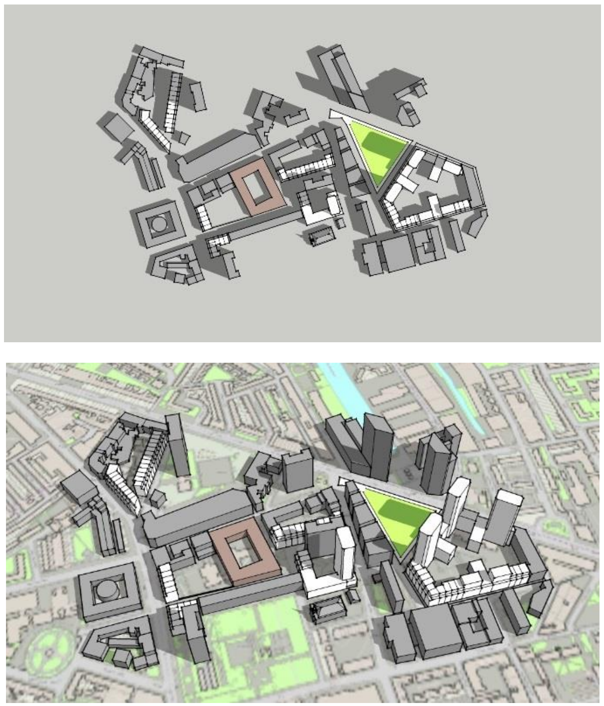
Based on this, the design alternatives for this study have been developed with these two opposing concerns in mind. Figure 10.22 shows the relationship of the three design alternatives with the two general design approaches explained above. Three different design options are proposed based on the degree to which they emphasise increasing the amount of green space or, alternatively, keeping a mid- rise urban form and preventing the neighbourhood becoming high rise.

Figure 10.22: Three Design Options

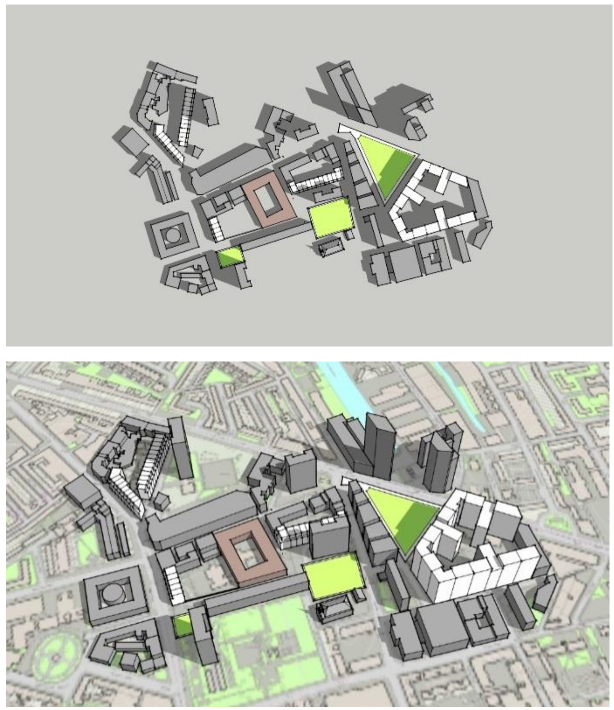
Option 1



Option 2



Option 3



On the left hand side, in option 1, the design approach is more focused on increasing the footprint of the buildings and keeping the height of the buildings between five to seven floors. This is the same scheme which was developed in the previous section and used to make comparisons between the 200dph and 400dph schemes. In order to reach such a high density target, it is inevitable that two high rise towers have to be added to the scheme. No public green space is allocated in this scheme. For comparison of the schemes, a more detailed figure and data about the amount of space and density of each urban block is presented in figure 10.23.

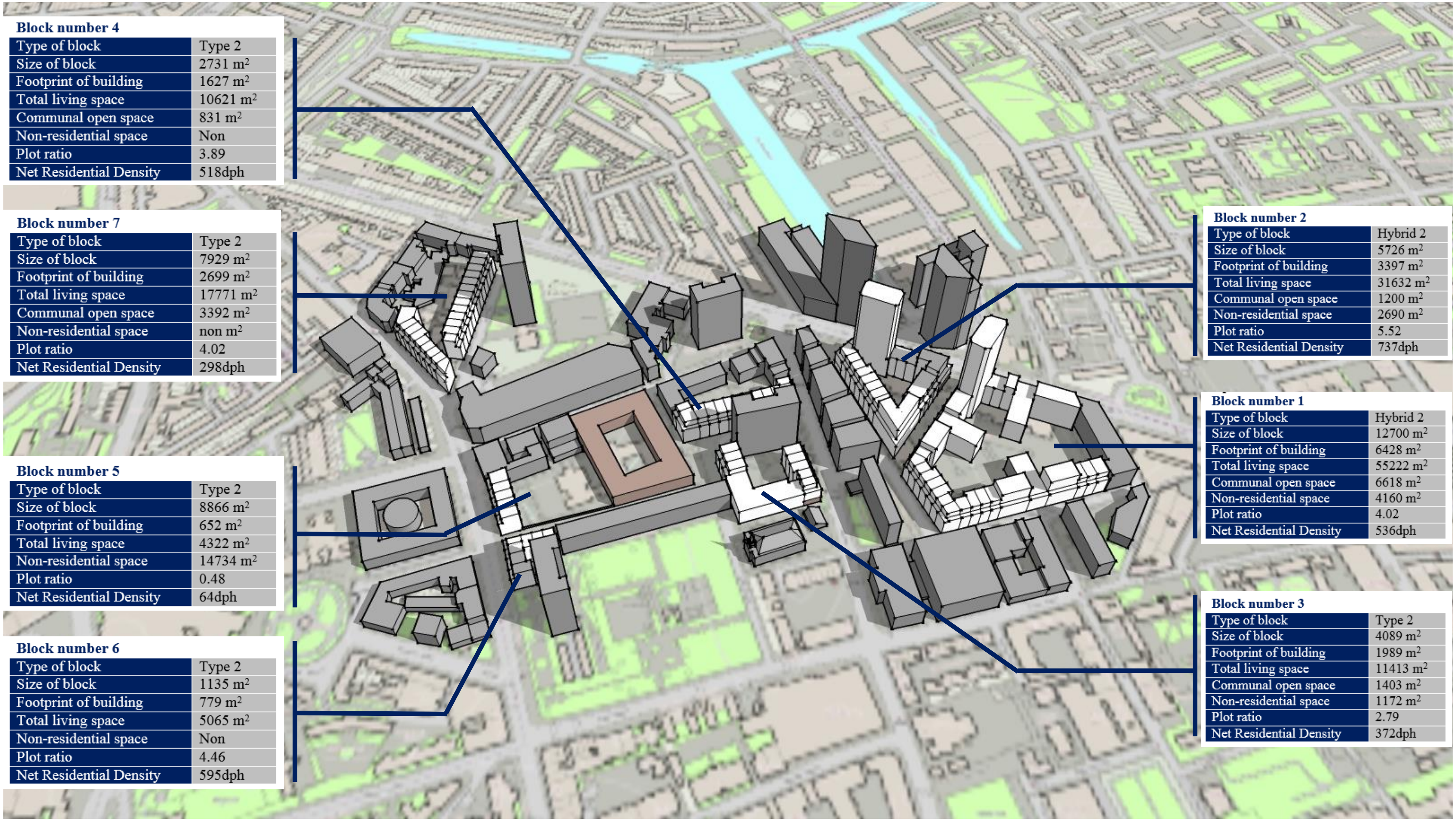
In option 2, one of the blocks has been replaced by a public green space. This is the scheme which shows a middle option between the two extremes in options 1 and 3. Here, the local demand for new green spaces is delivered but in a minimum way. As figure 10.24 shows, in this scheme, 5726 square metres of green space has been added to the neighbourhood. This green space has been allocated near City Road and next to the canal so that a new large public space can be developed for the area. However, this allocation of green space has resulted in the need for four high rise towers to be included in the scheme which are designed to sit next to the main streets of the neighbourhood to provide the residents with better accessibility to public transport and this keeps the high rise character just to the busy streets.

In option 3, the amount of green space is significantly increased. Three urban blocks have been replaced with green open spaces in this scheme. The green spaces are allocated in such a way so as to be close to each other and, with the park on the south side of the site, a network of green spaces has been developed for the neighbourhood (figure 10.25). Replacing the residential blocks with green space means that, in this scheme, a large number of dwellings have been added to urban block number one next to City Road in order to reach the target density of 400dph. In this scheme, 10950 square metres of green open space is allocated to the scheme which is double the area of green space in design option 2. On the other hand, 50826 square metres of living space has been added to urban block one. This change has resulted in a very high rise type of urban form for this urban block and the urban form type for this block has changed to urban block type three which was explored in Chapters Four and Six of the thesis.

As the schemes show, in option 1, with the larger footprint of the buildings, the overall urban form has a mid-rise and small grain character despite having no green space. However, as the footprint of the buildings reduces and the green space increases, through options 2 and 3, the urban form changes to high rise and large grain. The three alternatives here clearly show that, as we increase the amount of green space, due to local residents' preferences, the urban form inevitably moves toward a high-rise large grain character which is the most unfavourable form based on local responses.

Proposing such design alternatives can be helpful in negotiations with local residents and authorities. This is an easy way to show the consequences of stressing particular design aspects and disregarding others. In this way, even non-professionals can understand the conflicts of high density design and there is more possibility of reaching an agreement on the most acceptable option for all the different stakeholders in the neighbourhood.

Figure 10.23: detail information of Design



Block number 4

Type of block	Type 2
Size of block	2731 m^2
Footprint of building	1627 m^2
Total living space	10621 m^2
Communal open space	831 m^2
Non-residential space	Non
Plot ratio	3.89
Net Residential Density	518dph

Block number 7

Type of block	Type 2
Size of block	7929 m^2
Footprint of building	2699 m^2
Total living space	17771 m^2
Communal open space	3392 m^2
Non-residential space	non m^2
Plot ratio	4.02
Net Residential Density	298dph

Block number 5

Type of block	Type 2
Size of block	8866 m^2
Footprint of building	652 m^2
Total living space	4322 m^2
Non-residential space	14734 m^2
Plot ratio	0.48
Net Residential Density	64dph

Block number 6

Type of block	Type 2
Size of block	1135 m^2
Footprint of building	779 m^2
Total living space	5065 m^2
Non-residential space	Non
Plot ratio	4.46
Net Residential Density	595dph

Block number 2

Type of block	Hybrid 2
Size of block	5726 m^2
Footprint of building	3397 m^2
Total living space	31632 m^2
Communal open space	1200 m^2
Non-residential space	2690 m^2
Plot ratio	5.52
Net Residential Density	737dph

Block number 1

Type of block	Hybrid 2
Size of block	12700 m^2
Footprint of building	6428 m^2
Total living space	55222 m^2
Communal open space	6618 m^2
Non-residential space	4160 m^2
Plot ratio	4.02
Net Residential Density	536dph

Block number 3

Type of block	Type 2
Size of block	4089 m^2
Footprint of building	1989 m^2
Total living space	11413 m^2
Communal open space	1403 m^2
Non-residential space	1172 m^2
Plot ratio	2.79
Net Residential Density	372dph

Figure 10/24: detail information of Design

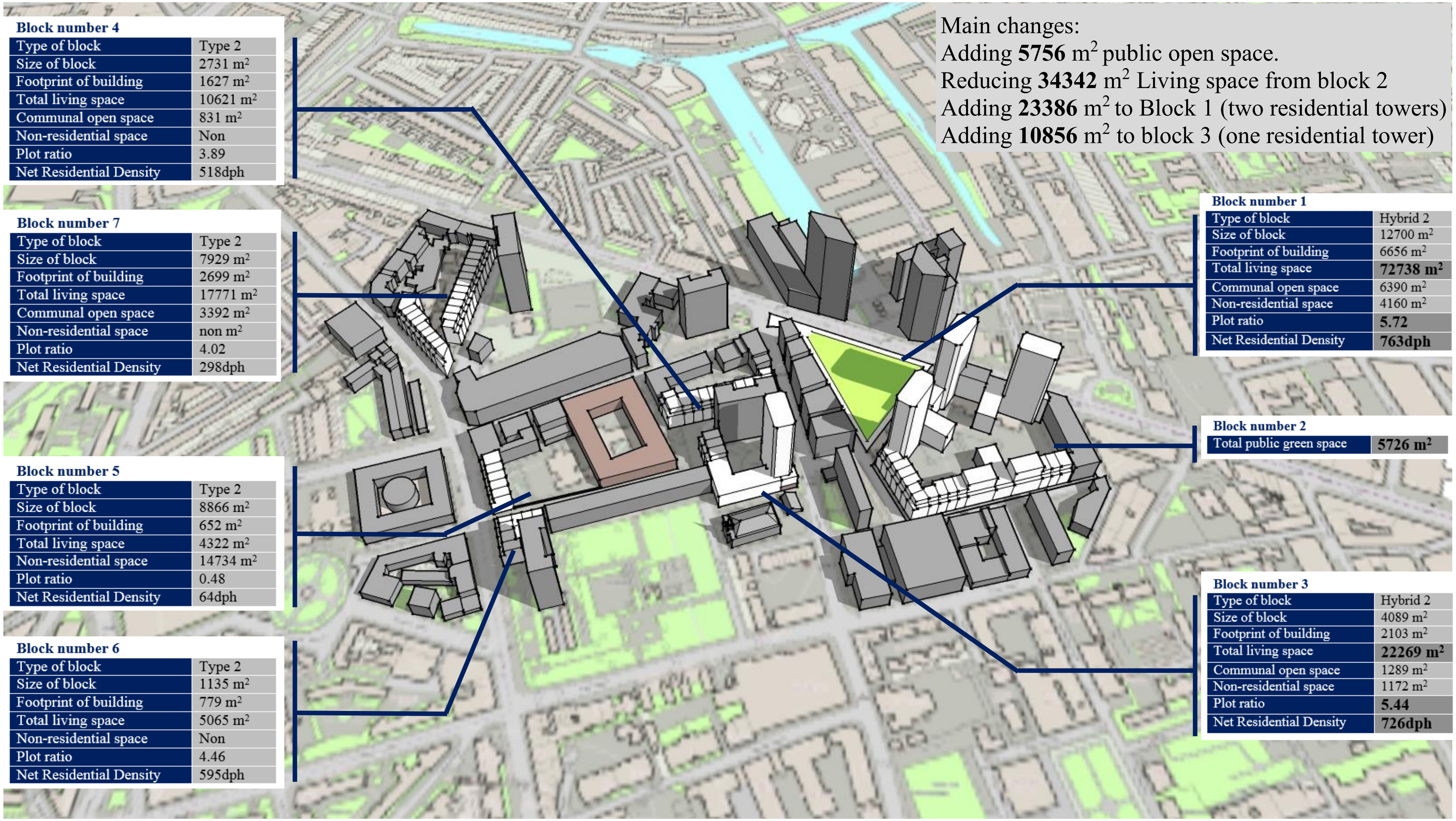
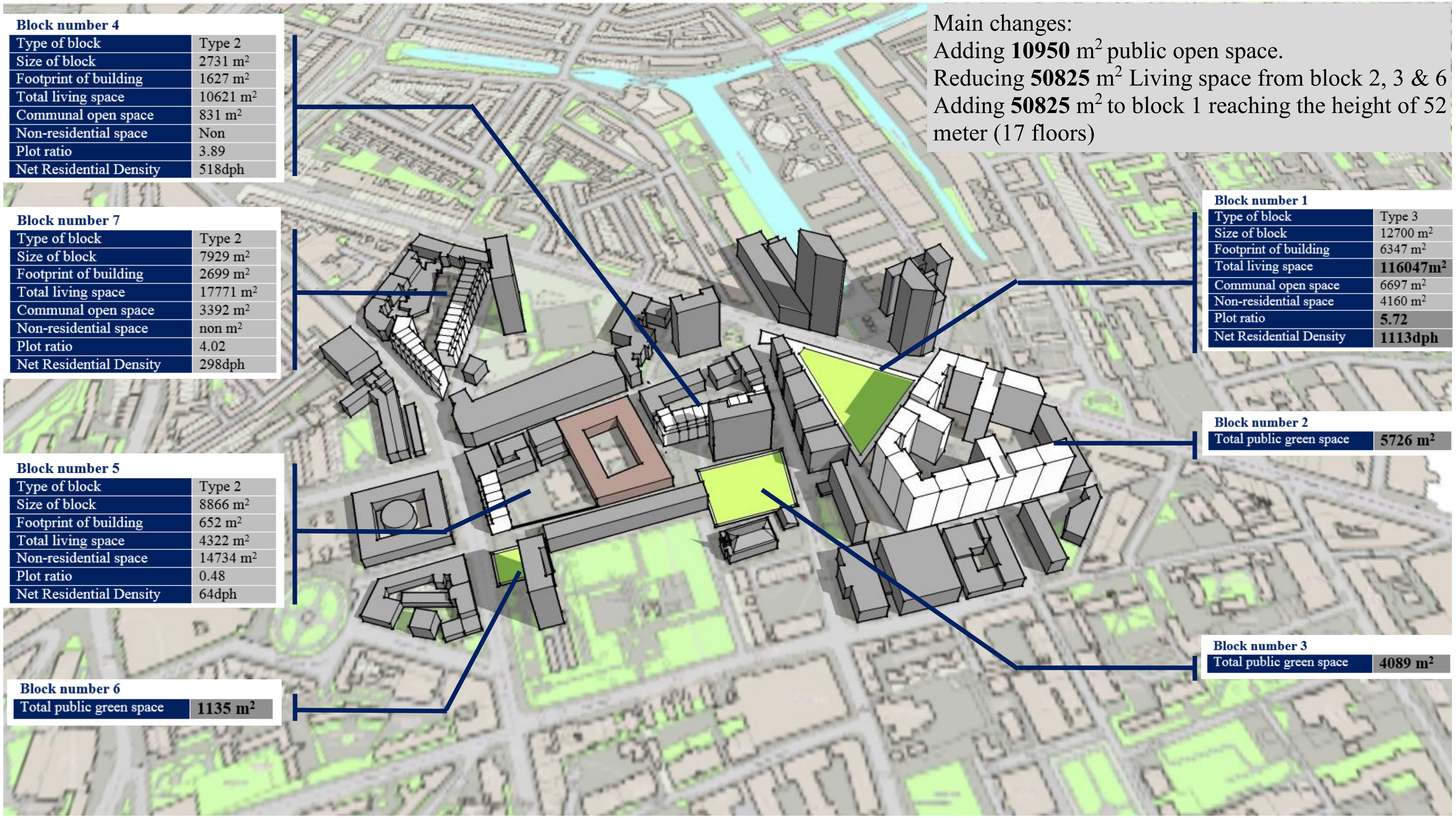


