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Where planning and design meet: transformation of urban tissue under densification policy – the case of Oslo

Hvor planlegging og design møtes: transformasjon av bystruktur som et resultat av fortettingspolitikken – eksempel Oslo

Gordana Zurovac

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Dedication

To my mother Darinka and my late father Dragomir

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Contents

Abstract

Over the past few decades, urban planning has been distancing itself from architecture and engineering, becoming increasingly dominated by strategic approaches and goals for sustainability. This shift of focus has created a gap, which is also possible to observe in the Norwegian planning context. Despite this gap, built structures and physical urban form still represent a significant part of the outcomes of urban planning. This empirically based PhD thesis aims to explore the physical outcomes of the current planning for densification in Norway, using Oslo as the case. The study includes two main analytical aspects: spatial and procedural.

The main research question posed in the thesis is, "What are the morphological characteristics of the physical outcomes of densification in Oslo, and what spatially related concerns have influenced the design of those outcomes?" Six sub-questions address spatial and procedural components of the analysis in further detail.

The field of urban morphology offers theoretical lenses for an integrative analysis of both the spatial and procedural aspects. In the spatial part of the analysis, the main concepts applied are *urban tissue*, *constituted tissue*, *urban block*, and *architectural type*. The spatial analysis covers the intermediate spatial scale (between a building and several urban blocks). The procedural part of the analysis encompasses three components – planning, actors, and design. The main concepts in this step are *planning instrument*, *strategic* and *project plans*, *actors*, and the *articulation* of physical form and architectural functions.

The study is designed as an embedded case study, with Oslo (its built-up area) as the main case and 71 multi-family residential buildings as sub-cases. In addressing each research sub-question, specific methods have been used: site visits, analysis of maps and aerial photos, document analysis and interviews.

The results expose a large variety of types of previously existing urban tissue that have undergone densification, a considerable variety of physical outputs of densification, and strong interrelations between the pre-existing urban tissue and the new structures. Among the analysed sub-cases, context-dependence appears both in terms of built form and the distribution of architectural functions. Regarding the spatially related concerns that arose in the planning processes, a number of considerations are common in the analysed cases (e.g. building heights and density), while a greater number of the considerations are site-specific, indicating that the design in densification places great attention on the immediate spatial context.

Considering the principles of the addition of new built masses at the intermediate spatial scale, the new structures have been added in numerous ways. A fairly surprising finding was that the morphological element of urban block continues to play a significant role in the design of new multi-family residential buildings. Entirely new urban blocks occur both in the pre-existing urban tissue dating from pre-modernist era and in the land-use transformation areas.

The new developments also relate to pre-existing urban blocks as additions (infills), thus contributing to a further consolidation of the pre-existing urban blocks. The study also identifies that densification in Oslo produces a particular architectural type, namely the "podium type", and exposes its varieties relative to the topographic features of the sites.

The planning instruments at the municipal planning level (i.e., identified among the analysed cases) partially provided the inputs for the design at the intermediate spatial scale. The analysis exposes a locally adopted planning instrument in Oslo – guiding plan for public spaces (*Veiledende plan for offentlige rom* [VPOR]), which has been devised with the aim to provide guidelines for design of more coherent urban areas, beyond the extent of particular, individual architectural projects. This instrument indicates the need for planning practice to re-establish connections between planning and design.

Norsk sammendrag

I løpet av de siste tiårene er byplanleggingen i økende grad blitt dominert av overordnet strategisk tenking og mål for bærekraft, og har distansert seg fra arkitektur og prosjektering. Denne endringen av fokus har skapt en kløft som også er mulig å observere i norsk planleggingssammenheng. Til tross for denne kløften, representerer bygde strukturer og fysisk byform fortsatt en betydelig del av resultatene fra byplanlegging. Denne empiribaserte PhD-avhandlingen tar sikte på å utforske de fysiske resultatene av nåværende planlegging for fortetting i Norge og bruker Oslo som case. Studien omfatter to analytiske aspekter: romlig og prosessuell analyse.

Det overordnede forskningsspørsmålet som stilles i oppgaven er: "Hva er de morfologiske egenskapene til de fysiske resultatene av fortetting i Oslo, og hvilke romlige hensyn har påvirket utformingen av disse resultatene?" Seks underspørsmål tar for seg de romlige og prosessuelle komponentene av de to analytiske aspektene.

Bymorfologi tilbyr et teoretisk perspektiv for å analysere både de romlige og prosessuelle aspekter på en integrert måte. I den romlige analysen er følgende hovedbegrep benyttet: *byvev*, *konstituert byvev* (byvev før fortetting), *kvartal* og *bygningstype*. Den romlige analysen dekker den romlige skalaen på mellomliggende nivå (mellom en bygning og flere kvartaler). Den prosessuelle delen av analysen omfatter tre komponenter: planlegging, aktører og design. Denne delen av analysen undersøker *planleggingsinstrumenter*, *aktører* og *artikulering* av fysisk form og arkitektoniske funksjoner.

Studien bygger på en integrert ("embedded") casestudie med Oslo (det bebygde området) som case og 71 flerfamilieboliger som under-case. For å belyse hvert enkelt underspørsmål er følgende metoder brukt: feltstudier, analyse av kart og flyfoto, dokumentanalyse og intervjuer.

Resultatene avdekker at fortettingen i Oslo har foregått i mange forskjellige varianter av eksisterende byvev og har resultert i en stor variasjon av fortettingsformer (f.eks. infill, transformasjon, etc.). Klaresammenhenger mellom den eksisterende byveven og de nye strukturene er også identifisert. Blant de analyserte under-casene vises tegn på kontekstavhengighet både når det gjelder bygd form og fordelingen av arkitektoniske funksjoner. Analysen av casene avdekket også at noen av de romlig relaterte hensynene som ble diskutert i planprosessene, var felles (f.eks. byggehøyder og tetthet), mens flere av hensynene var stedsspesifikke. Dette indikerer at utformingen i tilknytning til fortettingsprosesser i stor grad tar hensyn til den nære romlige konteksten.

På den mellomliggende ("intermediate") romlige skalaen, er den nye bebyggelsen innpasset på mange måter. Et noe overraskende funn var at det morfologiske elementet kvartal fortsetter å spille en betydelig rolle i utformingen av nye flerfamilieboliger. Helt nye kvartaler forekommer både i den eksisterende byveven som stammer fra førmodernistisk tid og i transformasjonsområder.

De nye boligprosjektene kan også være en utvidelse av eksisterende kvartaler (såkalte "infills"), og bidrar dermed til å konsolidere kvartalsformen ytterligere. Studien har videre identifisert at fortetting i Oslo resulterer i en bestemt bygningstype, nemlig "podiumtype", og viser varianter av denne typen tilpasset områdets topografiske trekk.

Planleggingsinstrumentene som ble identifisert på kommunalt plannivå i de analyserte casene ga delvis innspill til prosjekteringen på mellomliggende romlig skala. Analysen avdekket bruk av et lokalt vedtatt planleggingsinstrument i Oslo – Veiledende plan for offentlige rom (Veiledende plan for offentlige rom [VPOR]). VPOR er i hovedsak utarbeidet for å gi retningslinjer for utforming av mer sammenhengende byområder, men gir noen prinsipper for de individuelle arkitektoniske prosjektene. Dette indikerer at det var et behov i (praktisk) planlegging for å gjenopprette forbindelsen mellom planlegging og design og bidro muligens til at Plan- og bygningsloven av 2008 introduserte områderegulering som et nytt planleggingsinstrument.

List of papers

This thesis comprises three papers and each of the papers is single-authored. The papers are marked with Roman numerals in further text.

I Marjanovic, G. (2015). Bygningsform og bebyggelsesstrukturer i den fortettede byen. In G. S. Hanssen, H. Hofstad, & I.-L. Saglie (Eds.), *Kompakt byutvikling: Muligheter og utfordringer*: Oslo: Universitetsforlaget AS.
(Title in English: "Urban form and built structures in the dense city"; translated by the author.)

This paper was published as a chapter in peer-reviewed book "Kompakt byutvikling: Muligheter og utfordringer".

II Zurovac, G. (in press) Urban tissue transformation under the densification policy: The case of Oslo. *Formakademisk*.

This paper has been accepted for publishing as a scientific article in the journal "Formakademisk" and it is expected to be published in 2020.

III Zurovac, G. (in press) Design performance in planning for densification – The case of Oslo. *Nordic Journal of Architectural Research*

This paper has been accepted for publishing as a scientific article in "Nordic Journal of Architectural Research" and it is expected to be published in 2020.

The full text of papers is presented in the Appendices A to C.

1. Introduction

1.1. Overview of main thesis aims and main analytical aspects

Since the 1960s, urban planning has been distancing itself from architecture and engineering, acquiring an understanding of cities as "systems of inter-related activities" rather than as physical structures (Després, Vachon, & Fortin, 2011, p. 37). Today, urban planning is greatly dominated by goals for sustainable development and strategic approaches (Palermo & Ponzini, 2010), while at the same time a significant component of its outcomes are built structures. This thesis is motivated by curiosity concerning the physical development of urban built-up areas in such a setting.

This study focuses on the Norwegian context, where the domination of strategies for sustainability is also observed. Norway adopted the policy of *densification* as a position on sustainable urban development in the early 1990s (Hanssen, Hofstad, Saglie, Næss, & Røe, 2015). Since then, planning practice has been consolidating itself, and a rich experience has been gained, particularly in Oslo, where intense building activities have taken place. Hence, Norway, and Oslo in particular, is interesting and relevant for a study of current urban development oriented towards sustainability.

Starting from the aforementioned curiosity about the physical aspects of urban development today, this research centres on the spatial characteristics and design of new physical structures in the current planning for densification. The main research question is as follows:

What are the morphological characteristics of the physical outcomes of densification in Oslo, and what spatially related concerns have influenced the design of those outcomes?