Figure 10.25: detail information of Design



10.4.2 Analysis of the design alternatives

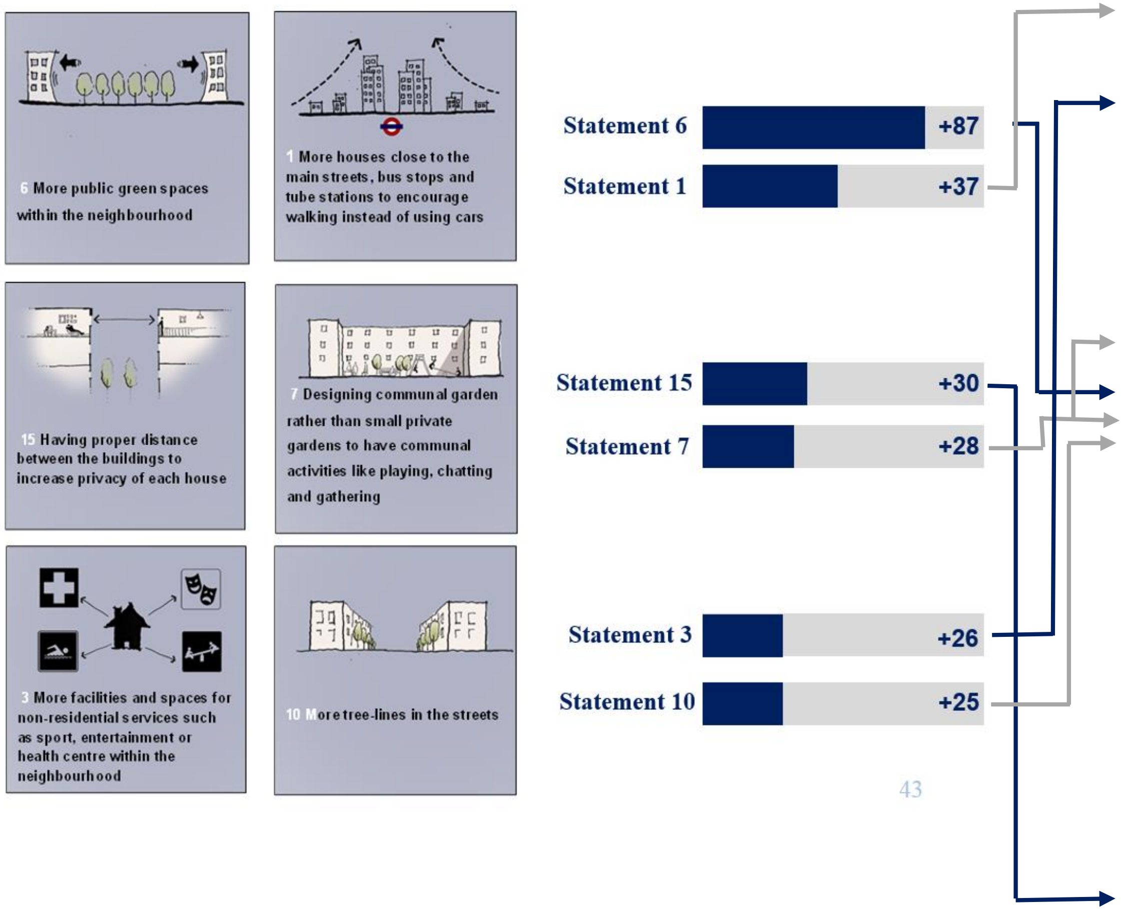
At this stage, in order to determine the advantages and disadvantages of each design option, each scheme is analysed. The process of analysis is similar to the previous analysis of the design schemes in this study, but with some adaptations according to the local context. In the previous parts of the thesis (in this chapter and Chapter Seven), the analysis was carried out using the main analytical table of the research developed in Chapter Five. Here, this analytical table has been adapted in such a way as to match to the main preferences of the local users.

Since the Q methodology provides a clear understanding of the priorities of local users, the results of the Q method analysis can be used to highlight specific qualities and indicators according to local demands and concerns. In other words, the qualities and indicators in the analytical framework can be sorted and ranked according to local responses. In this way, the analysis of the three design alternatives can be more locally oriented and the results are more helpful in choosing the appropriate design scheme for this particular neighbourhood.

Figures 10.26 and 10.27 show the way in which the main analytical framework of the research has been adapted according to local responses. In figure 10.26, the most favourable cards based on local responses are presented. This part of the figure is extracted from figure 9.5 from Chapter Nine showing a key result of the Q methodology analysis. On the right hand side of the figure, each of the cards relates to specific indicators in the main analytical framework. The most important indicators according to local concerns are highlighted in this table. In 10.27, the same process is carried out using the most unfavourable cards. These are also the important cards for local users.

Finally, in Table 10.3, all of the highlighted indicators have been sorted according to the priorities of local users. This is a new analytical table which has been specially adapted for this neighbourhood, according to local priorities with regards to design qualities. The main difference between this table and the main analytical table of the thesis is that the indicators are ranked and there is a focus on the design qualities which are most important for this particular locality.

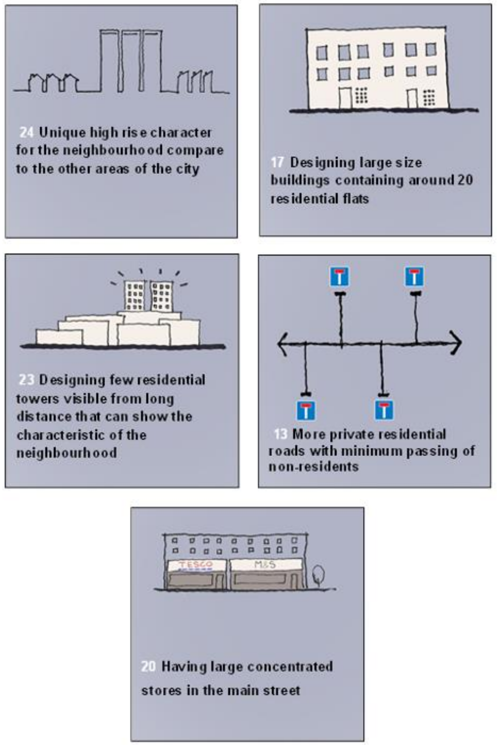
Figure 10.26: Using key result of Q methodology to prioritise indicators of analytical framework based on locality preferences. Relationship of Most favourable cards (see CH9 figure 9.5) with indicators of analytical table

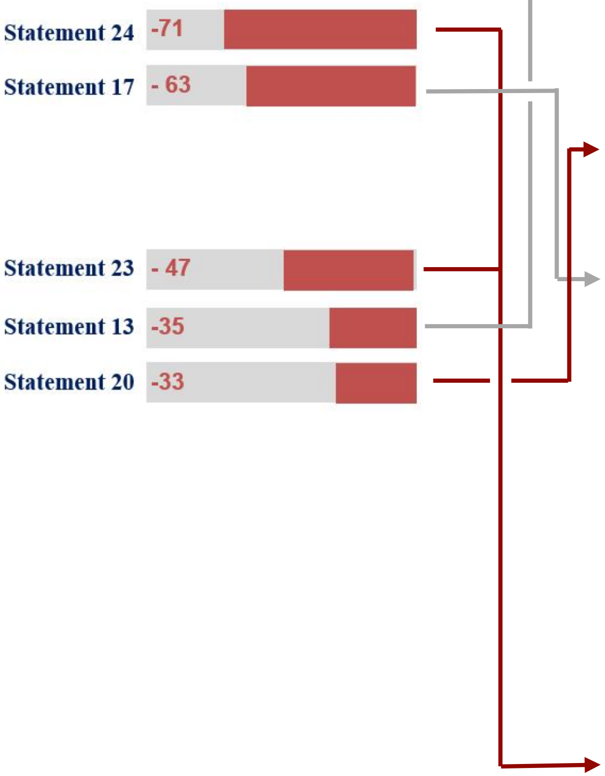


Analytical table

Urban Design Qualities	Indicator	Criteria: Low	Criteria: medium	Criteria: High
permeability	Average length of block			
	Existence of cul-de-sacs and dead ends			
Accessibility	**Density gradient designed according to main transport and business nodes**			
	Walkable distance to services			
Diversity	**Allocation of non-residential uses**			
	Proximity to main non-residential uses: Primary school			
	Proximity to main non-residential uses: secondary school			
	Proximity to main non-residential uses: medical Centre			
	Proximity to non-residential uses: main shopping area			
	Active edges produced and distribution of non-residential uses			
	Diversity in dwelling size			
Visual variety	Opportunity for personalization at the ground floor of buildings			
	Opportunity for vertical division of façade to improve diversity in visual experience			
Adaptability	Potentials for change of use in dwellings: access from building to public space			
	Potentials for gradual change of urban form			
	Opportunity for communal activities in open spaces in center of the blocks			
	Possibility for extension in buildings			
Biodiversity	**Total Public green space per person**			
	Total Communal green space per person			
	Connectivity of green spaces			
	Accessibility to green space (within walking distance of dwellings			
	Possibility for Variety of activities and character in green space			
	Opportunity for use of greenery on exposed surface of buildings			
	Opportunity for local food production (allotments)			
Environmental comfort	Receiving sunlight for all dwellings during the day			
	Receiving sunlight for all green open spaces during the day			
Resource efficiency	Average exposed surface of dwellings (for loss of energy)			
Legibility	legibility of public space network			
	Legibility through use of landmark buildings			
	Change of character of buildings and open spaces from center to edge of neighborhood			
	Varity of public spaces character within neighbourhood in terms of form, use and activities			
Character & Distinctiveness	Similarity of form and grain size in the urban layout to surrounding built environment			
	Respecting the existing height of buildings within the area			
	Distinctive characteristic of neighborhood from surrounding areas			
Safety	Overall length of Active edges at ground level of streets			
	Clarity of public, communal and private space			
Privacy	**Keeping appropriate back to back distance of dwellings**			
	View from street to the house in ground floor			
	View on private gardens from other dwellings			

Figure 10.27: Using key result of Q methodology to prioritise indicators of analytical framework based on locality preferences. Relationship of Most favourable cards (see CH9 figure 96) with indicators of analytical table





Analytical table

Urban Design Qualities	Indicator	Low	medium	High
permeability	Average length of block			
	Existence of cul-de-sacs and dead ends			
Accessibility	Density gradient designed according to main transport and business nodes			
	Walkable distance to services			
Diversity	Allocation of non-residential uses			
	Proximity to main non-residential uses: Primary school			
	Proximity to main non-residential uses: secondary school			
	Proximity to main non-residential uses: medical Centre			
	Proximity to non-residential uses: main shopping area			
	Active edges produced and distribution of non-residential uses			
	Diversity in dwelling size			
Visual variety	Opportunity for personalization at the ground floor of buildings			
	Opportunity for vertical division of façade to improve diversity in visual experience			
Adaptability	Potentials for change of use in dwellings: access from building to public space			
	Potentials for gradual change of urban form			
	Opportunity for communal activities in open spaces in center of the blocks			
	Possibility for extension in buildings			
Biodiversity	Total Public green space per person			
	Total Communal green space per person			
	Connectivity of green spaces			
	Accessibility to green space (within walking distance of dwellings			
	Possibility for Variety of activities and character in green space			
	Opportunity for use of greenery on exposed surface of buildings			
	Opportunity for local food production (allotments)			
Environmental comfort	Receiving sunlight for all dwellings during the day			
	Receiving sunlight for all green open spaces during the day			
Resource efficiency	Average exposed surface of dwellings (for loss of energy)			
Legibility	legibility of public space network			
	Legibility through use of landmark buildings			
	Change of character of buildings and open spaces from center to edge of neighborhood			
	Varity of public spaces character within neighbourhood in terms of form, use and activities			
Character & Distinctiveness	Similarity of form and grain size in the urban layout to surrounding built environment			
	Respecting the existing height of buildings within the area			
	Distinctive characteristic of neighborhood from surrounding areas			
Safety	Overall length of Active edges at ground level of streets			
	Clarity of public, communal and private space			
Privacy	Keeping appropriate back to back distance of dwellings			
	View from street to the house in ground floor			
	View on private gardens from other dwellings			

Table 10.3: Analytical table based on priorities of local participants.
The analysis of design schemes based on this table is carried out in the next section.

Urban Design Qualities		Indicator	Criteria		
			Low	medium	High
1	Biodiversity	Total Public green space per person			
2	Character	Respecting the existing height of buildings within the area			
3	Adaptability	Potentials for gradual change of urban form			
4	Accessibility	Density gradient designed according to main transport and business nodes			
5	Permeability	Existence of cul-de-sacs and dead ends			
6	Diversity	Active edges produced and distribution of non-residential uses			
7	Privacy	Keeping appropriate back to back distance of dwellings			
8	Adaptability	Opportunity for communal activities in open spaces in centre of the blocks			
9	Biodiversity	Total Communal green space per person			
10	Diversity	Allocation of non-residential uses			
11		Proximity to main non-residential uses: Primary school			
12		Proximity to main non-residential uses: secondary school			
13		Proximity to main non-residential uses: medical Centre			
14		Proximity to non-residential uses: main shopping area			
15	Biodiversity	Connectivity of green spaces			

10.4.3 Key analysis results

The new locally adapted analytical table is used to evaluate the design alternatives. This analytical method is more accurate and helpful particularly in this research process compared to the previous part of the analysis in Section 10.3. While using the inquiry by design method helps to find an appropriate design and density for a neighbourhood, this adapted analysis can be used to show exactly which of the design schemes can better deliver the qualities which are of concern to local users.

Table 10.4 to 10.6 show the analytical table for each of the three design options. In particular, figure 10.28 shows all three analytical tables together to illustrate the main differences between the schemes in regards to the delivery of important design qualities. As we move from design option 1 to 3, the most significant change is the improvement in the delivery of the quality of biodiversity. This is almost certainly because the main focus of the design alternatives is to increase the amount of green space which is the highest ranked quality according to local responses.

However, looking to the other qualities in the table, some other indicators have been compromised, from options 1 to 3, particularly in the third option. These indicators are related to the three qualities of character, diversity and adaptability. As discussed in the previous analysis, compromises in these qualities occur mostly because of the change of the scheme into a high rise and large grain urban form. Therefore, although more green spaces have been added to the third scheme, some other very important qualities for local residents cannot properly be delivered in this design. Table 10.7 also shows the results of all three analytical tables in one final table. The table shows how changes in the design scheme from option 1 to 3 can improve and compromise certain design qualities.

Based on this analysis, as a final suggestion for this research, option 2 can be considered the best option in the 400dph density target range. This is because this scheme respects the main preference of local residents with regards to having more green space in the area. Increasing the green space does not change the scheme into one which is completely large grain. In particular, using a hybrid type of form in blocks 1 and 3 keeps the small grain typology at street level. Therefore, in this scheme, the quality of biodiversity is improved, but the overall qualities of diversity and adaptability for change, which are related to having a small grain character at street level, also remain to a good standard.

Despite this final suggestion, the important issue for this research is to demonstrate the differences between the design alternatives in a clear and understandable way. The process of developing design alternatives and analysing them according to local preferences is the main goal of the research. As a result, the inquiry by design process can be used as a tool for communicating with the local community and making the final decision. Therefore, choosing option 2 as the best design alternative is merely a suggestion based on the results of the study and as a secondary outcome of the research.

Figure 10.28: 3 Design Options and their localised analytical tables. See next pages for larger tables.

Option 1

Urban Design Qualities		Indicator	Criteria: Low	medium	High
1	Biodiversity	Allocation of Public green space			
2	Character	Respecting the existing height of buildings within the area			
3	Adaptability	Potentials for gradual change of urban form			
4	Accessibility	Density gradient designed according to main transport and business nodes			
5	Permeability	Existence of cul-de-sacs and dead ends			
6	Diversity	Active edges produced and distribution of non-residential uses			
7	Privacy	Keeping appropriate back to back distance of dwellings			
8	Adaptability	Opportunity for communal activities in open spaces in centre of the blocks			
9	Biodiversity	Allocation of Communal green space for all residents			
10		Allocation of non-residential uses			
11		Proximity to main non-residential uses: Primary school			
12	Diversity	Proximity to main non-residential uses: secondary school			
13		Proximity to main non-residential uses: medical Centre			
14		Proximity to non-residential uses: main shopping area			
15	Biodiversity	Connectivity of green spaces			

Option 2

Urban Design Qualities		Indicator	Criteria: Low	medium	High
1	Biodiversity	Allocation of Public green space			
2	Character	Respecting the existing height of buildings within the area			
3	Adaptability	Potentials for gradual change of urban form			
4	Accessibility	Density gradient designed according to main transport and business nodes			
5	Permeability	Existence of cul-de-sacs and dead ends			
6	Diversity	Active edges produced and distribution of non-residential uses			
7	Privacy	Keeping appropriate back to back distance of dwellings			
8	Adaptability	Opportunity for communal activities in open spaces in centre of the blocks			
9	Biodiversity	Allocation of Communal green space for all residents			
10		Allocation of non-residential uses			
11		Proximity to main non-residential uses: Primary school			
12	Diversity	Proximity to main non-residential uses: secondary school			
13		Proximity to main non-residential uses: medical Centre			
14		Proximity to non-residential uses: main shopping area			
15	Biodiversity	Connectivity of green spaces			

Option 3

Urban Design Qualities		Indicator	Criteria: Low	medium	High
1	Biodiversity	Allocation of Public green space			
2	Character	Respecting the existing height of buildings within the area			
3	Adaptability	Potentials for gradual change of urban form			
4	Accessibility	Density gradient designed according to main transport and business nodes			
5	Permeability	Existence of cul-de-sacs and dead ends			
6	Diversity	Active edges produced and distribution of non-residential uses			
7	Privacy	Keeping appropriate back to back distance of dwellings			
8	Adaptability	Opportunity for communal activities in open spaces in centre of the blocks			
9	Biodiversity	Allocation of Communal green space for all residents			
10		Allocation of non-residential uses			
11		Proximity to main non-residential uses: Primary school			
12	Diversity	Proximity to main non-residential uses: secondary school			
13		Proximity to main non-residential uses: medical Centre			
14		Proximity to non-residential uses: main shopping area			
15	Biodiversity	Connectivity of green spaces			

Table 10.4: Localised Analytical table for Option 1

Urban Design Qualities		Indicator	Criteria: Low	medium	High
1	Biodiversity	Allocation of Public green space			
2	Character	Respecting the existing height of buildings within the area			
3	Adaptability	Potentials for gradual change of urban form			
4	Accessibility	Density gradient designed according to main transport and business nodes			
5	Permeability	Existence of cul-de-sacs and dead ends			
6	Diversity	Active edges produced and distribution of non-residential uses			
7	Privacy	Keeping appropriate back to back distance of dwellings			
8	Adaptability	Opportunity for communal activities in open spaces in centre of the blocks			
9	Biodiversity	Allocation of Communal green space for all residents			
10		Allocation of non-residential uses			
11		Proximity to main non-residential uses: Primary school			
12	Diversity	Proximity to main non-residential uses: secondary school			
13		Proximity to main non-residential uses: medical Centre			
14		Proximity to non-residential uses: main shopping area			
15	Biodiversity	Connectivity of green spaces			

Table 10.5: Localised Analytical table for Option 2

Urban Design Qualities		Indicator	Criteria		
			Low	medium	High
1	Biodiversity	Allocation of Public green space			
2	Character	Respecting the existing height of buildings within the area			
3	Adaptability	Potentials for gradual change of urban form			
4	Accessibility	Density gradient designed according to main transport and business nodes			
5	Permeability	Existence of cul-de-sacs and dead ends			
6	Diversity	Active edges produced and distribution of non-residential uses			
7	Privacy	Keeping appropriate back to back distance of dwellings			
8	Adaptability	Opportunity for communal activities in open spaces in centre of the blocks			
9	Biodiversity	Allocation of Communal green space for all residents			
10	Diversity	Allocation of non-residential uses			
11		Proximity to main non-residential uses: Primary school			
12		Proximity to main non-residential uses: secondary school			
13		Proximity to main non-residential uses: medical Centre			
14		Proximity to non-residential uses: main shopping area			
15	Biodiversity	Connectivity of green spaces			