This thesis has two closely interrelated aims.

The first is to provide systematic analytical insight into the physical outcomes of the densification policy and the changes effected in the physical form of Oslo's built-up area. Based on such a systematic analysis, the understanding of the emerging physical form can contribute to current planning practices in at least two ways. Firstly, it constitutes a basis for the evaluation of the planning practice relative to the changes caused by the planning in the urban built form. Secondly, it offers a basis for the consideration of possible modifications of the planning approaches. At the same time, a study of the emerging physical form provides evidence of the evolution of the built environment, contributing to general knowledge of urban planning.

This thesis secondly aims to analyse spatially related concerns that occur in planning processes and influence the physical outcomes. This examination provides insight into the planning approaches and challenges with which designers are faced in planning for densification. These concerns also elucidate relations between architectural design and urban planning in today's framework of predominantly process-oriented strategic planning. A deeper understanding of spatial aspects in the production of the built structures in densification further contributes to the assessment and potential future improvement of both the planning practice and the spatial results of densification.

This study therefore comprises two main aspects:

1. *spatial*, covering the analysis of physical outputs of densification, changes of physical structure in the urban built-up area they cause, and issues related to their design; and

2. *procedural*, which covers a part of planning approaches that concern the design of the physical outputs of densification.

The study is based on empirical data from 71 cases of multi-family residential projects, completed in the period between 2004 and 2014. Multi-family housing is the most frequent architectural programme in general, while in Oslo it is of particular importance, due to the great demand for housing to accommodate population growth (Boligvekstutvalget, 2016; Oslo kommune, 2015). The study addresses "ordinary" architecture, i.e. buildings that have been constructed across Oslo's built-up area, excluding Fjordbyen, which is a major waterfront regeneration project in Oslo (see, for example, Bjerkeset & Aspen, 2015; Grønning, 2011; Røe, 2015). This "ordinary" architecture is at the centre of attention in numerous public debates and is of interest for developers, professionals, and inhabitants of the city of Oslo (see, for example, Bakkemoen, 2018a, 2018b; Eggesvik & Bjerkan, 2016; Klem, 2017; Lundgaard & Torgersen, 2019; Pagh, 2019; Riaz, 2017). At a later stage of the analysis, three cases have been selected out of the total of 71 cases for a more detailed analysis of the procedural aspects of the planning processes.

1.2. Personal background

When I arrived in Norway and started my research, I observed a strong focus on environmental and process-related aspects in the current planning. Few researchers dealt with physical aspects from design perspectives, while the practice was dealing with intense building activities, especially in Oslo. From the beginning, my research was connected to a greater project called SUSPLAN, which aimed to study the densification policy in view of its consequences for natural diversity and various social aspects in Norway, based on Oslo and three other municipalities. Since the policy mainly stressed the long-term environmental issues in current urban development (especially climate change and reduction of CO_2 emissions), placing less attention on other aspects of sustainability, this project aimed to address social issues such as conflicting aims in a densifying city, planning processes, quality of life, placemaking, and so on. Having an architectural background, I set out to contribute by exploring the issues related to changes in the physical form of the built-up area of Oslo. In that endeavour, I opted for urban morphology as the main research approach for three reasons. First, urban morphology is a broad interdisciplinary field that provides tools for analytical explanation of the built environment, together with the underlying planning, societal and other forces and conditions, which makes urban morphology suitable for addressing urban transformation. The second reason was that a systematic morphological study of the physical outcomes of densification in the Norwegian context had not yet been conducted. The final reason was that I come from a school of architecture deeply rooted in urban morphology, and this holistic understanding shaped my knowledge of architecture and of the built environment.

Hence, my curiosity about the currently evolving urban form was inspired by notable works from this field, particularly the study of French urban morphologists Castex, Depaule and Panerai, *Urbane Forme* (1989) (Serbian translation of the book; it was published in English in 2004 with the title *Urban Forms: The Death and Life of the Urban Block*). It follows the

evolution of the morphological element of urban block starting from 19th century planning up to the functionalism of the 20th century, through the cases of Hausmann's Paris, English Garden cities, early 20th-century expansions of Amsterdam, Ernst May's New Frankfurt and Le Corbusier's Radiant city. The discussion revolves around the noted changes in the physical organisation of built and open spaces in urban blocks and the connection of those changes to the questions of use, urbanity, and altered social and economic conditions.

The early questions that I posed for myself were thus in the same line of morphological thought: What built forms does densification produce in Oslo? Does the urban block still have a role in the organisation of built and open spaces? How is the design handled in planning for densification? What effects do new developments have on the urban tissue; how do they change it? These initial questions clearly identified two main concepts for spatial analysis: the urban (physical) context, where densification takes place, and the physical form of the new intervention projects. As physical form is a final output of creative, societal and economic forces, this flow of inspiration unfolded towards the question of the operation of the densification process from the practical aspects of planning and design. In the particular context of Oslo, these questions link to the issues of the design and qualities of new developments as well as the concept of the "compact city", which has become significant in planning discourse in Norway in the past decade.

1.3. Background to the thesis

Urban planning is a complex activity that encompasses a range of aspects, such as economic, political, anthropological, ecological, spatial, and technological aspects. In the past few decades, planning theory has diverged towards social sciences, abandoning its original roots in architecture and engineering (Palermo & Ponzini, 2010). With this distancing, a void between urban planning and design has been created, with unfavourable effects on both fields (Palermo & Ponzini, 2010). As new challenges were identified and new approaches were adopted accordingly, two other relevant changes took place in urban planning. First, since the Brundtland report *Our Common Future* was published in 1987 (World Commission on Environment and Development, 1987), numerous countries in Europe and around the world directed their urban planning goals towards sustainability (OECD, 2012; McCormick, Anderberg, Coenen, & Neij, 2013). In spatial terms, it became largely accepted that the containment of urban sprawl, together with more efficient use of the existing built-up areas could ensure the attainment of the goals for sustainability. Thus, more effective use of existing urban areas, termed *densification* (or *intensification*), has become a common approach to urban development (Hernandez-Palacio, 2014). The second change in urban planning was that the approach of "strategic spatial planning" became widely accepted in many European contexts, as it was (and remains) considered most apt to respond to these sustainability-related challenges (Albrechts, 2004; Palermo & Ponzini, 2010).

However, regardless of the gap created by the distancing of urban planning from architecture and the shift of its focus towards strategies rather than structural issues of urban form, physical structures in urban areas represent a substantial portion of the results of planning activities. In city building, design is mainly connected with development of plans in the framework of spatial planning (Westrik, 2002). The translation of planning goals and strategies into tangible physical outcomes takes place in the design process. In this setting, the question of current planning in relation to the approaches to the design of urban architecture and open spaces comes to the foreground as important for connecting and improving these fields and for strengthening the practice and quality of new built environments.

The gap between urban planning and design, along with the orientation of planning towards sustainability and strategic approaches, can also be observed in the Norwegian planning context. Urban planning in Norway is aimed at sustainability, and the policy prescribes densification as the main planning approach. As this thesis investigates the changes of urban physical form that occurred in Oslo due to the implementation of densification policy, the background of the thesis is determined by the topic of the current urban planning as a setting for those changes. Therefore, this section continues with general insight into the development of the policies of *densification* and the *compact city*, both internationally and in Norway. Afterwards, a more detailed depiction of the evolution of the densification policy in Norway (with a particular consideration for Oslo) is provided. The chapter ends with an overview of the concept of the compact city and its implications for urban form.

1.3.1. Densification and compact city

The current planning strategy in Norway is based on the densification of existing built-up areas, as an approach to sustainable urban development by limiting urban sprawl and making the cities more compact. As mentioned, a major shift towards sustainability both in Norway and internationally took place after the publication of Brundtland report *Our Common Future* (World Commission on Environment and Development, 1987). This report identified sustainable urban development as a political priority (Breheny, 1996) and outlined the defining features of sustainability in terms of human needs, resource use, economic and societal development, and ecology and biodiversity. The Brundtland report also provided strategic imperatives for achieving sustainable development in different countries around the world. Shortly after its publication, the concept of the *compact city* gained a central position in many countries worldwide, especially in Europe (OECD, 2012, p. 48), giving rise to various discussions. The concepts of the compact city, densification and smart growth have since been used to define policies in various countries (OECD, 2012). Regardless of the terminology used in these policies, they encompassed a range of common development principles and aims for the future of urban areas. Some of these principles were to increase the use of already-developed built-up areas, to reduce the transportation needs and the consumption of resources, to improve quality of life, and to address various economic and social concerns. The study of compact-city policies by the OECD (2012) considered all these policies in the framework of the compact city concept. However, it acknowledged that this concept was rather loosely defined (in line with the observations of Hanssen and Hofstad (2013)) and stressed that the differences in policy definitions and frameworks stemmed from the differences in planning practices and geographical and socio-political contexts.

In the early profiling of the policy, the questions related to urban form were given significant attention. In 1990, the Commission of the European Communities published the *Green Paper on the Urban Environment* (1990), which offered visions for European cities based on "a rediscovery of the value of urban living" (OECD, 2012, p. 48) as opposed to the "failure of the periphery" (OECD, 2012, p. 48), emphasising that the aims for living and the environmental qualities could be achieved with dense development and mixed uses. The built form of compact cities was discussed with reference to old towns.

In the 1990s, the notion of the compact city also generated debates on the challenges and downsides of increased densities (e.g., see Breheny, 1996; Jenks, Burton, & Williams, 1996). In Norway, where the policy of densification was introduced, the government had long since realised the importance of a more holistic understanding of the possible effects of the

policy on the urban form and planning practices. Several studies of those implications were conducted in the early 1990s (see for example Guttu, Nyhuus, Saglie, & Thorén, 1997a, 1997b; Næss, 1992), and a set of guidelines, *Densification with Quality*, was published (Guttu & Thorén, 1996). The guidelines extensively covered questions of built form, along with the challenges of densifying the already-existing, urban built-up areas and achieving the living and urban qualities. The aims for qualities were given priority, and the policy was rephrased as *densification with quality*. Over time, planning for densification has been gradually framed in the rhetorical model (or ideal) of the compact city, which has gained a "hegemonic position among Norwegian planners" (Hanssen & Hofstad, 2013, p. 110).