Table 10.6: Localised Analytical table for Option 3

	Urban Design Qualities	Indicator	Criteria: Low	Criteria: medium	Criteria: High
1	Biodiversity	Allocation of Public green space			
2	Character	Respecting the existing height of buildings within the area			
3	Adaptability	Potentials for gradual change of urban form			
4	Accessibility	Density gradient designed according to main transport and business nodes			
5	Permeability	Existence of cul-de-sacs and dead ends			
6	Diversity	Active edges produced and distribution of non-residential uses			
7	Privacy	Keeping appropriate back to back distance of dwellings			
8	Adaptability	Opportunity for communal activities in open spaces in centre of the blocks			
9	Biodiversity	Allocation of Communal green space for all residents			
10	Diversity	Allocation of non-residential uses			
11		Proximity to main non-residential uses: Primary school			
12		Proximity to main non-residential uses: secondary school			
13		Proximity to main non-residential uses: medical Centre			
14		Proximity to non-residential uses: main shopping area			
15	Biodiversity	Connectivity of green spaces			

Table 10.7: Main Changes in Design Qualities from option 1 to 3

	Urban Design Qualities	Indicator	
1	Biodiversity	Allocation of Public green space	Improved
2	Character	Respecting the existing height of buildings within the area	Reduced
3	Adaptability	Potentials for gradual change of urban form	Reduced
4	Accessibility	Density gradient designed according to main transport and business nodes	Improved
5	Permeability	Existence of cul-de-sacs and dead ends	Same
6	Diversity	Active edges produced and distribution of non-residential uses	Reduced
7	Privacy	Keeping appropriate back to back distance of dwellings	Same
8	Adaptability	Opportunity for communal activities in open spaces in centre of the blocks	Same
9	Biodiversity	Allocation of Communal green space for all residents	Reduced
10	Diversity	Allocation of non-residential uses	Same
11		Proximity to main non-residential uses: Primary school	Same
12		Proximity to main non-residential uses: secondary school	Same
13		Proximity to main non-residential uses: medical Centre	Same
14		Proximity to non-residential uses: main shopping area	Same
15	Biodiversity	Connectivity of green spaces	Same



Option 1 **Option 2** **Option 3**

10.5 Conclusion

This chapter covers the design and analysis of a real neighbourhood in London. Overall, the chapter contains three main parts. The first part explains a step by step process of design whereby the residential density of the design scheme was gradually increased. Then, two main design schemes with 200dph and 400dph residential density are featured. In the second part, these two main design schemes are evaluated according to the analytical table in Chapter Five and similar to the analysis of the Generic Models in Chapter Seven. This part explores the detailed issues regarding the improvement or compromise involved in each of the indicators of design qualities by comparing the two design schemes. This study showed the degree to which various design qualities are delivered in an actual neighbourhood when the density of the scheme is changed. In the third part, additional design and analysis were carried out at the site. The focus of this part was only on the highest target density of the study. In this part, three different design alternatives were developed to see the possibility of better delivering design qualities with different design options. The key difference between the design alternatives related to the priority given to different design qualities. In particular, the quality of biodiversity and the amount of green space within the neighbourhood becomes a key issue as this was the most important matter for the local users (see Chapter Nine). Finally, the design alternatives were evaluated again with a more locally adapted analytical table. Such analysis showed the main gains and losses when emphasizing particular qualities in the densification scheme.

Overall, in this chapter, the second test part of the thesis is completed. This part covers the practical testing part of the study in a real neighbourhood. The inquiry by design process was carried out in this part by including the local context in terms of people and place matters (Chapter Eight and Nine) through the process of design and evaluation. In this way, the result of the study may be more accurate and applicable to other real contexts. These results are related to:

1. The degree to which design qualities can be delivered when the residential density is increased in a neighbourhood density scheme.
2. The design process which can be applied in other contexts to maximise delivery of these qualities in high density design schemes.

In conclusion, this study shows that, particularly in high density designs, it is critical to find a balance between the deliveries of different qualities. This matter becomes much more important in very high density schemes such as the 400dph target in this study. As the third part of this chapter showed, emphasizing one quality in such high density can have a major impact on the other design aspects. This situation shows how important it is to identify the trade-offs between qualities in high density scheme and also to negotiate these matters with local users in order to find a balanced acceptable design solution for all stakeholders within the community.

Up to this point, the main changes of design qualities in high density schemes have been identified. These changes are demonstrated through analytical tables and explanation in this chapter. In the next chapter, all these matters of density, form and design qualities are again brought together to conclude the key theories and findings of the study. The next chapter reviews the theories of the thesis developed in the first part and also the inquiry by design method that is used throughout the testing. In this way, the next chapter offers the final findings and recommendations of the study by reviewing the key issues involved in the whole process.

Chapter 11
Refinement of the Conceptual Framework

11.1 Introduction

At the end of the previous chapter, the testing part of the research was completed. This chapter introduces the main findings of the research to review and refine the overall theoretical proposition of the thesis. This chapter addresses the sixth and final objective of the research:

To use the results of the testing to refine the theoretical proposition, urban design principles and guidance.

While the previous chapters contained a detailed analysis and explanation of the process of design, this chapter focuses on the larger picture, summarising the whole research process and the major propositions developed as a result of this study. The chapter has three main parts covering three major contributions of the thesis to the body of knowledge in the field of the built environment. First, the major findings and recommendations of the research are proposed. These are more practical findings and design principles which might be used by designers to increase residential density in different localities. Secondly, the theoretical framework from chapter four is reviewed. This part refines the propositions of the research about the relationship between the three concepts of density, form and design quality with more focus on the results which have been developed based on the application and testing of theories in practice. Thirdly, the overall inquiry by design method of the thesis is reviewed, exploring the transferability of the method for other cases and the use of the method for other localities with the potential to increase residential density. In summary, this chapter presents the major outcomes of the thesis in relation to the three aspects of the theoretical view, the methodology and practical design principles.

11.2 Major findings

In this section, the key findings of the research are explored. These are about the impact of increasing density on the overall delivery of the design qualities, and also the key design considerations for high density residential neighbourhoods.

Based on the process of design and evaluation in previous chapters, in this part, the research suggests appropriate urban form types which improve the delivery of the design qualities which are of concern to urban designers. The following infographic (Figure 11.1) has been developed based on the results of the inquiry by design process in the previous chapter. This infographic can be used as a comprehensive tool showing the appropriate urban form types and major changes in the delivery of design qualities in different ranges of density. This figure can give a comprehensive overview to designers at the starting point of the design process and when choosing the range of density for residential neighbourhood schemes. This tool can also be used by local authorities in their decision making about the appropriate range of density and the consequence of such decisions in terms of overall urban form type and the design quality of the neighbourhoods.

In the following sections, some more detailed but key findings about the interrelationship between density, form and design quality are discussed. These are new findings which are not clearly discussed in the planning and urban design literature nor in the literature about the compact city and urban intensification.

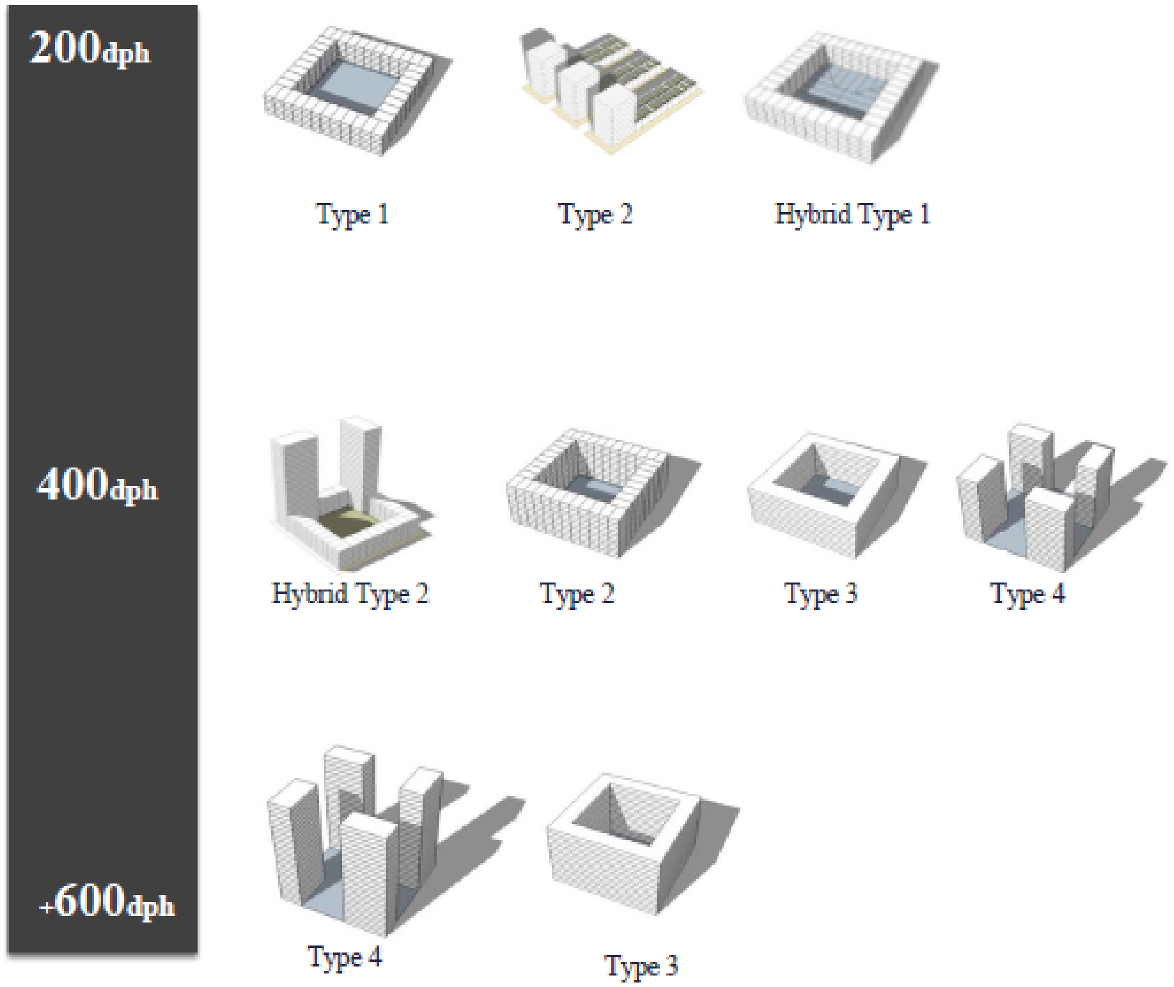
Density

Urban Form

Common possible urban form types in each density range;

Urban Design Qualities

Showing the overall improvement or compromises as a result of changing density



Permeability: can be delivered in all range of density by proper design layout

Accessibility: can be delivered in all range of density by locating all houses in walking distance to services

Diversity: There are more opportunities for new services in high density but losing small grain types can reduce the potentials for functional and visual variety

Biodiversity: Increase in footprint and height of buildings can reduce the amount of green space and duration of receiving sunlight.

Adaptability: large grain typologies in high density reduces the opportunity for incremental changes in the urban form

Environmental comfort: increase in height can result in overshadowing problem particularly in more than 400dph density range

Energy efficiency: increase of density can reduce the exposed surface of the dwellings and reduce the heat loss

Character: changing to high rise and large size buildings in higher densities can change the common character of English residential neighbourhoods. Such change of character is avoidable in higher than 400dph density ranges

Legibility: this quality can be delivered via proper layout design and even high-rise buildings as landmarks can improve the legibility of the neighbourhood.

privacy: the matter of overlooking to other dwellings can be solved via proper layout design and back to back distance of the buildings

Safety: delivering safety via design is mostly depends on proper design in the street level and having active edges for the ground level of buildings facing public spaces.

Figure x: Infographic of
Key relationship of density, form and design qualities

11.2.1 Finding the ideal urban form in high density areas

One of the issues which can now be discussed after completing the design and analysis process for this research is which urban form patterns are more capable of delivering various design qualities. Although it is not possible to identify which is the ideal type of urban form to deliver all design qualities, some of the typologies and urban form patterns which are used in this study show a better delivery of these qualities overall. It should be remembered that this research has mostly covered urban design layouts in the range between 200dph to 400dph; therefore, the recommendations and suggestions are more likely to be applicable within this density range. On the other hand, this is the range of density which is commonly considered as high density in the UK and most European cities. Even 200dph is quite a high range of density and is common in highly populated cities such as London, Paris and Barcelona. It should also be considered that the typologies which are discussed in this study are for neighbourhoods and urban areas which are predominantly residential. So, based on these circumstances, the study makes suggestions for the ideal types of urban form in high density areas.

The research shows that small grain urban form with small buildings and plots can deliver better design qualities such as diversity and adaptability, and that this also gives more control to local residents to alter and regenerate their private spaces. Ideally urban blocks should keep to a form with perimeter blocks of around 300 to 400 metres periphery. In this way, maximum permeability and accessibility are delivered and the overall urban area will also be more legible. It is also better to design open spaces as communal gardens which deliver more equity in terms of how the open spaces can be used, and allows more activities to be accommodated, particularly at high density levels. The combination of these urban form patterns can be seen in the urban block type 2 introduced in this study (See CH4 section 4.4).

This pattern of urban form has been regularly used in the design schemes in this research. The inquiry by design method shows the possibility of using such urban form patterns in the ranges of density included in this study. The analysis has shown that most of the qualities which are the focus in this study can be delivered in this type of urban form.

Certain examples of such urban forms in the real world were reviewed in previous chapters. However, while observing the urban areas in London during this research, it is clear that this combination of urban forms is not that common in the UK. However, many good examples of this form with this pattern exist in other countries such as Holland, Germany and Denmark (Figure 11.2).

Due to copyright reasons, the image has been removed in the online version of thesis.

Due to copyright reasons, the image has been removed in the online version of thesis.

Figure 11.2: Examples of Urban block type 2: plot base with communal gardens; this type of urban form is becoming more common in new residential development in Europe. Source: Tarbatt, 2012

Even in this study, this urban form type is delivered more usually in 200dph and in 400dph; in many cases, this pattern had to be changed to one of the other forms. However, the process of increasing the density step by step in the local design (As seen in Chapter Ten) showed that, even in the range of 300dph, it is still possible to preserve these ideal urban form patterns. It can be said that, however 400dph is a threshold above which urban form patterns radically change and a large grain urban fabric become inevitable within a design scheme.

11.2.2 Increases in density: a step by step design process

The local design process shows that increases in density can be achieved using a step by step process. This process is part of the new knowledge developed by this research. The Infographic (figure 11.4) shows this process in detail. The step by step process of design has been developed in order to increase density gradually. This is not a common case in urban design practice. Using this new design method can give designers more control over delivering design qualities even in very high density schemes.

One of the major changes which happen during these steps is an increase in the height of the buildings. Such an increase of height did not happen in a linear way. In some cases, more storeys were added to the urban form and, in some cases, a significant change in height occurred. This process shows that different height levels of buildings have different roles in design. In other words, different parts of buildings or urban blocks in terms of height have different roles in the delivery of urban design qualities. Based on this observation, this study reveals the major role of each height level in terms of the delivery of design qualities. There are lessons here for the designers in terms of providing a better understanding of how their decisions in relation to the height of buildings can be influential in relation to particular design qualities.

As figure 11.3 shows, the first height level is the ground floor. At this level, the main requirement is to have an urban layout which has the shape of a perimeter block and clearly separates the public, private and communal spaces on the ground. The design of the ground floor represents the main layout of the urban block and street pattern. Qualities such as permeability and diversity of use and active edges are therefore of most concern at this level. Based on this, the following is a list of the main considerations in relation to the first floor of the scheme or the urban layout (see also 2d part of Figure 11.4):

- Designing connected street patterns with an average 100 metres distance between junctions
- Avoiding loops and dead ends in the street patterns
- Keeping medium sized blocks of around 50-100 metres on each side
- Arranging the buildings around the periphery of the blocks and next to the street
- Keeping the depth of residential buildings to between 12 to 16 metres for natural sunlight and ventilation
- Keeping the back to back distance of buildings at more than 22 metres to ensure privacy
- Prioritising the use of small plots in the urban layout and the use of plot-based forms (urban form types 1 and 2 from the conceptual framework in Chapter Four)

The second height level comprises the 2nd to 5th floors of the building. At this level, the connection between the building and the street is still strong. The overall street scape and characteristics of the neighbourhood depend on the urban form patterns which are used at this height level. Continuity in shape of the block same as the ground floor can help to provide good enclosure for the street and a greater feeling of safety via windows which overlook the street. At this level, the activities taking place inside buildings can still bring a feeling of liveliness and vitality to public spaces. This height of buildings is quite common in cities such as London and represents a commonly mid-rise medium density urban form. In other words, this range of height is unlikely to represent or remind of a high density urban area.

The third height level comprises the floors higher than the 6th or 7th. Although there is no exact number for this height, commonly from this range of height the connection to the street level will have disappeared (Gehl, 2010). At this level, the urban form layout may not need to have any similarity to the ground floor footprint. This is because, at this level, the form of the building is mostly observable from a further distance rather than from street level. So, the main contribution to the urban form at this level is to the overall skyline of the neighbourhood or even the city. The qualities which matter at this level are, to a large extent, different from these at ground level. Landmark buildings which contribute to the iconic character and legibility of the neighbourhood is what matters at this level. The shape of the buildings is more likely to influence any overshadowing problem. Therefore, the continuity of the form, such as at the second level, is less of a concern and having gaps and a variety of heights may also contribute to better sunlight at ground level and being able to overlook higher level open spaces such as roof gardens.

Recognising that there are such different roles of building height level, designers can consider different design strategies for specific height levels. Such considerations are necessary when implementing a step by step process of increasing the density in a design scheme.

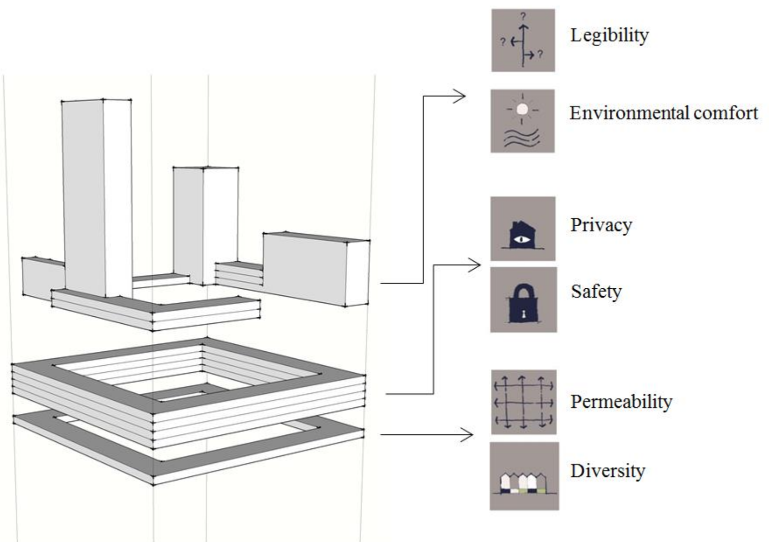


Figure 11.3: Height levels. Different height levels have specific roles in the delivery of urban design qualities source: Author

WHAT
Increasing Density

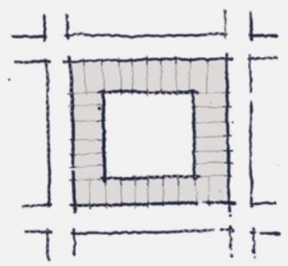
Figure 11.4: Infographic of the step by step densification process.
Source: Author

HOW
Step by Step Design:
Gradual Urban Form Change

WHY
Delivery of Design Qualities

2D: Layout Design

- Designing Urban blocks with the suggested measures.
- Allocating the buildings in the periphery of the block.
- Keeping the plots and buildings as the main grains of the neighbourhood in small size in width (8-10m) and depth (12m) for the initial stage of the design.