1.3.2. Planning for densification in Norway and Oslo

The evolution of planning ideas, which led to the adoption of densification as the main strategy of urban development in Norway, has been influenced by a number of issues from the end of World War II to the 1990s.

In the early 1960s, once personal vehicles had become accessible for the wider population in Norway, the dominant growth pattern in cities was sprawl. This growth pattern allowed for the building of single-family residential areas with large private gardens (Næss, Saglie, & Thorén, 2015). In 1965, a new Planning and Building Act (in Norwegian, *Plan- og bygningsloven* [PBL]) emphasised the aims of farmland protection (in Norwegian, *jordvern*) and introduced goals for more economic urban development, resulting in aims for planning for more concentrated and better-planned urban development (Johnsen, 1970). These aims were supported mainly by economic and technical arguments, since infrastructure, services and facilities can be managed more efficiently in denser settlements. Nevertheless, similarly to numerous other countries, the most significant move towards the adoption of densification policy in Norway started in the late 1980s with the publication of the Brundtland report, as mentioned before.

In Oslo, an important reason for the shift towards densification was the drastic decrease in urban population between 1969 and 1983, due to inadequate living standards in inner city and high costs of living in the city in general. The decrease in population had severe repercussions on municipal tax revenues and prompted the city's government to seek a solution. From the late 1970s through the mid-1990s, the municipality conducted a major regeneration of inner-city housing areas (Jørgensen & Thorén, 2012). At the end of the 1980s, a new local government further adopted densification as a way to attract more inhabitants to Oslo (Jørgensen & Thorén, 2012). The municipality initially had economic and demographic reasons for the shift in the planning policy, and these reasons aligned with the recommendations of the Brundtland commission report, later adding environmental and ecological concerns.

At the state level, the Brundtland report prompted the "Nature- and Environment-friendly Urban Development" (*Natur- og Miljøvennlig Tettstedsutvikling* [NAMIT]) project in 1992–93, aimed at developing criteria for sustainable urban development in the Norwegian context. Starting with social, economic and ecological aspects, the project defined 64 indicators of sustainable urban development and applied them in a case study of three cities. Different development scenarios following the indicators were created and compared, concluding that a densified city is the urban planning concept that performs best (the concept was later named "the compact city ideal"). The NAMIT project was among the most important inputs for establishing densification policy. In *White Paper no.31 on Regional Planning and Land Use Policy* (Miljøverndepartementet, 1993), for the first time in Norway, the goals and framework

of land use policy based on the principles of sustainability were presented (Næss et al., 2015, p. 42). The coordination of building patterns and transportation systems was stressed as the main approach to the reduction of transportation needs and energy use, together with limitations on construction in already-existing built-up areas of settlements and the preservation of green areas. Thus, the central parts of the cities, the areas around transportation nodes and along the sea-shore (where applicable), were specified for densification. The NAMIT project was highly influential, so its scenarios and subsequently the "compact city" concept have become a hegemonic ideal in Norwegian urban planning discourse (Falleth & Saglie, 2012; Hanssen & Hofstad, 2013), as mentioned earlier.

Another significant outcome of the NAMIT project was that urban green areas were given a stronger position in planning, as they were termed "green structure", and a planning programme for a system of urban green spaces was created through the revival of the park systems approach, originally established in the early 20th century (Jørgensen & Thorén, 2012). A step further regarding green areas was the multifunctional approach, introduced in the green plan for Oslo in 1993, which supported the goals for sustainable urban development. With the term "green structure", urban greening has been given a stronger position in planning and besides the multifunctional approach, analytical methods for the planning and assessment of urban green areas have been defined. This is a specificity of the Norwegian approach to sustainable urban development.

Norwegian planning for sustainability has a number of other distinctive characteristics. In general, the aims of compact urban development in Norway correspond to those in the global debate: handling the economic, social, environmental and ecological aspects of development. A specific feature of the Norwegian understanding of compact urban development is a stronger emphasis on environmental issues and resource use (Hanssen, Hofstad, & Saglie, 2015, p. 38). Another distinctive matter in Norway, raised soon after the introduction of densification policy, is the concern for the values and qualities of built and green structures in the densification process. The Ministry of Environment initiated a research project in the mid-1990s and a thorough professional discussion of qualities was undertaken. The results were used as a basis on which to develop the abovementioned handbook *Densification with Quality* (Guttu & Thorén, 1996). The report provided a set of guidelines for the densification of cities based on typological thinking, pointing to the values and qualities that should be preserved and created in urban areas – urban and living qualities, quality of air, aesthetic and spatial qualities of built and open spaces, with special concern for green structure.

The introduction of densification policy concurred with a shift towards "neo-liberal movement in planning" (Falleth & Saglie, 2012, p. 267), which was introduced in the 1980s and established the market-driven framework for urban development (Ellefsen & Tvilde, 1991, p. 6). The government had decided that the private sector should be more involved in urban development (Oslo kommune, 1984). This affected the position of actors involved in the planning activities, so the role of private actors has become more important. Today, the private initiative is the dominant driving force in urban transformation. The public ownership of land has furthermore been drastically reduced. In view of that reduction, urban development today must be understood as more project-based than driven by plans (Børrud, 2012).

1.3.3. "Compact city" as a concept for sustainable urban development

The compact city is one of the most-discussed concepts of sustainable urban development, adopted in numerous countries worldwide (OECD, 2012). However, there is no

clear and strict definition of the compact city, since in different contexts such a model is adopted for different reasons, leading to a variety of practices and interpretations (OECD, 2012; Hanssen & Hofstad, 2013). This variety has created debates concerning the understanding and implementation of compact city policies. It is, nevertheless, possible to outline the main characteristics of a compact city, which primarily reflect qualitative and performance-related aspects.

The *Dictionary of Urbanism* by Robert Cowan (2005) provides a definition of a compact city as "an approach to planning based on intensive development within existing urban areas, or on cities with relatively high densities and limits to their growth" (Cowan, 2005, p. 82). The Norwegian understanding of densification and the compact city (Næss, 1992; Miljøverndepartementet, 1993) is in line with this definition. Cowan continues by referring to different authors who stated that the old towns serve as models for "a balanced and ordered setting of human dimensions" (Cowan, 2005). The reference to the old towns for their liveliness, density and mix of uses can be found in the aims for compact urban development in the contexts of the European Union (Commission of the European Communities, 1990) and Norway (Hanssen, Hofstad, & Saglie, 2015). However, the specific "setting of human dimensions", as described by Cowan, which characterised the old towns and provided them with the liveliness, was largely determined by the scale of the built objects and open spaces and the distances between them, the transportation options available at the time and the needs of the inhabitants of those towns. In the meantime, modernist urbanism created a disruption with the spatial and functional logics of old towns. Obtaining such a setting of human dimensions in contemporary compact cities can thus be a challenge.

Another, more general definition of the compact city has been provided by the OECD in its report on compact city policies (OECD, 2012). It defines the compact city as a "spatial urban form characterised by *compactness*", with the following key characteristics:

- dense and proximate development patterns,
- urban areas linked by public transport systems, and
- accessibility to local services and jobs. (OECD, 2012, pp. 27–28)

Thomas and Cousins (1996) offered a predominantly performance-related understanding of the compact city, pointing out that the questions compact forms must address are "accommodating growth, energy consumption, accessibility, economic viability, ecological integration and protection, political achievability, popular aspirations of quality of life and the burden of proof of success" (Thomas & Cousins, 1996, p. 55).

Since the early 1990s, when sustainable urban development gained a central position in urban planning, the concept of the compact city has been evolving, and the list of expected performances regarding economics, society and environment has been enlarged. Dieleman and Wegener (2004) have stated that the proponents of compact cities have often pointed out the numerous benefits this strategy can produce. Some of these benefits were as follows:

- revitalised urban communities;
- repopulation of central cities;
- redevelopment of brownfield areas;
- housing affordability;
- more social equity and less racial and socio-economic segregation;
- reduced travel demand and shorter travel distances;

- more biking and walking;
- cost savings on infrastructure such as road, water and sewer infrastructure;
- preservation of farm land and open space;
- environmental protection and improved health;
- improved cultural climate of cities; and
- enhanced recreational opportunities.

Based on these definitions and the notions of the compact city, the main aspects of compact development can be summarised as *social, economic, environmental* and *ecological.*

There are various ways to achieve the mentioned benefits. Jabareen (2006), for example, has identified seven design concepts for achieving sustainable urban form: *compactness, sustainable transport, density, mixed land uses, diversity, passive solar design* and *greening*. A compact city combines almost all of them, and in terms of built form, densification and mixed uses play a major role: "Compactness proposes density of the built environment and intensification of its activities, efficient land planning, diverse and mixed land uses, and efficient transportation systems" (Jabareen, 2006, p. 46). In addition, more so than other urban forms, the compact city is believed to provide a response to urban sprawl and the problems of modernist city design, and it is widely regarded as an appropriate way of supporting resource efficiency, social equity, accessibility and economic viability. For these reasons, the compact city has become a widely supported concept.

As the concept of the compact city is characterised by the desired results rather than by particular physical forms, there is no universal way of establishing a compact city, and any planning and design intervention in the framework of the compact city demands a context-sensitive approach. Regarding densification, it is important to note that degree of density varies between cities, and it is a matter of decision how dense or compact a city will be.

1.3.4. Physical development and compact city

The central topic of this thesis is the physical form emerging from densification and compact urban development. Here, the compact city is understood as a concept rather than a model, as it is often termed, for it is planned based on strategic goals and recommendations. Densification is understood as the main approach to the physical development of the compact city.

In terms of spatial development and design, densification is a complex task because it entails the insertion of new built structures into an existing urban tissue. As mentioned, this integrative-planning task differs drastically from the tasks of previous eras of urban expansion. The insertion of new built masses implies a variety of relations between the new and the pre-existing built structures, not only in spatial terms but also in socio-economic terms that are dependent on the actors. The difference between the current planning era and previous planning eras is well illustrated by Sir Richard Rogers, a prominent British architect: "A major development in the last 20 years is a much greater consciousness of the morphology of cities – that buildings need to fit in, and even if they contrast, you have to be conscious of what they contrast with" (Architecture Today, 2009, in Kropf, 2011, p. 393).

In general, urban form can be studied at different spatial scales. The urban form resulting from compact-city planning can be primarily assessed by quantitative criteria (regarding densities, concentrations of uses, transportation, etc.) as exposed by the extensive

survey of compact-city policies worldwide by the OECD (2012), among other studies. Such assessments are based on the analysis of the urban form at the spatial scales of the city, urban agglomerations and region. The understanding of the urban form on these large scales is coupled with the notion of density, which can include concentration of new built masses, population and functions (such as services and jobs, etc.).

Concerning smaller spatial scales, such as those of the neighbourhood or the urban block, physical urban development under densification policy entails interventions (building activities) in the existing built-up area. This setting differs completely from the urban expansion that characterised the previous planning cycles. In terms of design, densification entails the insertion of new built structures in the pre-existing built environment. This kind of intervention implicates different questions that need to be addressed relative to the previously existing neighbouring buildings and their users, as well as the interests of different actors involves in the planning. Such a setting has a higher degree of complexity and demands different approaches to planning than does urban expansion (Børrud, 2012).

Therefore, it can be said that physical development in current planning for densification depends largely on the pre-existing urban situation and decisions regarding densities. More specifically, the emerging dense urban form is conditioned by these two factors. Dense, compact cities can thus have various growth patterns, making their physical forms highly context-sensitive and unique. This context sensitivity leads to the question of the varieties of physical outputs of densification in different planning and spatial contexts.

1.4. State of knowledge

This section is based on a literature review primarily covering topics related to the physical development and transformation of urban built-up areas in the current planning for sustainability. The review encompasses both the empirically based studies of already executed examples of urban transformation and theoretical work, focusing on both Norwegian and various international contexts.

The survey of the theoretical work includes the concepts that enabled the understanding of urban form in structural terms, such as the concepts of “urban tissue”, “urban block” and “building”. Other concepts included in the survey are related to the planning and design aspects of the development of urban form, such as “planning instruments” and “actors”.

Various sources have been used in the literature review. The primary source were libraries – library of the Norwegian University of Life Sciences and the BIBSYS network it is affiliated with (BIBSYS is an agency established by Norwegian Ministry of Education and Research for exchange, retrieval and storage of library resources, connecting universities, colleges and the National Library). In addition to the libraries, online databases of scientific publications have been searched. A citation search of the bibliography listed in the articles and books has also been applied. The types of literature the survey encompassed were scientific journals, books and conference papers, while a considerable share of the literature comprised research project reports, municipal plans and government documents not available online.

The survey exposed several directions among the studies, in terms of topics and approaches to the analysis of changes of urban built-up areas. Generally, such studies commonly employ the notion of urban form. Different fields of research approach urban form in different ways. Two main positions on urban form could be termed as “predominantly performative” and “structural”.

Concerning the performative understanding, urban form can be regarded as a question of coordination of transport, densities and land use. This kind of study often covers large spatial scale –that of the city or urban agglomerations (see, for example, Catalán, Saurí, & Serra, 2008; Holden & Norland, 2005; Jabareen, 2006; Nabielek, 2011; Næss & Andrade, 2013; Stead & Marshall, 2001). Another approach focuses on the micro-scale (the scale of buildings), concentrating on questions such as energy efficiency, technology and the effects different building types produce in the urban environment in terms of microclimate, densities and urban change in general (see, for example, Dahl, 2014; Futcher, Mills, Emmanuel, & Korolija, 2017).

Regarding the understanding of the urban form as a structure, it is found in the analytical-explanatory tradition of urban morphology. Urban morphology is an interdisciplinary field that provides a broad, integrative perspective by focusing on the analytical explanation of both the built structures (at different spatial scales or across scales) and underlying forces and conditions (e.g. the time at which the built structures are made, the planning and social forces or topographic conditions).

The integrative approach that the field of urban morphology offers is highly relevant both for investigating historic urban form and for studies of the contemporary processes of urban change. Even though contemporary planning is dominated by goals for sustainability and strategic approaches (Palermo & Ponzini, 2010), physical structures have an important place in current urban development. They therefore need as much attention as the other aspects of planning, such as strategies and planning processes. In her studies of contemporary processes of urban densification, Børrud stresses the importance of the knowledge of the actual processes of change concerning urban built-up areas (Børrud, 2005, 2012).

Therefore, the application of urban morphology in the studies of urban form is broad – from the studies aimed at developing the methods of urban analysis and the theory itself (see, for example, Gil, Beirão, Montenegro, & Duarte, 2012; Kropf, 2001; Oliveira, 2013; Scheer, 2015; Whitehand, 2012; Yoshida & Omae, 2005) to the studies of the urban tissue in different historic and planning contexts (see, for example, Gu, Tian, Whitehand, & Whitehand, 2008; Morley, 2012; Ünlü & Baş, 2017) and the studies that apply morphological thinking in addressing the different questions related to contemporary planning, such as socio-economic or political (Güzey, 2014; Hirt, 2006; Komossa, 2009; Lucan, 2012; Moshi, 2009; Racine, 2016; Swensen, 2012; Vasilevska, Vranic, & Marinkovic, 2014). Morphological studies can also be prescriptive. An example of such study is Lehmann's *The Principles of Green Urbanism: Transforming the City for Sustainability* (2010), which explores different questions of urban transformation in physical terms, covering the topics of density and housing types, among others. Prescriptive studies can be applied as analytical tools in the analyses of current planning and the transformation of urban tissue.

A common approach in contemporary studies that apply morphological thinking involves an analytical description of specific transformation projects built as a part of the regeneration of areas in cities, concentrating on the effects that those projects had on the city in physical and demographic terms and exploring certain aspects of planning and organisation (see, for example, Dündar, 2001; Güzey, 2014; Lucan, 2012; Pranlas-Descours, 2016). Such an approach, when a particular transformation project is investigated, provides a partial image of the current urban transformation in the analysed cities, while more comprehensive studies of changes in urban built-up areas are less common (see, for example, Lupala, 2002; Wiedmann, Salama, & Thierstein, 2012). The analysis of Oslo conducted by Børrud and Syvertsen (2012) is among the comprehensive studies. This study explored the changes in the

entire built-up area of Oslo in the period 1985–2010, covering all architectural programmes built over that timeframe. The study included the assessment of the character and distribution of interventions in the pre-existing urban tissue, along with the effects of the new built structures on different urban contexts and on the overall urban transformation, however without delving into smaller spatial scales.

Concerning spatial scales smaller than that of the entire city, the structural, morphological studies can cover the scale of a fragment of the urban tissue, the urban block or particular types of buildings, often applying a typological approach in the analyses. Numerous studies have focused on these spatial scales.

Morphological analyses of fragments of urban tissue often focus on types of urban tissues. Some examples of such studies cover the Swedish planning context. The studies by Rådberg and Friberg (1996) and Rådberg and Johansson (1997) apply the morphological methods of analysis to historic and contemporary tissues in order to assess types of urban tissue in Swedish cities and the relations between those types and urban qualities in different planning eras. Similar studies can be found in the Norwegian context, where the studies of urban tissue types were conducted mainly in 1990s with the aim of revealing the effects of densification on those types (Guttu & Schmidt, 2008; Guttu et al., 1997a, 1997b). In his survey of the historical development of the planning concepts regarding the green areas in housing estates in Oslo, Jon Guttu (2012) provides an overview of the urban tissue types, from 1850 until 2010s. As Norwegian cities, especially Oslo, have undergone intensive densification in recent decades, more material is available for further studies of urban tissue types and related questions.

Considerable attention in the field of urban morphology has been placed on the urban block as the constitutive element of urban form, covering aspects related to physical structure, the evolution of the urban block over time, and the social forces that led to the formation and transformation of urban blocks (Castex et. al, 1989; Komossa, Meyer, Risselada, Thomaes, & Jutten, 2005; Linn, 1974; Niković, 2013; Oikonomou, 2016; Schmidt & Thorén, 2001). Karl Kropf (2006) has analysed a particular type of urban block, the perimeter block, and discussed its application in urban planning. In a more recent study, Jacques Lucan (2012) exposes the emergence of a mega-block in the French planning context. In Norway, the urban block has rarely been analysed (among the few examples are Godø, 2019; Schmidt & Thorén, 2001) and structural analyses of more recent developments are lacking.

At the slightly smaller spatial scale – the scale of buildings – morphological studies have mainly addressed the different building types. For example, a typo-morphological study of new housing developments in the Netherlands, *Complex housing: Designing for density* (Robinson, 2017), investigated large multi-family residential projects that occurred as a type in the recent decades, in both structural and social respects. Per-Johan Dahl (2014) has studied an emergent architectural type, the accessory dwelling unit (ADU), and discussed its effects in the ongoing densification of suburban parts of San Francisco. Another study on building types, conducted jointly by the municipalities of Vienna and Bratislava (Kuzmich, 2011), presents examples of nine different housing typologies from 12 cities in Europe and North America that have been built in the framework of compact-city planning. That study employed a descriptive approach, and it lacked a more thorough analysis of the effects that the typologies have had on the pre-existing urban tissue. Similarly, Johan-Ditlef Martens (2000) provided an overview of the housing developments in Norway in the 20th century, focusing on the structural characteristics of the developments in this particular period. The overview of housing types in this book ends with the year 2000 and thus omits any additional analysis of more recent

developments. Later on, a number of studies of already-built new structures were conducted in several Norwegian cities (Guttu & Schmidt, 2008; Schmidt, 2007; Thorén, Pløger, & Guttu, 2000) covering the physical outcomes and their qualities together with the planning processes. The focus of these studies was on the multi-family housing developments, including only a small number of cases, however.