Permeability: connected street pattern

Diversity: Opportunity for small stores, active edges & visual variety

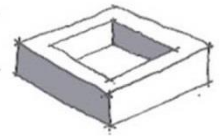
Security: all streets and public spaces are overlooked by residential buildings

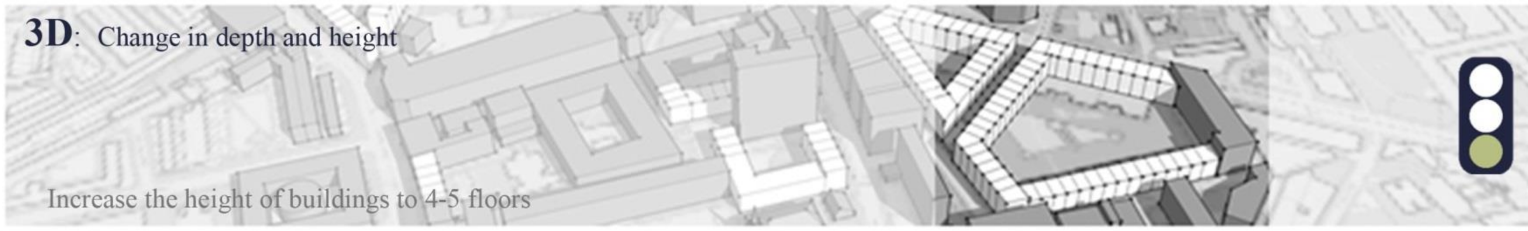
Privacy: proper back to back distance of buildings within the block

Less than 200dph

More than 600dph

3D: Change in depth and height

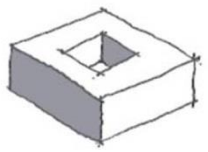


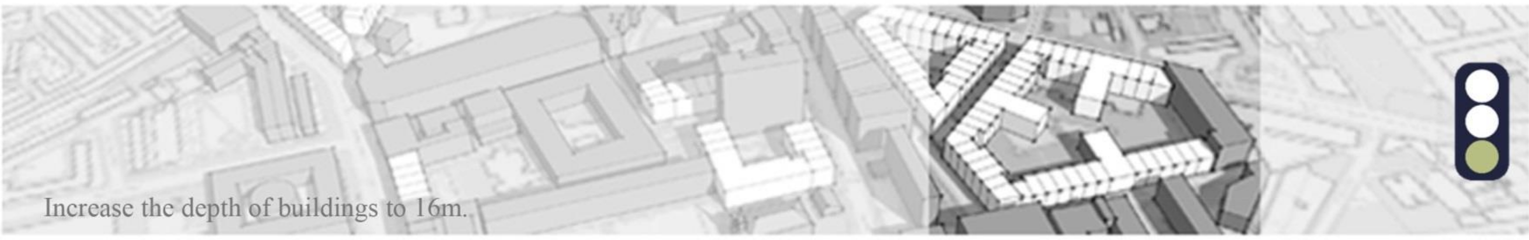


Adaptability: keeping small grain character for incremental change within the block

Diversity: keeping small plot layout for visual and functional variety

Environmental comfort: Avoiding overshadowing by controlling the height

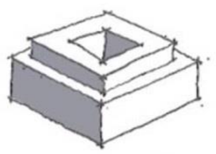




Character: keeping midrise character by: increasing footprint of building instead of increasing height to

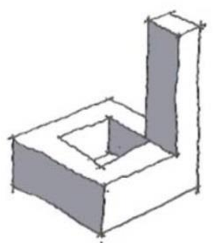
Biodiversity: controlling the footprint of buildings & keeping large green space within the block

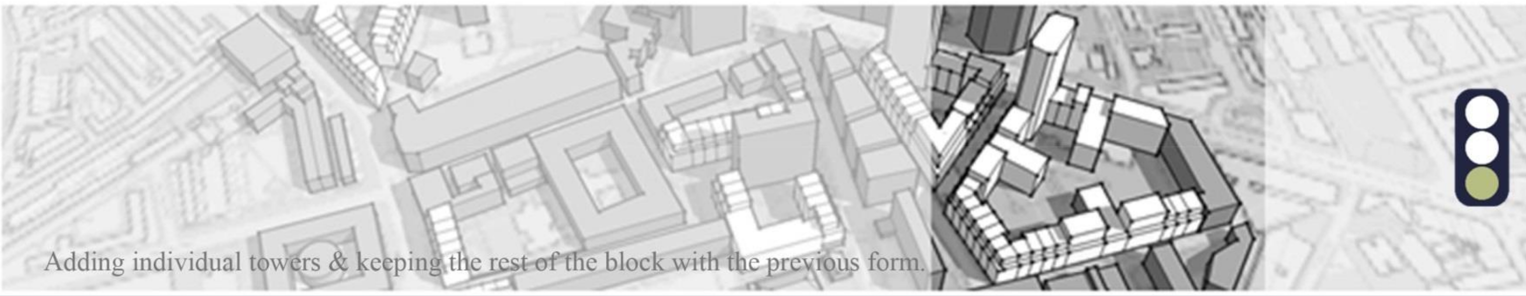
Privacy: keeping appropriate back to back distance of the residential buildings.



Character: keeping midrise character for the public spaces (4-5 floors height from street side).

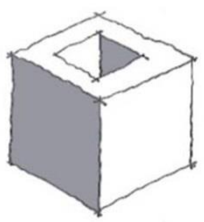
Environmental comfort: Avoiding overshadowing by controlling the height.





Diversity: keeping the small grain character for most of the block (other than the towers) & saving the visual and functional diversity

Adaptability: keeping the small grain character & opportunity for gradual changes within the block



Environmental comfort: Major overshadowing problems on streets and within the urban blocks

Character: changing the character of the neighbourhood into completely high-rise form

Adaptability: losing the small grain character and opportunity for incremental changes of the urban form

11.2.3 Major trade-offs between design qualities

Through the design process and the analysis, this research has come to the conclusion that the delivery of certain urban qualities has major impacts on each other, meaning that trying to improve some qualities may result in significant compromises for other qualities. These trade-offs between qualities are explained in detail in this section.

As has been said, it has been attempted to keep a small grain type of urban pattern as much as possible throughout the design process. In this way, certain qualities are relatively well preserved up until the 400dph density target. These qualities are mainly, one, the adaptability of the urban form to future changes, and two, retaining the existing character of the residential urban form which is common in London and also within older buildings in this area. Moreover, such a small grain urban form can provide better visual diversity and vertical division of facades through the street scape. Protecting the small grain urban form and keeping the associated design qualities depend on the density of each individual block being more than 200dph to 300dph (see Figure 11.4 and also the steps of the design process in CH10 section 10.2). Therefore, in cases where density rises higher than this in individual blocks, such as adjacent to City Road, the design tends to produce a large grain urban form pattern which reduces the above mentioned qualities.

On the other hand, the delivery of certain other qualities was limited because of the existing conditions, limitations and potential of the site. Through the process of densification in this site, it was attempted to keep public green spaces to a minimum. This is, as explained, because there is not much large open space available within the area to make a significant contribution to the greenery of the neighbourhood, and also the green spaces have been allocated in such a way so as to be experienced more in residents' daily lives and commuting. The amount of non-residential spaces within the scheme has also been kept to a minimum. This is also because of the guidelines of the Finsbury Local Plan (2011) and the fact that a high level of services and non-residential facilities already exist in this area. Based on this, the two qualities of biodiversity and functional diversity (mixed use) have been of lower priority in this scheme.

Obviously, adding more space for greenery and non-residential usage would completely change the urban form patterns of the scheme. More concentration on mixed use and biodiversity could result in a design proposal of just a few large blocks with high-rise form. If that were the case, then many qualities which have been explained here would not be delivered and the character of the area would be totally transformed.

Here, it can be said that the major trade-off between design qualities in such high density schemes is about reaching a balance between two sets of design qualities. On the one side are the qualities of adaptability, character, continuity of street scape and visual diversity which can be achieved by a small grain perimeter block shape urban form; on the other hand, are the qualities of biodiversity and functional diversity (mixed use) which inevitably changes the high density urban form to a few concentrated, very high rise blocks, to accommodate all the required space with a minimum footprint of buildings (see figure 10.21 and 10.22 in CH10: p304). This means that too great a focus and prioritisation on one set of these qualities can result in an extreme reduction of the other group.

The major challenge of densification schemes is to find the balance between particular qualities. Understanding these trade-offs should help designers to understand to what extent to focus on each quality. As the method of this research shows, the existing local conditions in terms of place limitations and opportunities and people's preferences and attitudes can also help designers to make appropriate decisions for specific sites.

11.3 Reviewing the Conceptual framework and methodology

11.3.1 Densification: a two-way process

In this thesis, the relationship between the three concepts of density, form and design qualities has been identified. These relationships have been investigated as a relatively linear process, meaning that a target density was chosen in the first step, then optimum urban form patterns were recommended through a modelling and design process and, finally, changes in urban design qualities were evaluated. In this way, the consequences of choosing various target density ranges were identified. This process also produced a tool for designers to use to have practical knowledge about the consequences of choosing certain ranges of densities and also to produce recommendations as design principles which designers can use to maximise the delivery of such qualities in their design scheme. The process normally starts with density ranges and ends with the findings and recommendations about design qualities.

However, as the local design process showed, at the end it can be stated that the other way of working through the process is as important as the first one. This means that the existing condition of the locality can and should influence this process, starting from design qualities and moving back to the target density. In other words, the locality requires a specific focus and ha particular needs with respect to certain design qualities. Therefore, the urban form should be designed in certain ways and consequently, specific ranges of density become more appropriate for the locality. In summary, the local specification can influence the design and form of the neighbourhood, but it can also influence the target density (figure 11.5).

This study does not try to establish specific and appropriate densities for all localities, but to suggest a method so that designers can take local issues into account and, through a two-way process, create designs which balance the needs of local people with the need to increase density. The main goal here is to devise a clear method of simplifying this process and ease the negotiation of urban qualities with local users. This study tries to produce a tool to understand the consequences of densification, allowing designers to go back to choose and reconsider the target density if necessary.

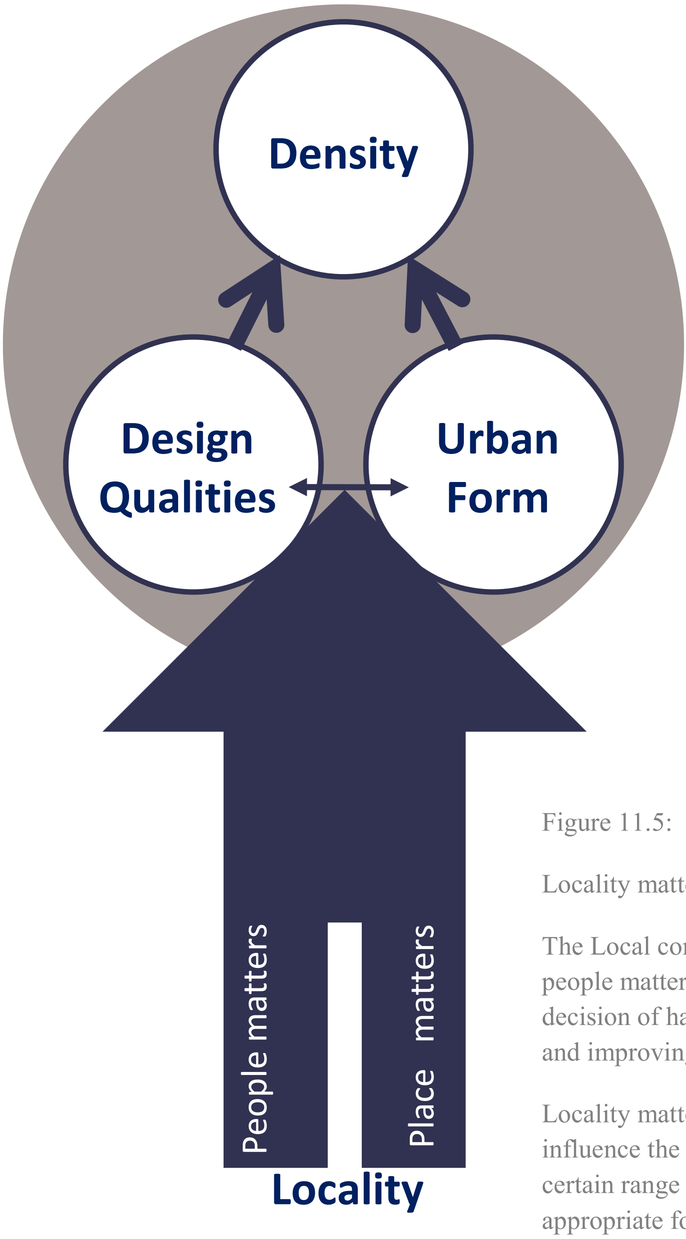


Figure 11.5:

Locality matters (adapted from chapter 4):

The Local condition in terms of place and people matters can have impact on the decision of having specific urban form type and improving certain qualities.

Locality matters therefore can even influence the density target and suggest that certain range of density may be more appropriate for the locality. Source: Author

11.3.2 An intermediate language to communicate between professionals and localities

One of the key contributions to a better understanding of this framework is to propose a method to take the local point of view into account in densification projects. The importance considering the local point of view was actually pointed out in many of the literature related to urban design and planning (ex: CABE, 2005a), but it mostly remained in the theory or analysis stage without having an exact method for applying the results. This study shows a method which designers can apply to understand the consequences of densification in specific sites in a simple way and, moreover, to negotiate the consequences with local residents using a more accessible approach.

The method may be of value in helping designers to develop a better understanding of the issues of density and design. Hence, it can enable designers to show the obstacles and benefits of densification to local users. Then, negotiation with locals on specific design matters can be carried out with more certainty.

It is important to let local people know how an increase in density might be beneficial for the entire city, and even though compromises may happen during the design process, other benefits may be provided locally. In addition, the process can show local users how designers try to bring their concerns and preferences into the project and what obstacles exist in this process. This is very important because some residents have pointed out that their opinions are heard when new local developments are planned, but that they are not considered in a final scheme. This is because there is a lack of communication and understanding of the obstacles during the design process and the trade-offs which should be made in a scheme which includes densification.

Due to such misunderstanding and lack of communication, there is a need for a framework such as this which bring an intermediate language which would ease the negotiation between professionals and users. This intermediate language has emerged from simplification of the analysis process; this simplification ends with straight forward ways of introducing design issues and ideas to people. Both professionals and users can benefit from this method. Professionals can communicate better with users and show the design aspects to the users. They can also show how far they can bring local concerns into their design scheme. Users will also understand more easily what the design obstacles are and to what extent their preferences can be achieved.

11.3.3 An inquiry by design method, a tool for simplification

The inquiry by design method used in this study helped to simplify the process of analysis. It helped to provide a clear explanation of the relationship between design and density. The problem with such an investigation is that there are always many different factors at play in relation to density and also to design. A change in any factor can influence others. The process of design is commonly a process of sacrificing some qualities and advantages for others and each of these decisions has various effects on the other aspects of design. As a result, the study tried to focus on just a few specific design aspects. However, this study also tried to bring together all the major aspects of densification which may be related to and influence the residential neighbourhood design. For this reason, this research suggests a deductive method which observes the changes and interrelationships of all these design aspects together.

The inquiry by design method was separated into two parts using primary generic modelling at first and then applying the findings in the form of hypothesis to a real site. In this way, this study suggests more of a step by step method to concentrate on specific design qualities first and then focusing on others. Such a design process on an abstract level helped the research to identify the potential urban forms which may be neglected while directly focusing the design process on a local site with its own specific limitations and obstacles. Therefore, one of the main contributions to theory here is the use of generic modelling as an inquiry by design method to find out the optimum and ideal types of urban form. The compromises and improvements related to an actual site could be more easily highlighted as a consequence, at the next stage.

This method shows that it is possible to use standards and benchmarks in design, based on existing recommendations and guidelines in urban design and planning literature. In this way, the design process can be rationalised and the final results and models will not just be based on the artistic and aesthetic preferences of the designer, but instead, will be based on the existing body of knowledge about urban design. The simplification of the design process and use of major patterns of change would help to keep a design scheme in an abstract shape not involving details which may not necessarily have a major impact on design qualities. Many such detailed design matters at smaller morphological scales such as components, colour or texture of buildings can be dealt with in architectural scale and the artistic preferences of designer can be involved in the process at that stage. However, that is not the concern of this study.

Using standards derived from the built environment literature means that the method should be transferable to other localities and even other cultural conditions. This is because the inquiry by design method shows how these standards are used in the design process. Thus, the fact that there are different standards in other countries, such as different sizes of household or minimum sizes of houses, means that new standards can be applied to this method and a new locality-based type of generic model and urban design principles can be generated.

11.3.4 A method of communicating design ideas to the locality

Another major benefit of this method is that it can suggest a way of communicating with the local community and discussing detailed design matters with them. The two-step inquiry by design method and use of the generic model in the first step helped to provide a clearer understanding of the design issues and possible design choices before communicating with local users. Using generic modelling and understanding the major urban form patterns and their consequences, main design ideas can easily be identified. These design ideas can then be translated into simple graphics understandable by non-expert residents. This results in better communication with the local people, as happened in this study. The main benefit here is that detailed design matters can be introduced to residents without initially prompting a sudden reaction to the notion of density or just having a vague and theoretical discussion about the ideal form of their neighbourhood. In other words, use of the Q methodology with graphical display enables local users to understand key design issues and to get strongly involved in discussions about the subject of a scheme. Involving participants to such a degree with design issues, means they can understand how designers think and, therefore, mutual concern about the improvement of design qualities within the area can be developed.

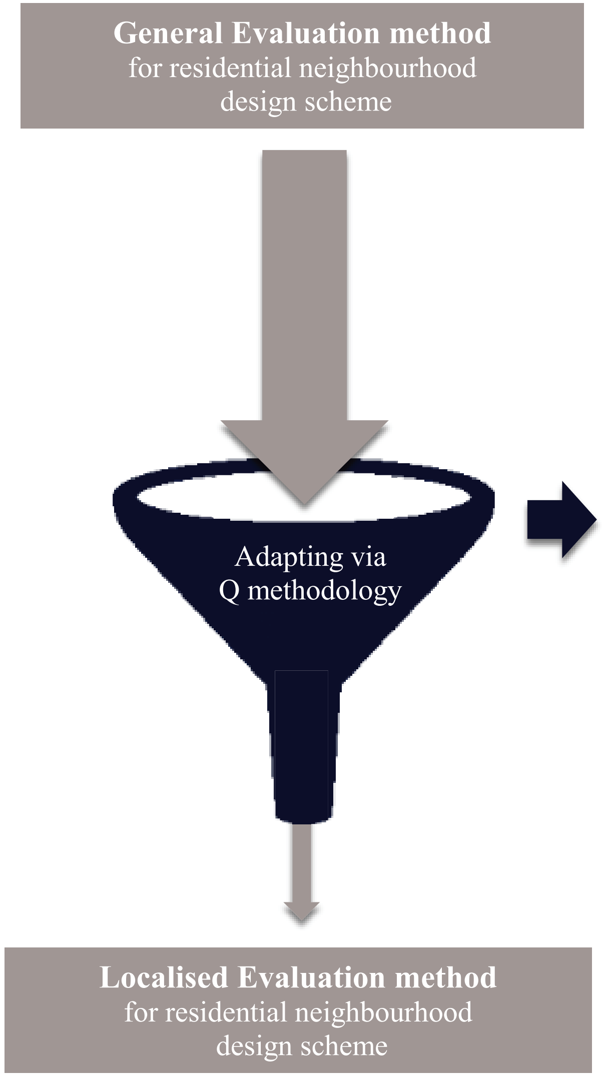
Better communication with the local community, using this method, can also help designers to make better recommendations. The method reveals the attitude and concerns of the locality in detailed form. The method also helps these concerns to directly shape design ideas and preferences which can be used in any densification scheme. These are valuable insights that can be directly used by designers. Although design principles can be developed by analysing and evaluating existing urban forms, using this process, the recommendations can be made more precise for specific localities.

11.3.5 Not just design qualities, but also priorities

The other main characteristic of this methodology is that the general findings and principles and even the analytical table which developed through this study were gradually altered to become more practically applicable in a specific locality (Figure 11.6). The basic principles have already been developed in the generic modelling about high density urban design. However, adding the analysis about place and people issues in particular neighbourhoods means that the principles will be slightly altered by the end of the study. The main changes here are not about the individual principle, but about the prioritisation of principles.

Establishing what are favourable and unfavourable design aspects from the people's point of view, and knowing the existing potential and limitations within the area, the design principles can be sorted in such a way as to take most of the preferences of the locality into account. In this way, during the process of decision making and trading-off the design qualities, some principles take priority in terms of the delivery in the design scheme. This approach to change the priorities is a key contribution of the research to the general inquiry by design method.

Within a design, this prioritising of design principles has also influenced the design process. Having this prioritisation of design principles, the design process also turned into a step by step procedure. As appeared in the design scheme, increase in density took place gradually so that compromises in the key design qualities could be minimised until the final target density was reached. Therefore, at the end, it can be rationally explained that all possible efforts have been made to consider local preferences in the scheme while increasing the density to the highest density target. Consequently, at the end, the design scheme can be justified and can show that, while considering local preferences, which type of design qualities can be improved or need to be compromised in order to reach a specific range of density.



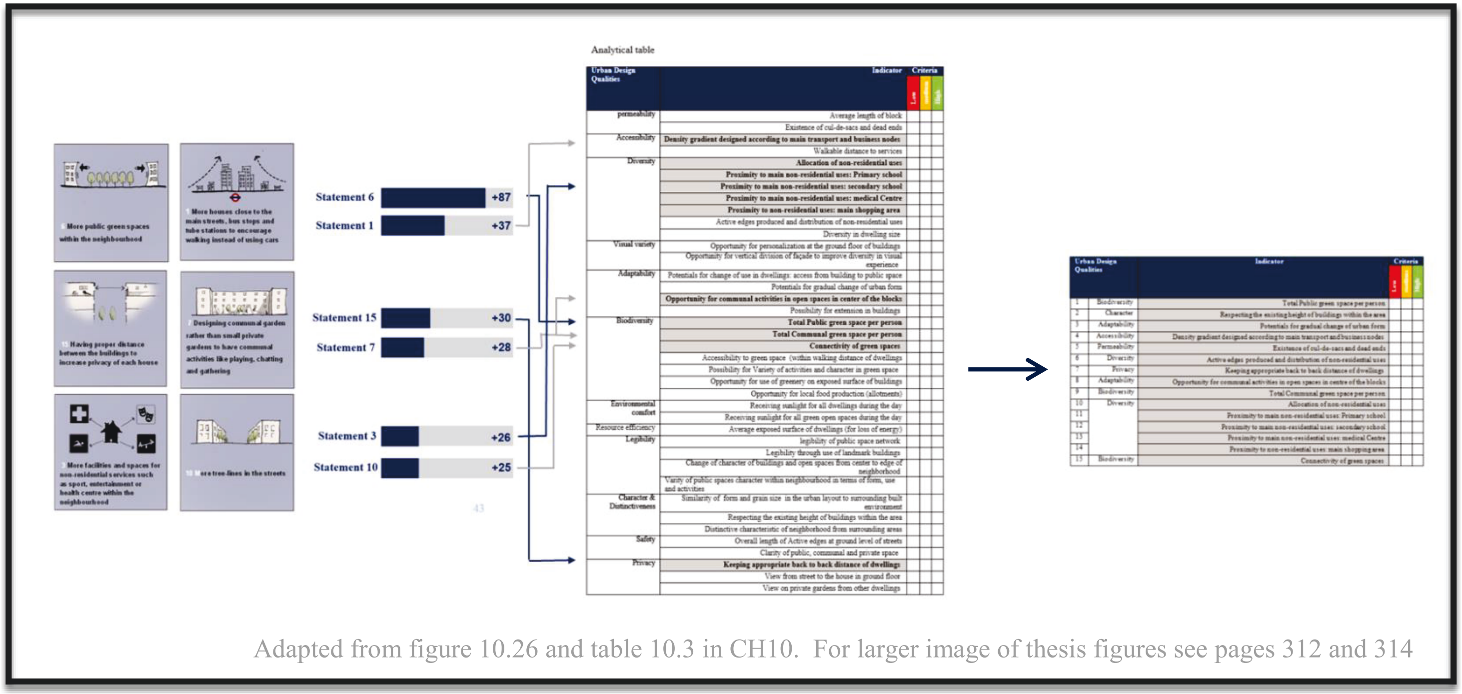


Figure 11.6: This study suggests a process to localise general evaluation method for any specific neighbourhood.

11.4 Conclusion

This chapter is the final chapter of this thesis which has presented the main results of the study. While chapter four was the final chapter for the theoretical part of the study, this chapter represents the final section of the test part of the study reviewing the propositions and providing more practical and validated results at the end of the study. This chapter was divided into two main parts:

In the first part, the key findings of the study were explored showing the issues which are of concern in the process of high density urban design. The issues related to types of residential urban form were explored. Also, a transferable design process for high density design was suggested based on the inquiry by design method which was used in the thesis. An infographic figure about the design process was presented which can be used by designers as a tool to maximise delivery of the design qualities in high density design schemes (figure 11.4). In the second part, the overall method and theoretical framework of the research were reviewed. In this part, the key benefits of using the research method were explored. The theoretical part of the study was also reviewed focusing on the key issues of the study including: simplification of the urban typology and bringing local users' concerns into the process of high density design.

The study shows that people's concerns and preferences can become more important and influential in the design process because, in the end, acceptability of the scheme by local users is critical to achieving a successful densification project. In this way, the quality of design, according to local preferences, becomes as important as the issue of reaching a certain target density. In other words, instead of having a target density at the starting point of a housing project, a participatory design process can be used to prescribe an appropriate range of density.

Based on the main questions of the thesis, this study tried to show the main characteristics of urban form in high density developments and point out how design qualities might be delivered or compromised as a result of increasing density. The infographic at the beginning of this chapter (Figure 11.1) shows a summarised answer to these key questions of the research. This figure shows the key changes in urban form and design qualities as a result of increasing density based on the overall findings of the thesis.

Conclusion Chapter

The aim of this study was to develop a conceptual framework which explains the interrelationship of three concepts of density, form and design quality in scale of residential neighbourhood and to propose a method to improve delivery of such design qualities in high density residential developments. The study reached a simplified and comprehensive explanation about such relationship of three concepts and developed simple and usable tools for designers to understand these relationships for practical design purposes and for communication with non-expert local users.

In this final chapter, the overall conclusions are developed for the thesis. The chapter summarises the process of the research in the thesis and also provides a summary of key findings. The main contributions to the existing body of knowledge are also highlighted. Furthermore, the implementation of the findings in urban design and planning practice are recommended. The limitations of the study are also explored and, finally, key areas for further research are suggested.

12.1 Summary of the thesis

The starting point for this research was the issue of urban growth and an acknowledgement of the fact that there are different approaches to create sustainable growth for a city. The research then focused on one specific approach to urban growth which is called urban densification. Within this approach, the need for new housing in a city is dealt with by increasing density within existing urban areas or in the vacant spaces in the city. The focus of the study was the intensification at the scale of a neighbourhood and particularly in neighbourhoods which have predominantly residential characteristics.

It was discussed that increases in density and interventions made to the physical shape of the neighbourhood can happen in different ways. The differences relate to the form of new development and the consequences of choosing different urban forms. Therefore, the form and design of densification are important when it comes to attaining a sustainable form of densification. Moreover, different urban forms can result in the delivery of different design qualities in the neighbourhood. The delivery of such design qualities can show to what extent the process of design and densification have contributed to the sustainability of a neighbourhood. Therefore, three key concepts became the main subject of the thesis; these are density, form and design qualities.

Based on this, the main methods of measuring and evaluating these three concepts were introduced. Different measures for density were discussed and particular measures appropriate for this study were chosen. Significant changes of urban form were identified and specific common types of form in residential neighbourhoods were introduced which show the main repeated patterns of urban form in residential areas. The main design qualities which might be influenced by a change of density were identified and indicators for changes in these qualities presented. Having developed precise measures and indicators for the three concepts of density form and design quality in the study, a theoretical method was produced which showed the interrelationship between these three concepts. In other words, at the end of the theoretical part of the thesis, a conceptual framework was produced which explains how an increase in residential density can influence the urban form and consequently the delivery of certain design qualities.

In the second and third part of the thesis, this conceptual framework was tested using an inquiry by design process comprising two stages.

In the first stage, generic models of ideal neighbourhoods were produced at different densities. These models were based on the urban form types which were identified during the theoretical stage of the research. The models generated were evaluated to test which design qualities were improved or were compromised as a result of increasing the density in the neighbourhood models.

Despite trying to achieve the ideal form of design in order to reach the maximum design quality, during this stage, the researcher concluded that there is still room for different choices of urban form type in order to prioritise different design qualities. In other words, the designer can still decide to emphasise particular qualities and compromise others.

The issue of setting priorities in relation to design qualities and making trade-offs between them was not initially discussed in the theory, and was barely explored in the urban design literature. However, this is an issue which becomes important in practice when there are concerns about the acceptability of a design at the urban scale to local residents. Based on these concerns, during the second stage of testing, a method was developed to identify users' priorities in relation to design qualities and to modify the densification design scheme based on local users' preferences. In this way, where there are trade-offs to be made between design qualities, the main rationale is to lead the design process in a way which is more acceptable to local users.

Based on this approach, in this stage of the study, different design proposals in terms of density and priority of design qualities were developed for a specific neighbourhood in London. The design proposal used a similar method of evaluation as in the previous stage identifying the main gains and losses in terms of the delivery of design qualities as a result of changing density.

Finally, based on this process of design and evaluation, the study concluded with a revision of the initial theoretical propositions of the research proposing final findings and recommendations with regards to the design process in high density residential neighbourhoods.

12.2 Summary of the findings

The findings are explained in two main parts. The first part presents the main facts identified through the process of design and analysis. The key impacts of densification on design quality are explained and the main qualities which are improved or compromised are explored. The second part provides the key recommendations of the research. These recommendations are presented as design principles which can be used by built environment professionals in order to improve the delivery of design qualities in high density residential areas.

Main Research findings

Through the process of design and analysis, specific qualities have been identified which are commonly improved through the process of densification. One of the main qualities which is improved is the opportunity for functional diversity. As density increases, there is more opportunity for new jobs and services and for non-residential spaces to be mixed in with residential neighbourhoods. Allocating new non-residential uses to the design scheme helps the neighbourhood to become more active and vibrant. Particularly at street level, these new spaces bring more active edges and visual diversity to a neighbourhood.

One other key improvement relates the quality of access to services and public transport. In this case, choosing an appropriate location for higher density development is crucial. If the higher density urban form is located close to transport hubs and neighbourhood centres, then an increase in density can increase the overall number of residents living close to these services. Therefore, overall, the neighbourhood and the city as a whole can be more accessible without the need for private cars. In other words, densification can make a major contribution to the accessibility and walkability of the city by accommodating a higher number of residents in walking distance of the main services and transport hubs.

Another main improvement relates to the use of open spaces. Observing real examples of residential neighbourhoods (see Chapter Six) the research identified a general tendency for designing communal open spaces in density ranges of 200dph and higher in more recent developments. This is because, in such ranges of density, communal gardens can afford all residents more opportunity to use open spaces compared with lower density developments, where small private back gardens are more common. Therefore, such design considerations result in more opportunity for a diverse and flexible use of open spaces in high density areas, improving social equity in relation to the use of space and bringing more opportunities for social interaction between neighbours, creating a sense of community.

The other main benefit of increasing density is related to energy efficiency. As the models show, an increase in density results in the reduction of the average exposed surface of dwellings. In this way, a high density design can reduce the overall amount of energy loss from the walls of the buildings. Obviously, many technical and architectural factors play a role in energy loss from buildings such as the materials on the walls and the size of the windows. However, in designs at the neighbourhood scale, high density urban forms result in more buildings being attached to one another which make a contribution to the energy efficiency of these forms.

On the other hand, specific design qualities were identified which have been compromised as a result of increasing density. The main qualities affected in this way were found to be biodiversity, environmental comfort and adaptability.

Biodiversity is reduced as density increases in the design models presented because of the need to allocate smaller green spaces in areas of higher density. Moreover, the inevitable increase in the height of buildings results in overshadowing the ground level and therefore reduces the environmental comfort and the ability of both lower level buildings and green spaces to benefit from direct sunlight. Such compromises are inevitable in higher density urban forms because the only way to increase density is to increase the height of buildings or their footprint. Increasing buildings height results in overshadowing problems and increases in footprint reduces the amount of green space. Therefore, using any form of design is expected to compromise these qualities.

One of the key findings of the research relates to the matter of grain size. This research recommends that the use of small grain urban form typologies can help to deliver many of the key design qualities discussed in this study. As the analysis of the designed models show, an increase in density correlates with a reduction in adaptability for gradual and incremental changes in the form of the neighbourhood. In this case, an increase in density results in the need to use a large grain type of urban form (in terms of the size of buildings and plots). Such large grain types provide less flexibility to make gradual changes. This is mostly because, in the case of large plots and buildings, the residents have less control over making changes because of the shared ownership of the space. Therefore, the required use of large grain urban forms in high density areas limits the control that residents have in relation to the space and activities. This type of urban form provides less flexibility to make small adaptations in the long term.

Observing such compromises in design qualities, the design models showed that the 400dph density is the threshold after which significant compromises in design qualities take place. This observation is based on using a step by step design process in Chapter Ten to observe the gradual changes in urban form. The 400dph density range is the starting point for losing plot-based small grain types of urban form and needing to use urban forms with block-based characteristics. As the design process showed in Chapters Six and Ten, a large amount of non-residential space should also be added to the scheme. Within this range of density, the use of high rise tower blocks with more than 15 floors is inevitable, at least in parts of the neighbourhood, resulting in overshadowing problems and significant changes in the character of the neighbourhood. Qualities such as adaptability, biodiversity and environmental comfort are significantly compromised at this point. Overall, the research concludes that many of the design qualities discussed in the urban design literature might be significantly compromised within this range of density. In other word, in such a density range, while there might be some advantages in increasing density, the negative consequences may be so significant that they override the benefits.

The research demonstrated that it can be stated that most of the qualities were delivered in the 200dph target range. It is clear that, by employing certain design principles, the target density for new residential developments can reach 200dph without any significant compromise in design qualities. This is very important because in many new residential developments density is either within a significantly lower range at less than 100dph or in a very high range, reaching the maximum acceptable target of 400dph based on planning policies and guidance. The new finding here is that the 200dph range, which is already frequently found in traditional residential developments particularly in London, should become a more common target density. In other words, instead of having a few very high density developments within the 400dph range, it is possible to regularly use the 200dph target for many new developments.

Main recommendations of the study

As the design process showed, both in relation to the generic models and to the design of a real site, the urban layout can play a key role in delivering design quality. Specific considerations in the design of the layout of the ground level can make a major contribution to the design qualities of a scheme. Many qualities can be delivered to a large extent by considering the street pattern, the size of the blocks and the arrangement of the buildings in the layout of the design scheme. For example, keeping the street pattern connected using medium size blocks (100m by 100m) can improve the permeability and the legibility of schemes. Arranging buildings around the periphery of the blocks can make a better connection between the street – as a public space – and buildings - as private spaces – bringing more active edges and surveillance to the streets. Therefore, qualities such as diversity and safety can be improved in a scheme. Moreover, prioritising the use of small plots in the layout can have an influence on keeping the adaptability of the layout as much as possible. All these considerations show that, at the starting point of the design at the ground level, many of key urban qualities can be delivered. Although some changes to the layout may be necessary in high density ranges, having an appropriate urban layout secures the delivery of many qualities even in areas of very high density (such matters explored in detail in CH11: section 11.2.2 and figure 11.3 and 11.4).

The other key recommendation of this study is about the step by step process of increasing density. Based on the concerns of local users and through the process of modelling, the study reached the conclusion that a step by step increase in density in the design process can help to ensure better control of and better compromise between the design qualities. As explained in Chapters Ten and Eleven, in each step of increasing density a specific alteration in the urban form takes place.

These step by step changes of form and increases in density are carried out in the following steps (more details in CH11: Figure 11.4):

1. Increase the height of buildings to 4-5 floors
2. Increase the depth of buildings to 16m.
3. Increase the height for 2-3 more floors with setbacks from the street side.
4. Adding individual towers and keeping the rest of the block with the previous form.
5. Increase the height of the whole block and shifting to large size plots.

This step by step process has been produced from the results of the first inquiry by design via the generic modelling in Chapter Seven and is also based on the priority design qualities among local users according to the results of the Q methodology in Chapter Nine. Using a step by step design process means that only specific changes in design qualities happen in each step. In this way, the designer has more control over the delivery of the qualities and is able to make changes to the urban form according to the needs and preferences of local users. As a result, the analysis and evaluation of the final design scheme is also easier because the designer has a rationale for changing the form at each step of the design and can show the inevitability of compromising particular design qualities while reaching certain ranges of density.

Another key recommendation for designers concerns the relationship between buildings and the open spaces. Connections between open spaces and buildings happen at ground level and at street level. Having reviewed the literature related to high density development and having observed real examples of high density residential neighbourhoods, one of the main issues which appears to be neglected in such an urban form is the design at street level (figure 12.1). This is where many of the qualities related to the quality of public space are delivered.