The Evolution of Urban Form – Typology for Planners and Architects by Brenda Sheer (2010) is another typo-morphological study that has examined architectural types (both residential and non-residential), their evolution and their connection to urban tissue types, encompassing both the physical form and the architectural functions and providing an analytical explanation of the role that planning tools have had in this evolution. In 2005, Børrud conducted an extensive study of four non-residential projects in Oslo and analysed thoroughly the actors' roles and performance in the design and development of the projects. However, similar detailed studies of recent residential developments have been rather scarce in the Norwegian context.

As mentioned earlier, the integrative stances of urban morphology allow for the explanation of the physical structures together with the underlying forces and conditions. Beside the studies of the physical outcomes of densification (presented earlier in this section), planning research in Norway has attended to the ways in which the planning system deals with questions of physical development. In a more recent study, Børrud and Aarskog Knuttsen (2018) have explored how the physical aspects of densification have been handled in the municipal master plans (in Norwegian, *kommuneplan* [KP]) in the period between 1984 and 2015. More precisely, they investigated whether strategies for the physical development of Oslo have been provided with clear and consistent directions in those plans. The main findings were that the main strategies had been consistent, while the spatial principles and concept of densification used in the plans varied and were almost unpredictable over the analysed timeframe. However, the ways those strategies influenced the individual projects has yet to be addressed more thoroughly. Furthermore, despite the abundance of the already-built new structures and long experience in planning for densification, a comprehensive *ex post* analysis of the residential developments and the effects of densification on different urban tissues in Oslo has not yet been made.

As mentioned before, numerous morphological studies have focused on the development of morphological theory and methods. In Norway, the aesthetic approach to the analysis of urban spaces by Thomas Thiis-Evensen (1999) has been most well-known up to now. The structural morphological approach has been developed by Ellefsen and Tvilde (1991) as a method of urban analysis and, to a certain extent, has been applied in practice.

Still, the application of the urban morphological approach in the analyses of recent changes of urban form in the context of densification in Norway has not commonly been researched. The morphological studies conducted so far also focused mainly on parts of the urban built-up areas, while the city as a whole and its transformation and structural changes have remained insufficiently understood. The transformation at the spatial scale of buildings and the urban block has also been scarcely investigated. This PhD study aims to fill these gaps by focusing on the scale of the individual projects and the urban block rather than on larger regeneration areas, as has been done in numerous other studies (both international and Norwegian); this study also includes a larger collection of data, which will allow for a more comprehensive reflections on the transformation of the entire urban built-up area.

1.5. The purpose of research

The purpose of this thesis is to extend the analysis of previous studies of densification in Norway and provide a deeper and more comprehensive understanding of changes to urban form. It is to be done by covering a more recent period of the densification policy implementation, including a larger number of more recent case projects and certain design-related modes of operation in the production of the physical outcomes.

The thesis builds upon an empirical investigation of the physical outcomes of current planning for densification and provides an analytical explanation of recent urban transformation. To an extent, it also covers the involvement of actors in the design of physical outcomes. However, this part of the analysis is limited to the actors' concerns regarding the spatial characteristics of the resulting built structures, and it does not delve into the relations between the actors or questions related to decision-making, governance and participation. The thesis contributes knowledge of recent changes in urban built form in the framework of sustainability, by providing the evidence from the Norwegian context.

Such an analysis is highly significant for planning practice. A systematic assessment of the outcomes of planning activities allows for a deeper understanding of the challenges planners encounter in densification. This kind of assessment is valuable for planning and design, as it is essentially a study of precedents, and as such, it provides a basis for learning from the experience, which is one of the types of knowledge acquisition in design disciplines (Breen, 2002, p. 96). New built masses are constantly being added, as densification is an ongoing process and as analyses of physical development should be made recurrently in order to collect updated insights into ongoing processes and their effects on the urban built-up structure. In addition, as stated earlier, compact cities take different spatial shapes, which result from specific planning and spatial contexts. Thus, densification in Oslo is specific for its spatial and planning context, and its specific features can be explored through empirical studies of real-world cases.

In terms of methodology, this PhD study develops the theory of urban morphology in Norway, since it applies the structural morphological approach to the ongoing urban transformation in Oslo. As mentioned, spatial scale is of a great importance for the analysis, because different scales provide different evidence about both physical and planning aspects of urban form. For instance, the large spatial scales expose the growth patterns of the city or the changes of a neighbourhood, while small spatial scales offer indications of architectural types and materials used. This PhD thesis explores physical outcomes, challenges related to design in the pre-existing urban setting and the effects of densification on the urban tissue in Oslo. Hence, it investigates individual projects, as they have a vital role in the current densification of Oslo, which is so noticeable that the planning can be considered as project-based (Børrud, 2012). The analysis thus focuses on the spatial scale of the projects built in the densification and the architectural objects contained in the projects.

1.6. Thesis structure

This thesis comprises three papers and the cover story. In addition, two parts of the analysis are provided as appendices along with other, rather technical information (detailed information on the data – case projects, and the interview questionnaire).

Regarding the structure of the cover story, this first chapter presents the outline of the thesis, explaining the background to the thesis, the initial research problem, the main research question, the main aspects of analysis and the state of knowledge that the thesis builds upon. Chapter 2 presents the theoretical stances and concepts that have been applied and the ways these concepts relate to the different aspects of analysis. It also presents the research sub-questions that have been necessary to define in order to address the main research question. Chapter 3 describes the methodology of the research, including an explanation of the research design for the entire thesis and the particular methods for each step of the analysis (each research sub-question). Chapter 4 comprises a brief summary of the three papers, including the main findings. Chapter 5 presents and discusses the study results as they relate to each sub-question. Further in that chapter, a synthesis of the findings across sub-questions is provided, relating the findings to the main research question and the aims of the thesis.

2. Theoretical approach and research questions

As mentioned earlier, the purpose of this thesis is to address the changes of the urban tissue in terms of the built outcomes and their design in the ongoing implementation of densification policy in Norway. In a range of theoretical fields that address urban spaces from different viewpoints, *urban morphology* stands out for its integrative perspectives that link both the spatial-structural and procedural aspects of urban development. In this study, urban morphology is combined with certain perspectives from planning theory in view of strengthening the procedural aspects of the analysis due to the complexity of the current planning.

2.1. Theory of urban morphology: Relevant viewpoints

Urban morphology is a theory which provides a framework for the study of urban phenomena, taking their physical form as a starting point. The built form of the cities is understood to be a result of human activities and, conversely, also as a condition for these activities. Thus, the notion of urban form encompasses both physical structures in a settlement (e.g. edifices, topography, roads, vegetation) and the intangible factors (e.g. social, economic, technological) which determined their creation and transformation. Built artefacts reflect these underlying forces through spatial and functional organisation. Through the analysis of this organisation, urban morphology explains why the built-up patterns and physical urban form have certain spatial characteristics. In the same way, it can explain the changes that the urban form has undergone over a certain period of time. Urban morphological analysis offers an understanding of urban forms without implying values, yet it can be used as a basis on which further normative discussions can be had.

Urban morphology is an interdisciplinary field, developed and composed by research schools built on two master disciplines: geography, reflected by English tradition, and architecture, found in Italian and French traditions. The main figure in the English tradition is Michael Robert Gunter Conzen, a British geographer of German origin. He developed some of the key concepts of urban morphology: *town plan*, *built fabric* and *land use pattern*. He also defined streets, plots and buildings as three basic elements of town plan (Heineberg, 2007). An important element in Conzen's work is "historicity" as the knowledge of how landscape is comprised and how it evolved (Whitehand, 2014). Hence, an urban morphological study is often referred to as a morphogenetic study. A significant work of his, *Alnwick, Northumberland: a Study in Town-plan Analysis* (Conzen, 1960), represents a basis for the development of the morphogenetic analytical approach and terminology. By addressing the physical form of the current development, this PhD study builds upon the knowledge of the urban morphogenesis, providing analytical data on densification as a particular urban development cycle.

Alongside Conzen's work and the English school of urban morphology, there are Italian and French traditions as well. The dominant figures in the Italian and French contexts have an architectural background, and their works were initially triggered by an interest in the preservation of historic cities, as a reaction to the modernist rejection of the historical processes in the urban fabric (Moudon, 1997). Unlike Conzen, who studied urban form from the scale of the town to that of the building, Italian and French morphologists started their investigation at the scale of the building and building elements. Their position is well captured by Aldo Rossi (Rossi & Eisenman, 1982, p. 112): "… through architecture, perhaps more than any other point

of view, one can arrive at a comprehensive vision of the city and an understanding of its structure."

Rossi's viewpoint is followed in this PhD study, and the selected starting point of the analysis is the architectural programme of multi-family residential buildings. The spatial part of the analysis examines the recently built projects in terms of their spatial organisation at the scales of the city, urban block and buildings. The procedural aspect includes the analysis of the ways in which planning instruments and the actors behind these projects address spatially related issues. This point of focus provides a deeper understanding of the design approaches applied in the densification of built form in Oslo and possible further improvements of the planning practice. In the investigation of procedural aspect, the urban morphological approach is combined with certain stances from planning theory.