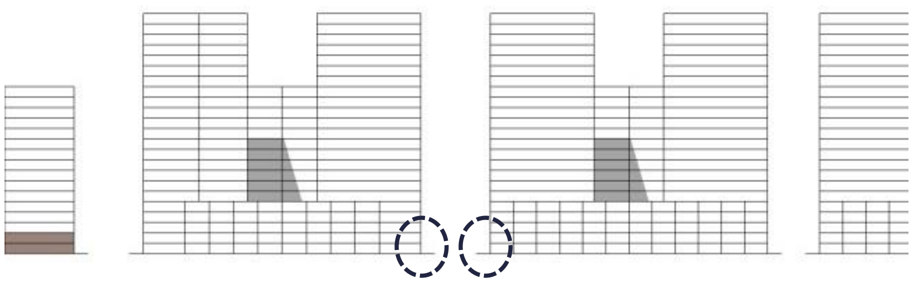


Figure 12.1: Street level design becomes more important when designing a high density neighbourhood.

Particular design considerations can help to improve the quality of public space at street level; first, using small grains in buildings and plots and dividing the facade on the ground floor can improve qualities such as visual diversity. Examples in Chapter Six show that even with a block-based type of urban form it is possible to design the ground level using smaller grains with a large number of entrances and dwellings which have direct access to the street. Establishing a better connection between the street and the buildings provides design qualities such as visual diversity, the opportunity to personalise the front garden and the opportunity to include non-residential activities such as shops can be provided just by having a different type of design at street level. In other words, no matter how much the density and the height of the buildings may increase, many of the qualities which make the street more active and alive can be achieved via an appropriate design at street level and by making better connections between the street and the ground floor buildings.

12.3 Research contribution to the existing body of knowledge

This section articulates the key contribution of the research to the existing body of knowledge. Firstly, I reviewed the key contribution related to the existing body of theory in the field of built environment; then, the contribution is explored in three main areas related to the main findings, the research method and the design process. In each sub-section below, one of the new findings is explored and discussed, then, based on this finding, a new design process or research method related to that finding is identified.

Contribution to theory

As discussed in the theoretical part of the research, the literature about the compact city and urban intensification barely discusses urban design qualities. However, these are the qualities that specifically matter in the neighbourhood scale design. One of the key contributions of this study is that of bringing these qualities into account in the theoretical debate about the compact city.

While trying to recommending practical principles for designers, it is necessary to see all these qualities together and the impact they have on each other. While it is difficult to bring all these qualities together, the literature related to urban density mostly avoids a comprehensive discussion about them, focusing on just one or two qualities.

In this research, by concentrating on key patterns of urban form and significant changes in design qualities, it has become possible to review all these qualities together and to have a more in depth discussion about the interrelationship between them. In such a way, the theories become more usable for the designers.

Another key contribution of this research is related to the importance of each design quality. The study showed that the importance of these qualities is not the same from the points of view of lay people and professionals. Even users of different ages have varied perspectives. Given this, the validity of professionals' point of view and priorities is not completely and scientifically justified. This study also showed that some of the design qualities and their importance are perceptual. Much of the urban design literature explores these qualities suggesting design guides and principles. However, such literature merely proves the validity and level of importance of the qualities in a scientific way. This study at least shows a method which can be used to check the validity and importance of the design qualities via users. This is just a starting point for this type of study exploring the differences between users' and experts' opinions about the value of the design qualities in a real context. Hence, at the end, this research points out and raises awareness of the differences in priority between professionals and non-professionals in the field of urban design for further discussion and investigation.

Threshold of increasing density

The first key new contribution is related to thresholds in the delivery of design qualities. One of the main questions of this research was to explore the threshold at which design qualities start to decline in higher density areas. As discussed in the literature review (Chapter One), there is a common perception, particularly in the UK context, that increases in density result in poor quality design. Although this study has confirmed that certain qualities are compromised in very high density areas, the study also shows that, with appropriate design, many qualities can be delivered to a large extent even in high density areas.

As explored in Chapters One and Two, many of the old examples of high density development in the UK context, particularly in the post war era, could not deliver good quality design. This has resulted in the public having a negative perception of high density development. The typical model of high density design is associated with high rise, separate tower blocks commonly developed in the post war era. This perceived model does not match the best examples of high density design.

However, this study demonstrates that, if certain principles are employed throughout the design of the urban layout, many design qualities can be delivered even in very high density developments. The question which has been explored in this study is whether there is a threshold density after which point design qualities cannot be delivered. The detailed answer to this question is that this threshold does not just relate to the target density, but also to the design principles used in a densification scheme and that it also depends on the existing conditions of the neighbourhood and local demands. On the other hand, a more concise answer is that this study shows that the threshold density at which any key design qualities are compromised is higher than commonly perceived. Despite common perceptions and expectations, with an appropriate design, many design qualities can be delivered even in a 400dph scheme which is the maximum acceptable density in the UK and is only used on rare occasions.

This study has shown that the design process can be guided in such a way as to maximize delivery of design qualities even in very high density areas. One of the key new contributions of this study to the existing body of knowledge is that, in the design process for this research, a step by step method of increasing density was proposed (in Chapter Ten) which would give designers better control over the delivery of all design qualities.

A key parameter in the step by step process of increasing density is to keep the grain size as small as possible. The concept of grain size was discussed in Chapter Two and Four (sections 2.5 and 4.4) and the step by step process which keeps grains small is demonstrated in Figure 11.3 (infographic) in Chapter 11. Preserve of small grain design can maximize the delivery of qualities such as diversity and adaptability for change and in most cases, it respects the existing character of the neighbourhoods in the UK. The step by step design process helps to keep grain sizes small even in areas with a very high range of density. The final design proposal in Chapter Ten also showed that even in 400dph schemes it is possible to have a small grain type of urban form for a major part of a new development.

To summarise, the new knowledge here is that the study has reached the conclusion that the density threshold after which many design qualities are compromised is higher than commonly perceived. Thus, this research proposes a step by step design process that if applied would help to deliver design qualities even in very high density areas.

Generic modelling

One of the key contributions of the thesis is proposing a detailed method for the generic modelling and the analysis. This method can be used as a helpful tool for designers to propose and examine new urban form typologies. Therefore, this method can help to initiate innovative design ideas from theory and to improve them to ensure more feasible and practical design solutions. Given that the method helps to provide standards and rationales for design process and given that the evaluation is based on the literature review and the use of the existing body of theories in the field of urban design, the final product can be more practical. Hence, the method can be helpful not just in the field of urban design but also in architecture and planning, particularly for innovative designers.

Locally adapted evaluation method

Chapter Three established the design qualities that are of concern in this research. These are the qualities that are often discussed in the urban design literature. The review of the literature shows that these qualities and their delivery are commonly discussed in a general and prescriptive way in urban design resources. Typically, the urban design literature explores each of these qualities one by one and makes design recommendations to enable the delivery of these qualities. The element which is missing here is that all the qualities are explored with equal emphasis and priority. Even the literature which suggests an evaluation method also explores each of these qualities separately with no priority given to any of them. This is mostly because the literature is intended for use across many different locations and neighbourhood conditions.

In contrast, this research shows that, when working within a locality and in a participatory design process, some of these qualities are more important for local users than others. In other words, the local user prioritises some qualities over others. This is one of the reasons why some design schemes may be rejected by local residents despite delivering many design qualities. Urban design solutions cannot work properly unless adapted for each specific locality and such adaptation depends on how local users prioritise these qualities. This is also important when densification schemes are proposed for different neighbourhoods because during the process of densification, some qualities are inevitably sacrificed for others. There are certain qualities that are more important for local residents than others and there may even be some qualities that local residents will not accept being compromised. Therefore, ranking the qualities becomes an even more important matter when designing densification schemes.

One of the major outcomes of this research is the development of a method of ranking design qualities according to the physical condition of the neighbourhood and the demands and preferences of local users. The use of the Q Methodology in this study helped to establish a method of ranking design qualities according to local preferences. This ranking of qualities is helpful both throughout the design process and also for the evaluation of the proposed schemes. The general evaluation methods which are commonly used for neighbourhood development schemes do not take the concerns of local users into account. Thus, the ranking of qualities suggested in this research can be used to adapt the general evaluation methods and create a more locally based evaluation method taking into account the condition of the neighbourhood.

12.4 Implementation of the findings

This section discusses the opportunity and challenge of implementing the results of the research in practice. The potential implementation of the study is explored in the three following areas:

- Implementation of the research method
- Use of the findings by designers and local authorities
- Influence on planning policies

One of the key implications of the study is the use of this research method as a tool for producing design briefs. The study has applied an inquiry by design method which can be useful for councils and local authorities to produce models and alternatives for urban intensification. Using this method, modelling can be carried out before finalising a scheme for a particular neighbourhood, at the stage of evaluating different options and negotiating the design solutions with local residents.

The key advantage of the inquiry by design method used in this study is that it enables designers to discuss detailed design matters in a simple and graphic way with a non-professional audience. In this way, the method can help to foster better communication between professionals working in the built environment, local authorities and local residents and to inform local users about the trade-offs or gains and losses throughout the intensification process. In this way, a better understanding between local residents and the local authority can be developed while the main benefits and obstacles of residential developments can be explained in a simpler manner.

Moreover, the inquiry by design method in this study is based on common urban form types and a step by step process of design. As a result, it makes it easier to repeat the design process and complete it in a short period of time. Such a method of generic design, allows the final design scheme to be more flexible to incorporate changes and alterations based on negotiations with different stakeholders. Also, the consequences of any changes are more predictable because of the simplification of the design issues within certain types of urban form and certain indicators of design quality. Hence, overall, this method can make the process of design easier and faster, particularly in the primary stages and in the case of participatory design and involvement of different stakeholders.

The other main area of implementation of this study relates to the main findings. The findings of this study show the likely consequences of changing density, particularly within the highest acceptable ranges in the UK. These findings are presented in a more graphic way in Chapters Six and Ten via models and types of urban form. These findings could be used by designers and local planning officers to help develop a better understanding of the design options for densification even before starting the design process. The use of infographics such as the ones in Chapter Eleven (figure 11.3 and 11.6) might be used to explain the design issues in a simpler and faster way.

The other main implication of the results of the study relates to local planning policies. As discussed in Chapter One, the existing housing policies in the UK give flexibility to local councils in relation to setting an appropriate housing density. The appropriate density is then decided based on the local demand for new housing and the potential of the area in terms of the availability of services and public transport. However, as appeared to be the case in Islington, there may be conflict between the demand for new housing and the preferences and attitudes of local residents. Based on the demand for new housing and the potential available in this area, the council aims to significantly increase residential density. On the other hand, although there is a need for new housing in such neighbourhoods, the local residents may not be completely in favour of increasing the residential density and they may have concerns about the consequences of such changes. Therefore, even with such flexibility in target density, the final outcome might not be in favour of local residents.

This study does not suggest a particular method of finding the exact target density for a neighbourhood, but it aims to offer a design plus evaluation method to find a more locally acceptable solution using a more democratic procedure. In other words, the results of this study could be used to develop a better process of design and approval of intensification schemes instead of dictating a particular range of density for any locality. As the key outcome of this study is a proposed design and evaluation process, this process can be used as a tool for starting negotiation about design and density with local stakeholders. The inquiry by design process in this research could become part of the process of design approval for large scale housing design projects for any residential neighbourhood. In this way, a final design scheme could be developed in a more democratic way, using a participatory approach which involves local users. Hence, the final scheme would have a stronger rationale and be more acceptable to local users.

The process which is suggested in this study can be applied for approving neighbourhood design schemes by local authorities. Here, two ways to use and apply this process are suggested:

The first way is the long version of the procedure. The process should be carried out similar to the complete inquiry by design method suggested in this study. As figure 5.9 in the methodology chapter shows (Chapter Five), the process combines two types of test carried out via modelling and evaluation of the developed models. Following the complete process can be suggested when the method is used in a completely different context, such as countries in the Middle East or Asia which are experiencing rapid urbanisation. In such contexts, following the complete process may help to identify possible new urban form types or even new design qualities. The complete conceptual framework and analytical table of the study would need to be changed according to the local context. Therefore, the long procedure, as carried out in this study, should be adapted according to local needs.

The second way to apply the method is the short version. This version can be used mostly for other neighbourhoods in the context of the UK. In this version, the conceptual framework and analytical table can remain essentially the same. Figure 12.2 shows the main steps in this short version of applying the method of the study. The main change in this version relates to the demands and preferences of different neighbourhoods. This process is therefore just about the parts which may need adaptation based on local conditions. Therefore, the theoretical part of the study and the generic modelling would not need to be carried out again. Most of the changes would relate to adaptations in target density and design issues which are explored through the Q methodology. This is because these issues can change from one neighbourhood to another. This version of the research procedure can be completed in a short period of time and the results can be used to inform the local council of the most acceptable design scheme for the neighbourhood.

1. Localising the Conceptual Framework: Choosing the target density
The target density can vary from one neighbourhood to another. Based on the method used in this research, two key target densities can be chosen for any neighbourhood. One target can be close to but slightly higher than the existing density within the area. The second target should be a significantly higher density, according to the maximum recommended density target proposed by the local planning authority.
2. Adapting the Q methodology
This part is similar to the process of analysis of local place and people matters in Chapters Eight and Nine. The main alteration here is that the Q method in this study should be adapted according to the local context. Some of the Q cards should be altered and some new cards may need to be added to the study.
3. Developing models and alternatives
The process of developing models is similar to the inquiry by design method in Chapter Ten of this study. However, the priorities of the design qualities and the variety of design alternatives may be different from this research. The models should be designed according to the principles and priorities developed based on the results of the Q methodology analysis in Step 2.
4. Evaluating models
The basic analytical table of this study in Chapter Five can be used for other neighbourhoods. However, the table can be adapted based on the result of the Q method of inquiry in the local context. This process of adapting and localising the analytical table is explained in Chapter Ten section x.
5. Proposing the main design principles and priorities
Based on this localised design and evaluation process, the main principles and design alternatives can be proposed for densification of the neighbourhood. These results can be used as a tool for negotiating with local residents and authorities and to rationalise the design decisions.

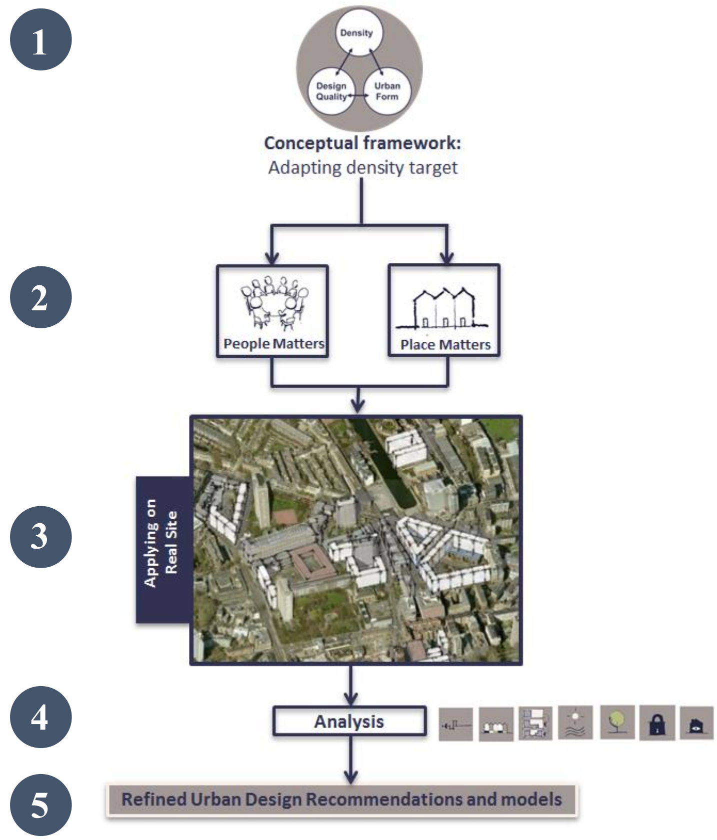


Figure 12.2: adaptation of the method for application in other neighbourhood developments in the UK context. The table explains the main parts that might need to be adapted based on physical and socio-cultural characteristic of the different neighbourhoods.

12.5 Limitations of the study

In this section the main limitations of the research are explored. This section explains how the research method could be improved and what other questions could be added to the study.

One limitation of the study is related to the conceptual framework. The research attempted to bring together all the key design qualities which are of concern to urban designers and discussed in the literature with regards to the issue of increasing density. However, there are some other indicators which could have been added to the study as sub indicators of the design qualities. The key indicators which are neglected here are urban heating problems and also the wind tunnel effect of high rise development. One of the reasons why these issues were not discussed in this research is that the main approach of the research is to focus on bringing local concerns into the design process. However, the above mentioned indicators would need more technical and laboratory testing and more quantitative analysis which might have changed the focus of the study.

On the other hand, issues relating to the wind tunnel effect were considered briefly while identifying the urban form types in Chapters Four and Six of the study. Three of the urban form types introduced for the modelling have a perimeter block shape with large footprint buildings around the periphery of the block. Such typologies minimise the wind tunnel effect at street level. Therefore, a brief consideration of such matters was carried out before starting the inquiry by design process.

Another issue related to the conceptual framework is that most of the design qualities which are discussed here, based on the main body of the urban design literature, are related to environmental and social aspects of neighbourhoods. On the other hand, the economic aspects of increasing density could also have been included in the study. Issues such as the increase in social housing and the affordability of dwellings in high density developments could be added to the framework. Such issues may have less impact on the physical form of the models in different ranges of density, but they have more value because they are key to negotiation with local residents. This is because a key issue in the acceptability of a design scheme by local residents is likely to be the reduction in housing prices. In other words, if economic factors are taken into account, local residents may agree with some of the compromises in higher density design in order to make housing more affordable.

The other limitation of the study is in regard to the research method. For the second part of the testing, the study focused on one neighbourhood. This is because the process of testing does not only consist of data gathering and analysis of the case studies, but also includes modelling at various densities, changing the design schemes accordingly and comparing the models. For this reason, because of the extended research process, the focus of this study was on one case. However, the use of two or three cases would help to validate the results of the study. Most importantly, comparison of the Q methodology results in two neighbourhoods might improve understanding of the degree of difference between local users' attitude to housing design and intensification in different neighbourhoods.

Another limitation concerns the measurement of design qualities. The study tries to comprehensively bring together all design qualities so that the interrelationships among them can be scrutinized during the design process. Hence, a very in depth analysis of particular qualities was not possible and overall delivery of the design qualities was evaluated instead. Some of these qualities, such as a sense of safety and privacy, are also descriptive and cannot be accurately measured, particularly in a simulated model of a neighbourhood. Some of these qualities are also contingent and thus, they depend on the context and experience of users after the development of the design proposals in the neighbourhood. Therefore, since the analysis has been carried out for design models and not for real neighbourhoods, it was not possible to evaluate some aspects of the models; for example, to evaluate the quality of legibility, the more accurate method is the use of mind maps, but because of the use of computer models in the testing part of this research, such types of evaluation were not possible. Overall, the research focused on the delivery of all urban design qualities as a whole, instead of looking very in depth at a few of them and neglecting the others.

12.6 Areas for further research

The main areas for further study recommended here relate to modifying the research approaches and methods. The second key areas are about changing the focus of the case studies to other geographical contexts and also to other urban typologies.