Since urban morphology is a broad field which bridges the gap between the planning and design to the greatest extent (Çalişkan & Marshall, 2011), encompassing different aspects and scales of urban form, it is a theory that integrates various disciplines. Taking the built results as a starting point, it is highly practice-oriented and provides explanations of planning and design in a given timeframe. It also creates a link to the policies, planning and actors behind the built results which, in the case of ongoing processes, can provide insights into planning and design approaches and raise awareness about the different qualities of the built results of a given planning epoch. From the viewpoint of urban history, it adds to the body of knowledge on different planning eras. It also contributes to the knowledge and practice of urban design, since it explains the origins of cities, their layouts and types of urban tissues that constitute them, relating to questions of density, distances and accessibility in different parts of the city. This knowledge can be applied in other studies, for example studies on transportation. Urban morphological studies are often referred to as "urban analyses" (Moudon, 1989). Urban morphology provides significant knowledge connected with architectural theory and design by revealing the origins and permanency of design concepts and building technology applied in the past and present. By addressing the underlying forces that influence urban forms, it provides a basis for studies of urban sociological aspects, urban economics, planning and environmental psychology.

The contribution of the present study of Oslo lies primarily in deepening knowledge of the physical outcomes of the ongoing densification in a systematic way, along with the planning and design approaches employed in the creation of these results. It provides a basis for further research on economics in the construction, building technology and aesthetics of recent developments. It also contributes to the knowledge of the historic development (morphogenesis) of the urban form of Oslo.

2.1.1. Key aspects of analysis in urban morphology

The two traditions in urban morphology share a main theoretical position, namely the idea that the city can be analysed and understood based upon its physical form, following three components of analysis:

1. *material*, which encompasses the basic constitutive physical elements of the urban form: buildings (and the adjacent open spaces), plots (or lots) and streets;
2. *space*, in the sense that the urban form can be studied on different *spatial scales* – of the building/plot, street/urban block, the city and the region. Spatial scales illuminate

the modularity of urban space, where the different elements of urban form fit together in a spatial hierarchy (Figure 1);

3. *time,* an element inseparable from the morphological analysis as the physical urban form is constantly changing and has to be studied through historic sequences and contexts, which together offer perspectives on the transformations (Moudon, 1997).

Therefore, the common notion for all traditions of urban morphology is that urban form is created by various forces and frameworks – such as material, social, economic, political, cultural, climatic and topographic – which co-act in an urban environment over a certain period of time. For that reason, it is possible to understand their repercussions from the built artefacts.

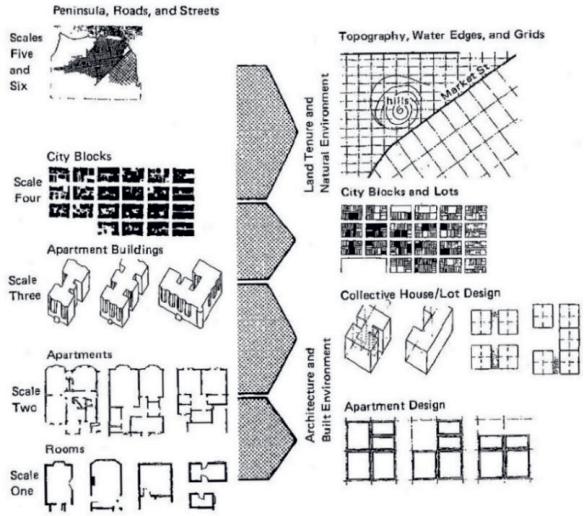


Figure 1. Modularity in the built landscape (Moudon, 2007, p. 260); presents the different spatial scales and the ways a building fits into the urban fabric

2.1.2. Contemporary urban development seen through morphological lenses

The study of the built form relies greatly on its historic development, as cities are created by layers dating from different epochs. Different development cycles of cities created different growth patterns. In the past, the most frequent has been "expansion" or "addition", where larger built-up areas have been added to the previously existing urban fabric: for instance, the expansion of medieval cities beyond their walls around 16th century, which occurred due to the increase in population, or modernist developments in mid-20th century, which were part of the post-WWII urban regenerations aimed at providing dwellings. The expansion phases of European cities often had homogeneous urban form, with distinct principles of spatial organisation and relationships between the basic morphological elements (building, plot and street).

However, in recent decades, awareness of finite natural resources has increased, and sustainable development has gained a central position in urban development strategies. In numerous planning contexts, concerning the built form at the scale of the city, the tendency toward sustainability implies that the urban built-up area has been strictly delimited and that further building activities have been allowed only within defined boundaries. In this process, the existing urban fabric is undergoing densification, and it is therefore subject to increasingly

intense use of available land. This process produces a particular growth pattern, and those patterns are unique in each city. To analyse these patterns, one must adjust the concepts and analytical approaches to the particular case.

2.1.3. Operationalisation of morphological theory

In the operationalisation of typo-morphological theory for the analysis of both historic and contemporary urban tissue, the initial steps are to assess the availability of information about the tissue, define a *study area* and determine the spatial *scale* for the study.

The availability of information is a crucial issue in the consideration of the case selection and the scope of research. This importance extends into the methodology of research, which will be explained more in detail in a separate chapter.

Regarding the study area, in the studies of past developments it is often possible to delineate a homogeneous and continuous area. However, as cities have a long history, it is most likely that an area will consist of layers dating from different planning periods. In this thesis, the case city is Oslo and its current urban development which, in compliance with the planning policy, entails densification across the entire built-up area (see, for example, the mapping by Børrud & Syvertsen, 2012). Three main principles of densification applied in Oslo have been identified (Hanssen, Hofstad, Saglie et al., 2015):

1. transformation of industrial areas (brownfield);
2. intensification of land use within the urban built-up area, as infill or division of plots; and
3. expansion within the city limits by building on undeveloped land, such as green areas and other open spaces.

The concept of the study area as a homogeneous, delimited part of the urban tissue is not applicable in densification, since new buildings are inserted into the pre-existing fabric in different patterns and locations. Therefore, in this study the concept of "timeframe" is applied as a way to delimit the scope of analysis. Such delimitation is inherent to morphological studies, as urban morphology addresses the characteristics and changes of urban form in a given planning cycle. This study of Oslo addresses multi-family residential buildings completed between 2004 and 2014, whose common feature is that they emerged under densification policy.

Concerning spatial scale, Moudon's understanding of the modularity of the built landscape has been used as a basis (Figure 1). The physical outputs of densification are observed across spatial scales, from the entire urban built-up area to the scale of buildings. A substantial part of the analysis focuses on the scale at which the new buildings form a synthesis with other elements of urban tissue. Here, this scale is termed *intermediate spatial scale*. In traditional, pre-modernist urban tissues, this scale is recognised in the hierarchical relations between the building, plot and street (Figure 2), while in modernist tissues, where those relations have been dissolved, the intermediate spatial scale is reflected in different building arrangements consisted of freestanding buildings in open spaces (Figure 3). In densification, this is the scale at which new buildings (individual projects or interventions) transform previously existing urban tissue in terms of both built and open spaces (plots, streets and other outdoor areas); in other words, at this scale planning and design take effect in the physical urban space.

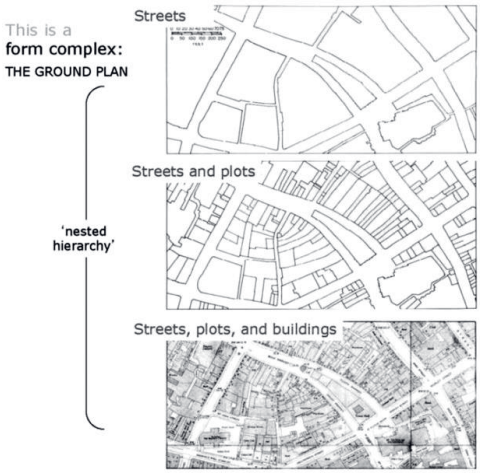


Figure 2. Spatial hierarchy of the basic urban form complex (image by Conzen, 1981, as cited in Conzen, 2018, p. 131)

Figure 3. Example of modernist urban tissue with different patterns of freestanding buildings in open spaces (image by Kropf, 2018, p. 46)

In order to address the physical aspects of the ongoing urban transformation in Oslo, this study employs (and partly adjusts) the following morphological concepts:

- *Urban tissue* (or urban fabric) is one of the essential concepts in urban morphology and the central concept in this study. It is understood as the "ensemble of aggregated buildings, spaces and access routes" in a city, following Cannigia's notion (Larkham & Jones, 1991, p. 80). According to Kropf (2011), urban tissue can "provide an essential foundation for understanding the structure and complexity of the built environment as well as for creating, transforming and managing it" (Kropf, 2011, p. 393). Morphological concepts that are used in the analysis of urban tissue are building, plot, street and the urban block. The building, plot and street (Figure 2) are fundamental elements of built form (Conzen, 2018; Kropf, 2014).

- *Constituted tissue* is an analytical concept based on the concept of urban tissue. It was introduced by Jacques Lucan (2012) in his study of the contemporary development of French cities and employed in this analysis of Oslo. Constituted tissue is a vital concept in the analysis of a densifying city, as it refers to the urban tissue that existed prior to densification. As such, it represents the spatial context for the new structures and provides certain conditions for their planning and design.

- *Urban block*, a morphological element which is part of the urban tissue, is a concept applied extensively in the analysis of the physical characteristics of the new developments as well as their relations with the pre-existing urban tissue. It can be defined in different ways and is often referred to as a "city block" or a "building block". By focusing on the urban block in the current development in Oslo, this study links to a work from French morphologists, *Urban Forms: The Death and Life of the Urban Block* (Panerai, Castex, Depaule, & Samuels, 2004). In the pre-modernist development of 19th and early 20th century, the most common layout was a rectangular grid, where the urban block commonly had four sides and had streets surrounding it on all sides (such as in central Paris or Amsterdam). Modernist urbanism in the 20th century caused a dissolution of the traditional urban block (Panerai et al., 2004). However, planning for densification in Oslo, which has been rhetorically framed as the "compact-city model", is aimed at creating urban qualities, resembling the traditional compact city, such as walkability, liveability, density, mixed functions and urbanity. The urban block played an important role in supporting these qualities in the past. Therefore, urban block is adopted as a concept in this analysis in order to explore how densification relates to it and to provide evidence for the evolution of the urban block as morphological element in the current urban development. The notion of the urban block is ambiguous, and there are various definitions of it in literature. The *Dictionary of Urbanism* (Cowan, 2005) defines the urban block as "the area bounded by a set of streets and undivided by any other significant streets", continuing by saying that "the term is of US origin, particularly appropriate in towns laid out on a rectangular grid" (Cowan, 2005, p. 35). British morphologist M.R.G. Conzen defines the urban block (or street-block) as "a plot or group of contiguous plots bounded partly or wholly by street-lines and forming a discrete part of the plot pattern of the town" (Conzen & Conzen, 2004, p. 258). He added that the block could be part of a layout, which he defines as "a plan-unit showing an arrangement of streets, plots and buildings based on a unified design". In this PhD study, the understanding of the urban block is based on Leon Krier's notions (Krier, 2007, p. 244), so an urban block is defined as an entity consisting of one or more adjacent plots, surrounded by planned and unplanned paths, roads and streets on all sides, with buildings located on the plot(s).

- *Architectural type* is a morphological concept used in the final stages of the present analysis, to investigate the spatial characteristics of the new buildings constructed in the process of densification. Italian and French schools of urban morphology developed the concept of "architectural type" (also referred to as "building type") and the taxonomic approach of "typology". This line of thought within urban morphology is referred to as "typo-morphology", and it could be said that typo-morphology addresses the relations between the architectural type and the corresponding urban tissue. Architectural typology corresponds to a study of types, while architectural type indicates a group of buildings with certain common characteristics (Brito Laranjeira, 2011). The most widely used definition of type is that of Aldo Rossi: a concept "associated with a form and a way of life, although its specific shape varied widely from society to society" (Rossi & Eisenman, 1982, p. 40). Concerning typology, Rossi defines it as a "study of types of elements that cannot be further

reduced, elements of a city as well as of an architecture" (Rossi & Eisenman, 1982, p. 41). Peierre Gauthier (2005) furthers the understanding of architectural type, building upon the notions established by Italian morphologist Muratori (and later expanded by Caniggia and Maffei) according to whom "type encompasses both the form and the knowledge pertaining to the fabrication and usage of the concrete objects that correspond to the said form" (Gauthier, 2005, p. 88). Gauthier elaborates on the non-formal aspects of type and argues that the forces that affect the course of typological process involve various kinds of knowledge and cultural models that guide the actions of different agents. These actions are exerted through practices that can be studied by praxeology, so he proposes that the approach to studying a type should integrate the morphological study of (built) form with the study of practices that lead to its emergence (Figure 4). In that sense, this analysis encompasses certain aspects of the planning practice in Oslo, to be elaborated in Section 2.2 (which covers procedural aspects).

Figure 4. Gauthier's diagram (2005, p. 91) of the "mirror theories" of the built environment in the making

In the structural analysis of the buildings constructed in densification, Kropf's (2014) understanding of built form is followed. He states that built form can be understood as a composition of different spatial elements and voids, from building materials to streets, where the voids include both the occupation space and the movement space. He proposes this approach for different spatial scales, which is to say in studying a street (Figure 5) or in studying a multi-storey residential building (Figure 6). This approach has been applied in the analysis of the new building types in Oslo, focusing on the spatial scales between "rooms" and "plot", since the subjects of the study have been multi-family residential buildings constructed as individual intervention projects in the pre-existing urban tissue (Figure 6).

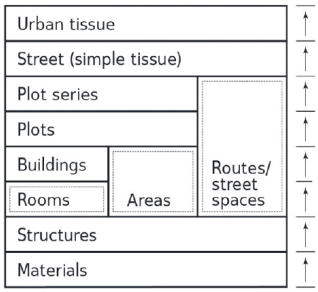


Figure 5. "Multi-level diagram showing the position of the route or street space and its relationship to plot series to form the street" (Kropf, 2014, p. 50).

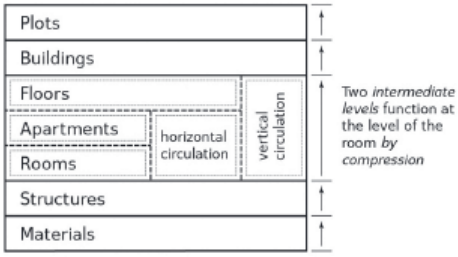


Figure 6. "Multi-level diagram of the multistorey apartment house" (Kropf, 2014, p. 52).

The typo-morphological approach has also been applied in the analysis of new urban blocks. The typologisation of urban blocks is essentially based on the *pattern recognition* of plan layouts (figure-ground), which is among the main epistemological approaches in knowledge acquisition in urban morphology (Scheer, 2015). Urban tissue is composed of sets of buildings, plots and streets distributed in certain ways, forming patterns. Aside from the

physical aspects of the individual interventions and the constituted tissue, a typological way of thinking is also applied in the analysis of planning instruments employed in the intervention projects. Likewise, relations between types of planning instruments and physical features in the particular intervention projects are also analysed through the approach of pattern recognition. This approach brings an integrative view of the ways in which the physical form at the intermediate spatial scale has been addressed through the planning instruments, representing a link between the physical form and underlying planning forces.

2.1.4. List of morphological concepts and definitions

Terminology is a vital tool of urban morphology, as numerous terms are used with different connotations by different authors. This incongruity indicates an apparent difficulty that the theory faces in the creation of a uniform set of terms, which may arise from differences in the understanding of morphological notions among the different schools of urban morphology. Therefore, a list of terms used in this study is provided for the sake of clarity. A number of terms have been adopted from *A Glossary of Urban Form* by Larkham and Jones (1991). For certain terms, I provide additional contextual details as relevant to this PhD study.

Terms denoting elements of built form

- *Urban fabric* and *urban tissue* are used interchangeably in this study. *A Glossary of Urban Form* defines urban tissue as follows: "In Caniggian analysis, the urban tissue is the ensemble of aggregated buildings, spaces and access routes" (Larkham & Jones, 1991, p. 80).
- A *multi-family residential building* hosts three or more flats.
- An urban block can be defined in various ways. In this study, the following definition of urban block has been devised and applied: urban block is an entity consisting of one or more adjacent plots, surrounded by planned and unplanned paths, roads and streets on all sides, with buildings located on the plot(s). This definition is based on a general definition of the block by Leon Krier: "the block is primarily a plot of land defined all around by a multitude of planned and unplanned paths, roads and streets" (Krier, 2007, p. 244).
- A *plot* is defined by *A Glossary of Urban Form* (Larkham & Jones, 1991, p. 64) following Conzenian terminology as "A parcel of land representing a land use unit defined by boundaries on the ground". It is a town-plan element. In this PhD study, this definition is widened, and a plot is understood as not only a parcel of land representing a certain land use but also representing the property owned by one or several parties.
- A *built-up area* is understood as "An area predominantly occupied by buildings where a system of street lighting is required. Colloquially, broadly synonymous with 'urban'" (Larkham & Jones, 1991, p. 26).
- A *building footprint* is understood as plot area covered by buildings.
- *Layout* is used in this thesis as substitute for the term "plan" of the building, or footprint, to avoid misunderstanding with "plan" as a planning document or instrument.
- *Plan* is a term for which *A Glossary of Urban Form* (Larkham & Jones, 1991) provides two meanings:

> (1) A drawing made by projection on a horizontal surface especially showing relative parts of (one floor of) a building. A large-scale map of a district (OED). A plan is usually of such a large scale as to

> differentiate between elements of the town plan. The most common plans used for studies or urban form in Britain are the Ordnance Survey 1:500, 1:1,250 and 1:2,500 series.
> (2) (planning terminology) Colloquial term for planning document: in England, Structure Plan, Local Plan, Unitary Development Plan (Heap, 1987); in the U.S., a Master Plan or Comprehensive Plan may legally be mandated and development may legally be required to be 'in accordance' with it. In this study, the second meaning is used. (Larkham & Jones, 1991, p. 60)

The second meaning of "plan" is applied in this PhD study.

- A *street* is understood as follows:

> A town or village road that has more or less *closed building development* along its length. It is a space (street-space), is bounded by *street lines* and is provided either for through traffic – *a major traffic street* – or for access to parts of a plot – *an occupation street* – or a solely residential street. It is a *plan-element*. (Larkham & Jones, 1991, p. 74)

- A *street line* is "The line dividing street-space from adjoining street blocks (urban blocks)" (Conzen, 1969, as cited in Larkham & Jones, 1991, p. 74).
- *Frontage* is understood as "The interface between main access street or waterway with the boundary of a *plot*. It is measured as the length of street taken up by it" (Conzen, 1960, as cited in Larkham & Jones, 1991, p. 41).
- The concept of the *street front* refers to buildings based on the concept of frontage. It encompasses not only the boundary of the plot and the length of the street it occupies, but also the façade of the building located on the plot as a three-dimensional determinant.
- *Flat* is a British term for "apartment". In *A Glossary of Urban Form*, an apartment is defined as "a dwelling within a block of similar dwellings" (Larkham & Jones, 1991, p. 15). In this study, the term is used interchangeably with "housing unit".
- *Land use* is understood as "The functional application within a unit of land" (Larkham & Jones, 1991, p. 48).

Terms related to changes in built form

- An *addition* is, specifically, "The addition of floorspace to an existing building; extension" (Larkham & Jones, 1991, p. 13).
- *Infill* is understood as the addition of built mass(es) in existing urban fabric.
- An *expansion*, in this study, is used to denote a change in the built-up area through addition of the new beside the existing urban fabric. Expansion links to additive processes, which in Conzenian terms are defined as "a sequence of activities whereby new forms are created at the outer edges of an urban area (Whitehand, [Ed.] 1981, pp. 114–121). Contrast with transformative processes" (Larkham & Jones, 1991, p. 13).