In terms of the research approach, one recommendation would be to focus more on case study analysis instead of the inquiry by design approach. Although such approaches have been used and explored in previous studies such as those by Alexander (1988) and DETR (1998) and discussed in Chapters One and Six, there is still potential for further use of case study analysis approaches. This study shows one method of identifying the main patterns of change in urban form and of categorising the typologies of residential development. This study also provides clear indicators and criteria for evaluating design qualities. Using this method of categorisation and evaluation, a large number of real examples of high density residential developments could be analysed and this might identify the degree to which each type can deliver different design qualities. Such studies would show designers a large number of potential design options in high density schemes and the possible consequences of using each option in terms of the delivery of various qualities.

The other main area for further research relates to changing the focus of the study to other typologies of buildings. This would be particularly useful for evaluating urban forms in business centres of the city with non-residential uses. A similar method to the one in this research might be used to identify the main characteristics of the physical elements of the urban form for these predominantly non-residential urban areas. The main differences might be found in the footprint and depth of buildings, the common size of plots and also the use and distribution of open spaces. Identifying typical urban forms in the same way as carried out in the conceptual framework of this research might help to show the main patterns of change in such typologies. As a result, the main variations in form in different ranges of density could be easily detected. Such a study would also help to understand the main differences between residential and non-residential types of urban form in high density developments. This is an important issue because some very high-rise/ high density areas of cities are predominantly non-residential and so they do not have the same characteristics or urban form types as explored in this research.

The other potential area of study might be to do with urban density in other geographical/ cultural contexts. The inquiry by design method in this study could be used in different contexts such as in high density residential developments in Asian cities. In such cases, the main differences in the findings of the study might related to the perceptions of the locality and the degree of acceptability of high density urban forms in contrast with the UK context. Therefore, the social aspects of the study might significantly change the final outcomes in terms of neighbourhood models and design principles.

Furthermore, planning policies at the city or regional scale in other countries may target a higher density than the one explored in this study. This study focused on a density range between 200dph and 400dph based on common practice and the maximum acceptable standards in the UK context. However, in other cities, particularly those with rapid urban growth, the target density might be completely different from this. In such cases, the same inquiry by design method introduced in this research could be used, but there would be a need to make some alterations in the deign process. These alterations would mostly relate to setting new design standards based on local needs and making changes in the urban form types introduced in the conceptual framework in order to reach the new target density.

Moreover, the climate in other geographical contexts could influence the outcomes of the research. As an example, the differences in the climate of Middle Eastern countries could significantly change the outcomes of the research. In other contexts, different patterns of urban form and typologies are common. Therefore, throughout the modelling process, different standards and urban form types should be used and therefore the final outcome may vary from the one in this thesis. The main issue here is that the inquiry by design method in this study can be modified in such a way as to be applicable to other contexts. These modifications can lie in the urban form patterns, or the priority given to different design qualities based on local needs. While the overall method would be the same as in this thesis, the outcome would be completely different, based on local conditions.

From another point of view, future changes in the theory and practice of urban design could be included in the context of this research. For example, the overall research method in this study could be used in the future for any new urban forms which arise. This study focused on the existing common types of urban form which can deliver urban design qualities. However, possible new types of urban form may be developed in the future which may be different from the current examples. In such cases, the new urban form patterns can be identified and included in the conceptual framework and inquiry by design process of the research. Thus, the study is sufficiently flexible for further use, not just for other geographical contexts, but also for other periods of time. In the same manner, the urban design qualities may well change to some extent or new qualities may be added based on new studies or a different understanding of the needs of users. Again, such possible future changes could be applied to the analytical framework of this research by adding new qualities and indicators or by altering the existing ones. It appears that the study could be continually usable by incorporating the new body of knowledge in the field of built environment.

As the final point of the thesis, it can be stated that this research aimed to contribute to the practice of improving the sustainability of cities. One way of attaining sustainable cities is to increase the urban density, which was the main focus of this study. In this research, it appears that local residents may not be completely in favour of such densification. In other words, although densification may eventually improve the sustainability of the city as a whole, this process may have some negative impacts and may conflict with the interests of local residents.

Densification is about finding a balance between the demands and preferences of people on a global scale through to city scale and finally to neighbourhood scale. Sometimes, in order to improve sustainability on a global scale, it is necessary to compromise at the small scale such as within cities and also neighbourhoods. In other words, in order to reach sustainability targets for the city as a whole, it might be necessary to compromise some qualities at the neighbourhood scale.

The way in which such conflicts might be resolved is to develop a better understanding of the conflicts and trade-offs between local and global interests, and to negotiate with the local community throughout the process of change. Such communication with local users means they can be informed about the need for change, and the inevitable compromises which may be needed in their neighbourhood. The interests and preferences of the locality could well become more influential throughout the process of physical change in the neighbourhood. Therefore, the final outcome will be more acceptable to the local community.

Finally, in order to find a balance between global and local interests, it is necessary to inform local communities more precisely about the trade-offs involved and also to take their concerns into account as much as possible.

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Appendix one: email version of the q method

The cover email for survey:

Dear ....

My name is Soroush Nikeghbali. I am a PhD researcher in the field of urban design in department of Planning, Oxford Brookes University. My research topic is related to new housing development. Particularly I am interested in quality of future residential developments in Finsbury area. As part of my study I need to bring into account the local residents point of view and also comments of built environment professionals which are familiar with Finsbury area about appropriate design ideas for this neighbourhood.

May I ask you please to spend some time and take part in this study?

I have attached a graphical questionnaire to this email. It is a simple exercise about sorting some graphical images/statements. Doing the exercise will not take long time, is actually fun and gives you new ideas about design of neighbourhoods.

Also could you please forward this email to other residents of this area or nearby areas in Islington or hackney or professionals in the field of built environment who had previously involved in developments of Finsbury area?

Many thanks for your time and help.

For your convenience, I have also attached an Informative document if you like to have more information about the research.

Sincerely
Soroush Nikeghbali

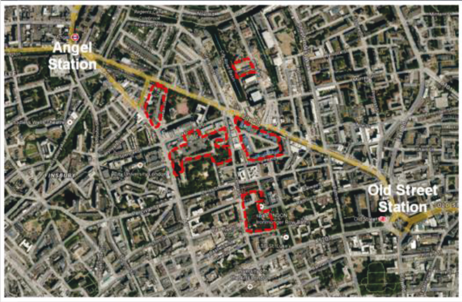
The power point page made for doing the sorting process on computer (2 pages):

First of all, thank you for participating in this research.

This study is related to housing development in South Islington. The following image shows part of the area which is designated for future housing development. This research seeks understand housing design preferences and concerns of residents in the area.

This is an academic research for Oxford Brookes University. It is not related to Islington council, nor any development project within the area. The results of this study may be helpful to inform the Islington council about residents' preferences for their future housing projects.

OXFORD BROOKES UNIVERSITY

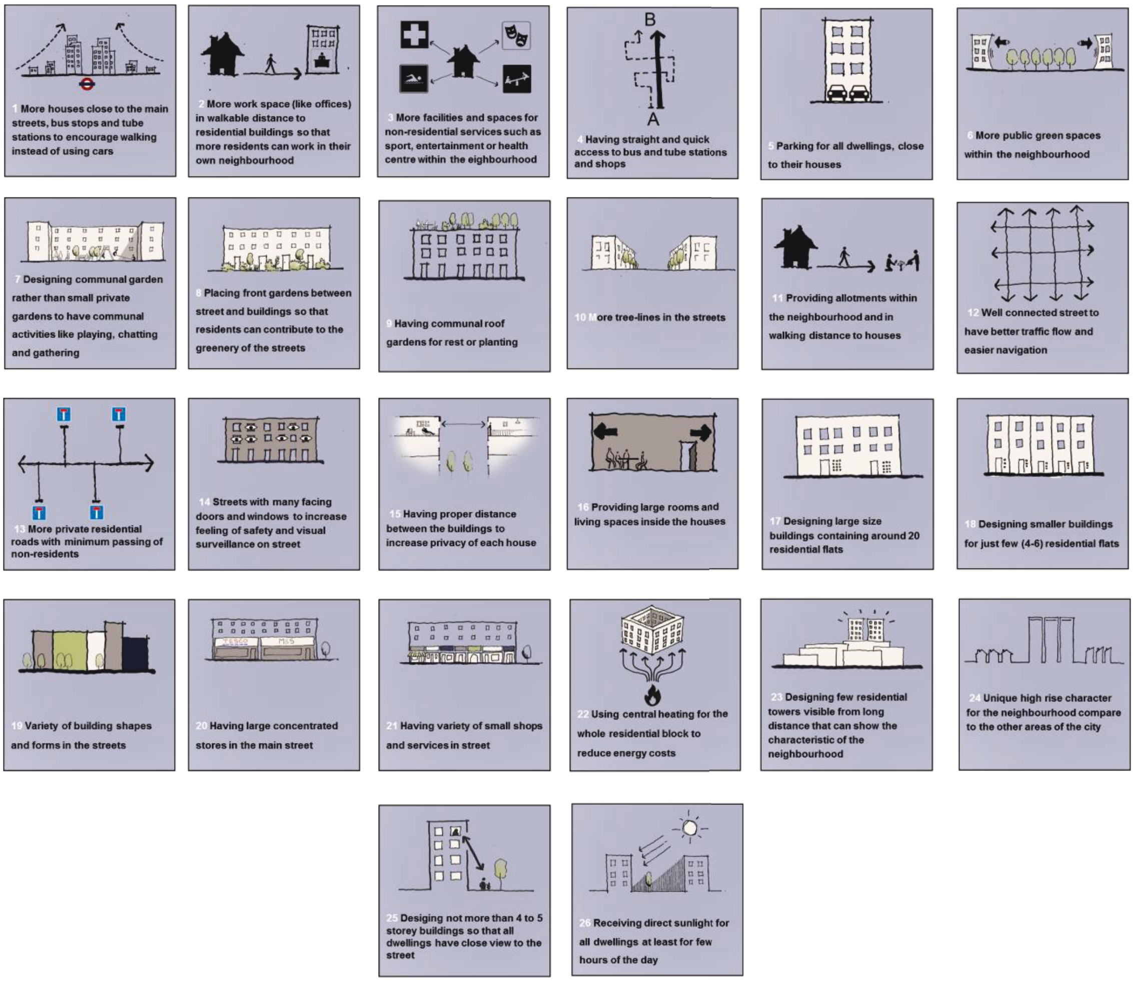


Potential sites for new housing based on Finsbury Local Plan

We are invite you to participate in a simple exercise. Please read the following statements written in individual boxes. The statements are some simple design ideas which can be applied to new developments in South Islington. Then place the cards on the table based on the degree of your agreement with these ideas. This exercise is just about comparing and prioritising ideas. Therefore, placing a statement on favourable side does not mean that you are fully agreed with it. It just means that this statement is more favourable compare to the others.

Here is the step by step instruction:

1. **Please read the design ideas which are presented in individual blue boxes.**
2. **Select each card individually from the edges of the card, then drag and place it in one of the grey boxes on the table (you can zoom back the screen to make dragging easier.)**
3. **If you would like, you can review the table and make final alterations.**



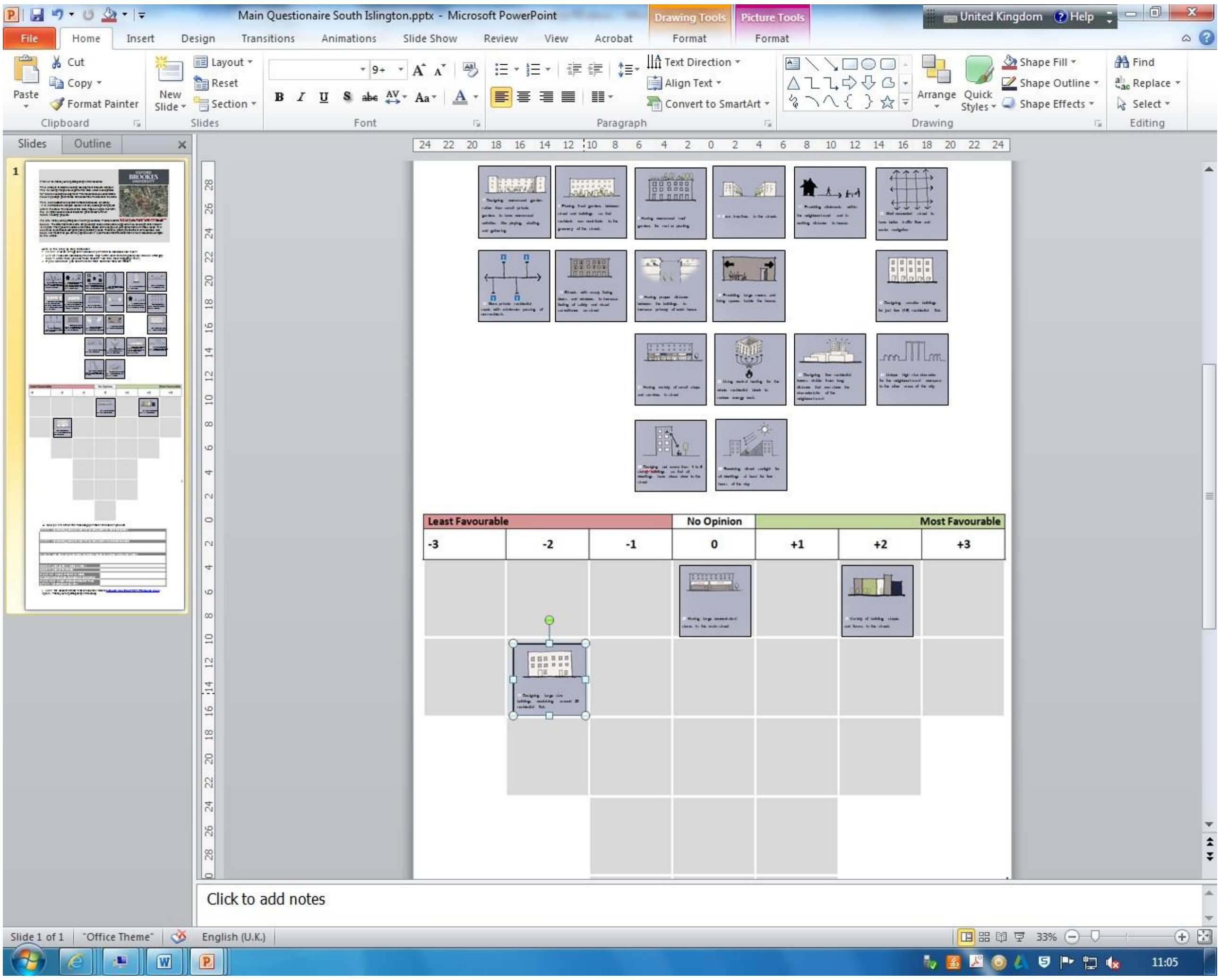
Least Favourable			No Opinion			Most Favourable
-3	-2	-1	0	+1	+2	+3

4. Now please answer the following questions as much as you can.

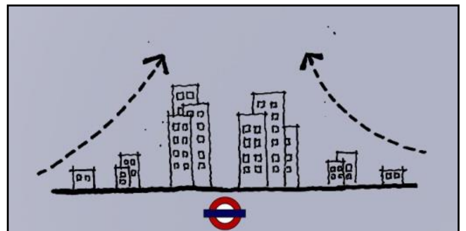
Please explain why you have chosen specific cards as most favourable.	
Please explain why you have chosen specific card as most unfavourable	
Is there any other idea/comment you think should be considered for this study?	
What is your gender? (Male/Female)	
What is your year of birth?	
If you are a local resident, in which neighbourhood and borough are you living?	
If you have a Built environment profession, please specify your expertise.	

5. Save the document and send it back via email to soroush.nikeghbali-2011@brookes.ac.uk
Again, Thank you for participating in this study.

Appearance of the computer version of q method sorting:

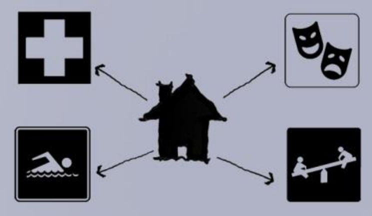


Appendix two: Q sort cards on actual size (Page1)

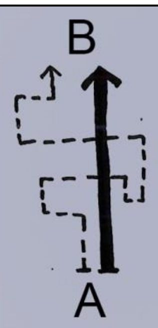


1 More houses close to the main streets, bus stops and tube stations to encourage walking instead of using cars

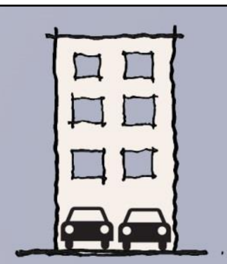
2 More work space (like offices) in walkable distance to residential buildings so that more residents can work in their own neighbourhood



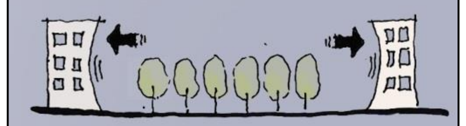
3 More facilities and spaces for non-residential services such as sport, entertainment or health centre within the neighbourhood



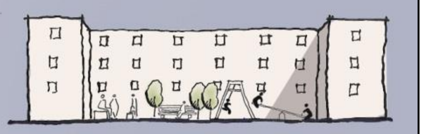
4 Having straight and quick access to bus and tube stations and shops



5 Parking for all dwellings, close to their houses



6 More public green spaces within the neighbourhood



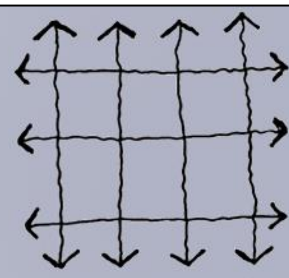
7 Designing communal garden rather than small private gardens to have communal activities like playing, chatting and gathering

8 Placing front gardens between street and buildings so that residents can contribute to the greenery of the streets

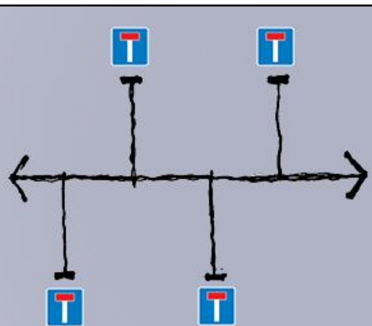
9 Having communal roof gardens for rest or planting

10 More tree-lines in the streets

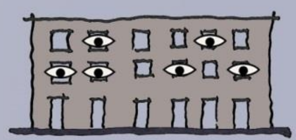
11 Providing allotments within the neighbourhood and in walking distance to houses



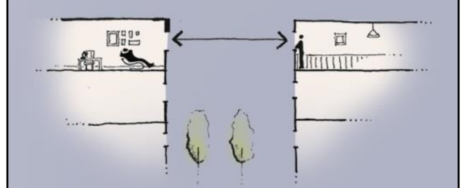
12 Well connected street to have better traffic flow and easier navigation



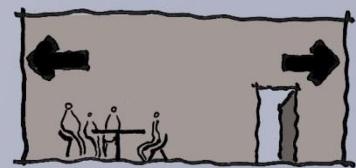
13 More private residential roads with minimum passing of non-residents



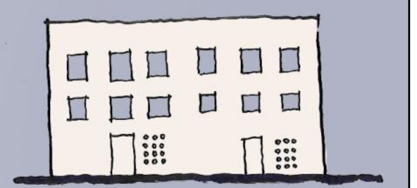
14 Streets with many facing doors and windows to increase feeling of safety and visual surveillance on street



15 Having proper distance between the buildings to increase privacy of each house



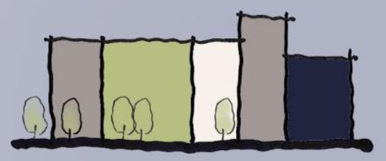
16 Providing large rooms and living spaces inside the houses



17 Designing large size buildings containing around 20 residential flats

18 Designing smaller buildings for just few (4-6) residential flats

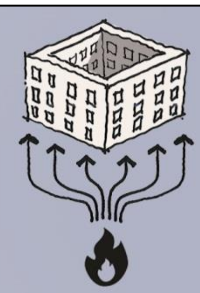
Appendix two: Q sort cards on actual size (Page 2)



19 Variety of building shapes and forms in the streets

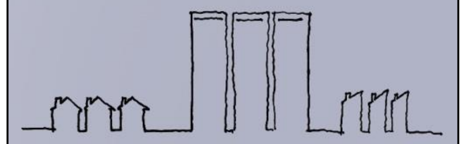
20 Having large concentrated stores in the main street

21 Having variety of small shops and services in street

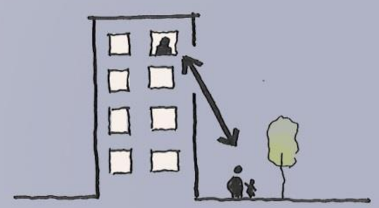


22 Using central heating for the whole residential block to reduce energy costs

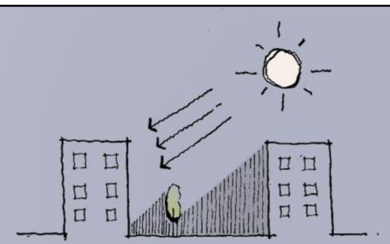
23 Designing few residential towers visible from long distance that can show the characteristic of the neighbourhood



24 Unique high rise character for the neighbourhood compare to the other areas of the city

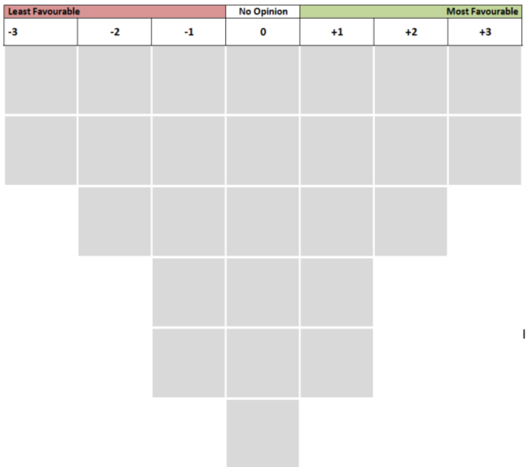


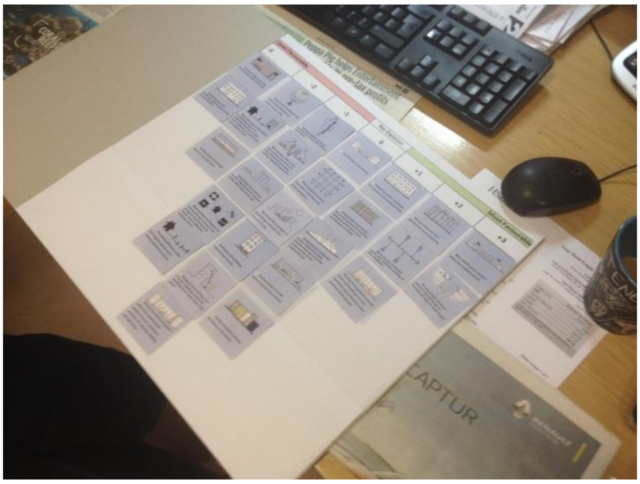
25 Designing not more than 4 to 5 storey buildings so that all dwellings have close view to the street



26 Receiving direct sunlight for all dwellings at least for few hours of the day

Appendix Three: Sorting tables





-3	-2	-1	0	1	2	3
16	2	1	5	14	8	6
17	20	3	7	18	9	15
	22	4	10	19	13	
		11	12	21		
		24	25	23		
			26			

res10

-3	-2	-1	0	1	2	3
9	16	5	1	3	4	6
15	21	8	2	7	12	10
	26	11	17	13	20	
		14	18	22		
		25	19	24		
			23			

res1

-3	-2	-1	0	1	2	3
13	5	7	3	12	1	2
17	9	10	11	14	6	4
	26	20	15	18	8	
		24	16	21		
		25	19	22		
			23			

res2

-3	-2	-1	0	1	2	3
12	9	4	2	5	7	1
26	13	6	3	10	14	15
	19	8	17	18	16	
		11	23	21		
		20	24	22		
			25			

res3

-3	-2	-1	0	1	2	3
23	8	5	1	4	3	15
24	19	10	2	7	14	16
	20	17	6	9	26	
		18	12	11		
		21	13	25		
			22			

res4

-3	-2	-1	0	1	2	3
12	9	5	2	1	15	19
13	11	10	3	4	16	26
	14	20	6	17	22	
		23	7	18		
		24	8	25		
			21			

res5

-3	-2	-1	0	1	2	3
14	9	6	2	1	3	5
23	10	7	12	4	17	11
	13	8	16	15	21	
		20	18	19		
		22	24	26		
			25			

res6

-3	-2	-1	0	1	2	3
7	9	18	2	1	5	3
8	13	19	12	10	6	4
	17	20	14	11	24	
		23	21	15		
		25	22	16		
			26			

res7

-3	-2	-1	0	1	2	3
3	8	9	15	1	2	4
17	19	11	18	10	5	6
	24	13	20	12	7	
		21	22	14		
		26	23	16		
			25			

res8

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 21 ! 20 !  1 !  2 ! 13 !  8 !  3 !
!----!----!----!----!----!----!----!
! 24 ! 22 !  5 !  4 ! 14 ! 11 !  6 !
!----!----!----!----!----!----!----!
     ! 26 ! 10 !  7 ! 15 ! 12 !
     !----!----!----!----!----!
          ! 23 !  9 ! 18 !
          !----!----!----!
          ! 25 ! 16 ! 19 !
          !----!----!----!
               ! 17 !
               !----!
res9
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 16 !  2 !  1 !  5 ! 14 !  8 !  6 !
!----!----!----!----!----!----!----!
! 17 ! 20 !  3 !  7 ! 18 !  9 ! 15 !
!----!----!----!----!----!----!----!
     ! 22 !  4 ! 10 ! 19 ! 13 !
     !----!----!----!----!----!
          ! 11 ! 12 ! 21 !
          !----!----!----!
          ! 24 ! 25 ! 23 !
          !----!----!----!
               ! 26 !
               !----!
res10
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 19 !  4 !  8 ! 11 !  2 !  7 !  1 !
!----!----!----!----!----!----!----!
! 24 ! 17 !  9 ! 13 !  3 ! 18 !  6 !
!----!----!----!----!----!----!----!
     ! 23 ! 10 ! 14 !  5 ! 22 !
     !----!----!----!----!----!
          ! 16 ! 15 ! 12 !
          !----!----!----!
          ! 20 ! 25 ! 21 !
          !----!----!----!
               ! 26 !
               !----!
res11
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 19 !  4 ! 12 !  1 !  3 !  8 ! 10 !
!----!----!----!----!----!----!----!
! 24 !  7 ! 14 !  2 !  5 !  9 ! 21 !
!----!----!----!----!----!----!----!
     ! 17 ! 22 ! 11 !  6 ! 20 !
     !----!----!----!----!----!
          ! 23 ! 13 ! 15 !
          !----!----!----!
          ! 26 ! 18 ! 16 !
          !----!----!----!
               ! 25 !
               !----!
res12
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 20 ! 12 !  3 !  1 !  7 !  2 !  6 !
!----!----!----!----!----!----!----!
! 24 ! 17 !  4 ! 14 !  8 ! 11 !  9 !
!----!----!----!----!----!----!----!
     ! 23 !  5 ! 16 ! 10 ! 26 !
     !----!----!----!----!----!
          ! 13 ! 18 ! 15 !
          !----!----!----!
          ! 19 ! 22 ! 21 !
          !----!----!----!
               ! 25 !
               !----!
res13
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 13 ! 22 !  7 !  5 !  1 !  3 !  4 !
!----!----!----!----!----!----!----!
! 17 ! 23 ! 10 !  8 !  2 !  9 !  6 !
!----!----!----!----!----!----!----!
     ! 24 ! 12 ! 18 ! 11 ! 20 !
     !----!----!----!----!----!
          ! 14 ! 19 ! 15 !
          !----!----!----!
          ! 16 ! 21 ! 26 !
          !----!----!----!
               ! 25 !
               !----!
res14
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 19 !  9 !  4 ! 11 !  2 !  1 !  3 !
!----!----!----!----!----!----!----!
! 24 ! 17 !  8 ! 12 !  5 !  7 !  6 !
!----!----!----!----!----!----!----!
     ! 23 ! 10 ! 14 ! 13 ! 18 !
     !----!----!----!----!----!
          ! 16 ! 15 ! 21 !
          !----!----!----!
          ! 20 ! 25 ! 22 !
          !----!----!----!
               ! 26 !
               !----!
res15
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 17 ! 12 !  4 !  2 !  1 !  8 !  6 !
!----!----!----!----!----!----!----!
! 24 ! 20 ! 11 !  3 !  9 ! 13 ! 15 !
!----!----!----!----!----!----!----!
     ! 22 ! 16 !  5 ! 14 ! 18 !
     !----!----!----!----!----!
          ! 19 !  7 ! 21 !
          !----!----!----!
          ! 25 ! 10 ! 23 !
          !----!----!----!
               ! 26 !
               !----!
res16
```

```
 -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 19 !  4 !  7 ! 11 !  1 !  8 !  3 !
!----!----!----!----!----!----!----!
! 24    9 ! 12 ! 13 !  2 ! 10 ! 21 !
!----!----!----!----!----!----!----!
     ! 17 ! 22 ! 14 !  5 ! 20 !
     !----!----!----!----!----!
          ! 23 ! 16 !  6 !
          !----!----!----!
          ! 26 ! 18 ! 15 !
          !----!----!----!
               ! 25 !
               !----!
res17
```

```
 -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 17 ! 12 !  8 !  5 !  1 !  4 !  3 !
!----!----!----!----!----!----!----!
! 24 ! 13 ! 10 !  7 !  2 !  9 !  6 !
!----!----!----!----!----!----!----!
     ! 23 ! 14 ! 18 ! 11 ! 21 !
     !----!----!----!----!----!
          ! 16 ! 19 ! 15 !
          !----!----!----!
          ! 22 ! 20 ! 26 !
          !----!----!----!
               ! 25 !
               !----!
res21
```

```
 -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 20 ! 12 !  4 !  1 !  7 !  2 !  6 !
!----!----!----!----!----!----!----!
! 24 ! 17 !  5 !  3 !  8    9 ! 15 !
!----!----!----!----!----!----!----!
     ! 23 ! 13 ! 14 ! 10 ! 26 !
     !----!----!----!----!----!
          ! 19 ! 16 ! 11 !
          !----!----!----!
          ! 25 ! 18 ! 21 !
          !----!----!----!
               ! 22 !
               !----!
res18
```

```
 -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 13 ! 19 !  7 !  5 !  2 !  1 !  4 !
!----!----!----!----!----!----!----!
! 17 ! 23 ! 11 !  8 !  3 ! 10 !  6 !
!----!----!----!----!----!----!----!
     ! 24 ! 12 !  9 ! 15 ! 20 !
     !----!----!----!----!----!
          ! 14 ! 21 ! 18 !
          !----!----!----!
          ! 16 ! 22 ! 26 !
          !----!----!----!
               ! 25 !
               !----!
res22
```

```
 -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
!  9 ! 15 !  5 !  1 !  7 !  3 !  6 !
!----!----!----!----!----!----!----!
! 16 ! 19 !  8 !  2 ! 13    4 ! 10 !
!----!----!----!----!----!----!----!
     ! 21 ! 11 ! 17 ! 20 ! 12 !
     !----!----!----!----!----!
          ! 14 ! 18 ! 22 !
          !----!----!----!
          ! 23 ! 24 ! 25 !
          !----!----!----!
               ! 26 !
               !----!
res19
```

```
 -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 19 !  9 !  5 ! 12 !  2 !  7 !  1 !
!----!----!----!----!----!----!----!
! 24 ! 17 !  8 ! 13 !  3 ! 18 !  6 !
!----!----!----!----!----!----!----!
     ! 20 ! 10 ! 14 !  4 ! 21 !
     !----!----!----!----!----!
          ! 16 ! 15 ! 11 !
          !----!----!----!
          ! 23 ! 25 ! 22 !
          !----!----!----!
               ! 26 !
               !----!
res23
```

```
 -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 19 !  8 !  5 !  1 !  4 !  3 ! 10 !
!----!----!----!----!----!----!----!
! 23 ! 20 !  9 !  2 !  7 ! 14 ! 15 !
!----!----!----!----!----!----!----!
     ! 24 ! 11 !  6 ! 16 ! 26 !
     !----!----!----!----!----!
          ! 17 ! 12 ! 18 !
          !----!----!----!
          ! 21 ! 13 ! 22 !
          !----!----!----!
               ! 25 !
               !----!
res20
```

```
 -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
!  8 ! 15 !  5 !  2 !  1 !  4 ! 10 !
!----!----!----!----!----!----!----!
! 16 ! 21 !  9 !  3 ! 12 !  6 ! 20 !
!----!----!----!----!----!----!----!
     ! 26 ! 11 !  7 ! 13 ! 17 !
     !----!----!----!----!----!
          ! 14 ! 18 ! 22 !
          !----!----!----!
          ! 25 ! 19 ! 24 !
          !----!----!----!
               ! 23 !
               !----!
res24
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 21 !  8 !  5 !  1 !  2 ! 11 !  3 !
!----!----!----!----!----!----!----!
! 23 ! 18 ! 10 !  4 !  7 ! 15 ! 14 !
!----!----!----!----!----!----!----!
     ! 20 ! 17 !  6 ! 13 ! 26 !
     !----!----!----!----!----!
          ! 22 !  9 ! 16 !
          !----!----!----!
          ! 24 ! 12 ! 25 !
          !----!----!----!
               ! 19 !
               !----!
res25
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 17 !  4 !  1 !  5 !  9 !  6 !  8 !
!----!----!----!----!----!----!----!
! 20 ! 16 !  2 !  7 ! 10 ! 13 ! 15 !
!----!----!----!----!----!----!----!
     ! 24 !  3 ! 18 ! 11 ! 14 !
     !----!----!----!----!----!
          ! 12 ! 19 ! 21 !
          !----!----!----!
          ! 22 ! 23 ! 26 !
          !----!----!----!
               ! 25 !
               !----!
res26
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 17 !  4 !  9 !  2 !  5 !  1 !  6 !
!----!----!----!----!----!----!----!
! 23 ! 19 ! 10 !  3 ! 12 !  7 ! 18 !
!----!----!----!----!----!----!----!
     ! 24 ! 11 !  8 ! 13 ! 22 !
     !----!----!----!----!----!
          ! 16 ! 15 ! 14 !
          !----!----!----!
          ! 26 ! 20 ! 21 !
          !----!----!----!
               ! 25 !
               !----!
res27
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 16 !  9 !  1 !  5 !  4 !  2 !  6 !
!----!----!----!----!----!----!----!
! 17 ! 18 !  3 !  7 ! 19 !  8 ! 15 !
!----!----!----!----!----!----!----!
     ! 24 ! 11 ! 10 ! 20 ! 13 !
     !----!----!----!----!----!
          ! 14 ! 12 ! 21 !
          !----!----!----!
          ! 23 ! 25 ! 22 !
          !----!----!----!
               ! 26 !
               !----!
res28
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 17 !  4 !  8 ! 10 !  2 !  7 !  1 !
!----!----!----!----!----!----!----!
! 23 ! 19 !  9 ! 13 !  3 ! 18 !  6 !
!----!----!----!----!----!----!----!
     ! 24 ! 11 ! 14 !  5 ! 22 !
     !----!----!----!----!----!
          ! 16 ! 15 ! 12 !
          !----!----!----!
          ! 20 ! 25 ! 21 !
          !----!----!----!
               ! 26 !
               !----!
res29
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 12 !  5 !  9 !  2 !  1 !  3 !  8 !
!----!----!----!----!----!----!----!
! 13 ! 17 ! 11 ! 14 !  7 !  4 ! 19 !
!----!----!----!----!----!----!----!
     ! 20 ! 16 ! 15 ! 10 !  6 !
     !----!----!----!----!----!
          ! 18 ! 21 ! 23 !
          !----!----!----!
          ! 25 ! 22 ! 24 !
          !----!----!----!
               ! 26 !
               !----!
PRO1
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
!  2 !  3 ! 11 ! 10 !  1 !  7 !  6 !
!----!----!----!----!----!----!----!
!  9 ! 13 ! 18 ! 14 !  4 !  8 ! 12 !
!----!----!----!----!----!----!----!
     ! 21 ! 23 ! 15 !  5 ! 26 !
     !----!----!----!----!----!
          ! 24 ! 16 ! 20 !
          !----!----!----!
          ! 25 ! 17 ! 22 !
          !----!----!----!
               ! 19 !
               !----!
PRO2
```

```
  -3   -2   -1    0    1    2    3
!----!----!----!----!----!----!----!
! 13 !  5 !  2 !  3 !  8 !  7 !  1 !
!----!----!----!----!----!----!----!
! 24 ! 17 !  4 ! 10 !  9 ! 19 !  6 !
!----!----!----!----!----!----!----!
     ! 20 ! 15 ! 12 ! 11 ! 25 !
     !----!----!----!----!----!
          ! 22 ! 14 ! 18 !
          !----!----!----!
          ! 26 ! 16 ! 21 !
          !----!----!----!
               ! 23 !
               !----!
PRO3
```

-3	-2	-1	0	1	2	3
5	11	2	8	1	10	6
13	20	4	14	3	12	15
	24	22	16	7	26	
		23	17	9		
		25	18	21		
			19			

PRO4

-3	-2	-1	0	1	2	3
17	13	2	4	8	1	6
24	20	3	9	10	7	18
	22	5	12	11	25	
		15	14	19		
		26	16	21		
			23			

PRO5

-3	-2	-1	0	1	2	3
13	1	5	4	3	7	6
20	2	17	9	10	18	8
	24	19	11	14	21	
		23	12	15		
		25	16	26		
			22			

PRO6

-3	-2	-1	0	1	2	3
23	15	3	4	6	1	2
24	17	5	12	7	10	9
	20	11	18	8	14	
		13	21	16		
		19	22	25		
			26			

PRO7

-3	-2	-1	0	1	2	3
2	9	3	10	1	6	8
13	21	11	14	4	7	12
	23	16	15	5	19	
		18	17	22		
		24	20	26		
			25			

PRO8

-3	-2	-1	0	1	2	3
20	2	1	3	4	6	8
24	13	5	9	7	18	10
	17	19	11	14	21	
		22	12	15		
		25	16	26		
			23			

PRO9

-3	-2	-1	0	1	2	3
2	21	9	3	1	7	6
13	23	11	14	4	10	8
	24	16	15	5	12	
		17	19	22		
		18	20	26		
			25			

PRO10

-3	-2	-1	0	1	2	3
17	13	4	2	7	8	1
24	16	5	3	10	18	6
	20	15	9	12	25	
		22	11	19		
		26	14	21		
			23			

PRO11