Terms related to planning system and actors

- The concepts of *actor* or *agent of change* "denote all those active in the process of *built-fabric* change" (Larkham & Jones, 1991, p. 14).
- The *municipal planning authority* is the planning authority of Oslo municipality in this study, namely the Agency for Planning and Building Services (*Plan- og bygningsetaten* in Norwegian), which is responsible for general land use planning, management of plans and construction case management, map management, and mapping and sharing operations (Oslo kommune, 2019a).

2.2. Procedural aspects of the analysis

Aside from the spatial features of densification, this study examines procedural aspects through the analysis of certain components of design performance in the production of physical form under densification policy. In each intervention project is an interaction between the previously existing urban tissue and the newly built structures, since densification entails the insertion of new built masses into the existing built-up areas. This interaction is handled through a design process which is part of a planning procedure. The design process encompasses planning strategies expressed in the planning instruments applied in the design process and the actors' concerns regarding the spatial features of the new built structures. The understanding of design performance thus comprises the performance of actors in the design process (including the underlying planning strategies and spatially related concerns) and the performance of the resulting physical structures in the previously existing tissue (Figure 7).

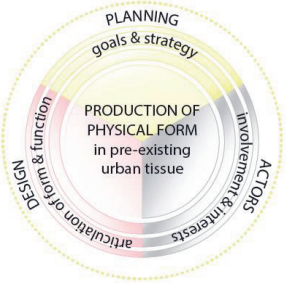


Figure 7. Aspects that determine the production of physical form in a planning procedure

2.2.1. Planning aspect

The production of physical structures takes place in the framework of the planning system, where planning goals and strategies are expressed through municipal plans and other instruments that regulate economic and social relations. Here, a planning instrument is understood as a government instrument for defining strategies for development, guiding the planning processes and structuring the planning and building activities as well as the public-private coordination in these activities. An instrument can take the form of a "document formally adopted under planning legislation by state, territory or local government and used to manage the use and development of land" (The Planning Academy, 2011). There are also other policy instruments, such as fiscal instruments. This study focuses primarily on municipal plans and the spatial concerns or guidelines expressed in those plans that apply to the design of individual architectural projects. Instruments other than municipal plans that are encompassed in this study include those concerning the design of physical form in individual projects. Hence,

policy instruments such as fiscal instruments or different contracts between actors are not included.

Planning system in Norway

The Norwegian planning system is notably complex. It is here explained with an emphasis on the planning instruments by which densification has operated since the introduction of the policy, provided by the legal framework. Since early 1990s, two PBLs have been in effect (Lovdata, 1990). One is from 1985, further referred to as PBL 1985, and the other is from 2008, further referred to as PBL 2008 (Kommunal og Moderniseringsdepartementet, 2008). As mentioned in the introduction, this study encompasses the period of densification between 2004 and 2014, so both acts are important to understand here. Planning instruments prescribed by the law have also been termed "formal instruments*"* in this study.

The PBLs provide a legal framework for planning at three levels: national, regional and local (municipal) (Hanssen & Hofstad, 2013). The analytical part of this study focuses on municipal planning with an awareness that plans adopted at this level of planning are subordinate to the plans adopted at higher administrative levels as prescribed by the PBL and to the national policy, national policy provisions (in Norwegian, *rikspolitiske bestemmelser*, as defined in PBL 1985) and national policy guidelines (in Norwegian, *rikspolitiske retningslinjer*, as defined in PBL 1985) or central government planning provisions (in Norwegian, *statlige planbestemmelser*, as defined in PBL 2008) and central government planning guidelines (in Norwegian, *statlige planretningslinjer*, as defined in PBL 2008) (see Table 1).

Table 1. Outline of planning instruments in Norwegian system following the Planning and Building Acts (*Plan- og bygningsloven* [PBL]) from 1985 and 2008.

	Legislation from 1985 (PBL 1985)	Legislation from 2008 (PBL 2008)
Planning instruments prescribed in legislation	National policy	National policy
	PBL	PBL
	National policy provisions/guidelines (*Rikspolitiske bestemmelser/retningslinjer*)	Central government planning provisions/ guidelines (*Statlige planbestemmelser/planretningslinjer*)
	County master plan (*Fylkesplan*)	Regional master plan (*Regionalplan*)
		Municipal planning strategy (*Kommunal planstrategi*)
		Planning programme (*Planprogram*) – guidance for a forthcoming planning process; can be made for any planning product
	Environmental impact assessment (*Konsekvensutredning*) –can be done for any planning and building activity	Environmental impact assessment (*Konsekvensutredning*) –can be done for any planning and building activity
	Municipal master plan (*Kommuneplan* [KP])	Municipal master plan (*Kommuneplan* [KP])
	District master plan (*Kommunedelplan* [KDP]) – thematic or geographical	District master plan (*Kommunedelplan* [KDP]) – thematic or geographical
	Zoning plan (*Reguleringsplan*) and detailed plan of an area (*Bebyggelsesplan*)*	Area zoning (*Områderegulering*)
		Detailed zoning (*Detaljregulering*)
	Building permit application (*Byggesak*)	Building permit application (*Byggesak*)

* Optional use

N.B. The original Norwegian names are provided in parentheses, while English translations are adopted from authorities (Regjeringen.no, 2010), even though they are potentially misleading. For instance, the KP in fact has the characteristics of a strategic zoning plan for the entire municipality, while "zoning plan (*reguleringsplan*)" corresponds to a master plan, as it defines the conditions for planning activities.

By the current law from 2008, the first step is the general strategy for the development of a municipality (in Norwegian, *kommunal planstrategi*), adopted at the political level. This

step is new compared to the law of 1985. This general strategy is elaborated through the municipal master plan (in Norwegian, *kommuneplan* [KP]). The strategy primarily provides objectives for the social development of the municipality (in Norwegian, *kommuneplanens samfunnsdel*), which influences the creation of the plan for spatial development (in Norwegian, *arealdelen*). The KP is legally obligatory, which is a specific feature of the Norwegian planning system (F. Holth, personal communication, May 2, 2016). The spatial part of the KP, *arealdelen*, is a tool that defines the areas in the city which are intended for development and gives directions on that development. For instance, it provides an overview of the zones marked for densification, protected areas, transportation nods, and so on.

Various steps can be taken between the KP and the realisation of a development (Figures 8 and 9); that is, different planning instruments can be applied in the planning process, following PBL 1985 and PBL 2008. A district master plan (in Norwegian, *kommunedelplan* [KDP]) can be adopted with the goal of providing more detail on the ways and the timeframe by which the strategy is to be realised. A KDP can be thematic (e.g. a plan for green infrastructure or a plan for squares and meeting places), or it can refer to a specific area or neighbourhood and provide the aims for its development (e.g. plan for Nydalen – KDP 3). It is important to understand that not all the neighbourhoods in the city must be covered by a KDP.

The next in the hierarchy of plans is the zoning plan (in Norwegian, *reguleringsplan*). In PBL 1985, a zoning plan was intended to provide a framework for the detailed plan of an area (in Norwegian, *bebyggelsesplan*) or for a building permit application (in Norwegian, *byggesak*). In PBL 2008, zoning is differentiated into area zoning (in Norwegian, *områderegulering*) and detailed zoning (in Norwegian, *detaljregulering*). Zoning plans can be elaborated by public planners or proposed by private developers and organisations. Today, the private sector has a vital role to play in the urban development, and the majority of zoning plans are made by private actors (Falleth & Saglie, 2012; Hanssen & Hofstad, 2013).

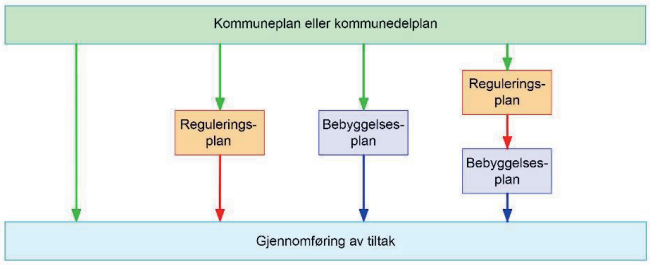


Figure 8. Diagram of possible steps from the municipal plan (*Kommuneplan* [KP]) or district master plan (*Kommunedelplan* [KDP]) to the implementation of a new development (in Norwegian, *tiltak*) following PBL 1985 – from the guidelines *Kommuneplanens arealdel* (*Spatial Part of the Municipal Master Plan*) (Miljøverndepartementet, 1998, p. 8). Explanation of terms: "Kommuneplan eller kommunedelplan" – KP or KDP; "Reguleringsplan" – zoning plan; "Bebyggelsesplan" – building development plan; "Gjennomføring av tiltak" – project implementation.

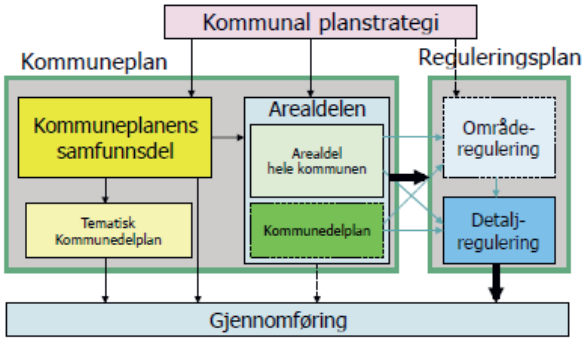


Figure 9. Diagram of possible steps from the municipal plan to the implementation of a new development following PBL 2008 – from the guidelines *Kommuneplanens arealdel – utarbeiding og innhold* (*Spatial Part of the Municipal Master Plan – Preparation and Content*) (Miljøverndepartementet, 2012, p. 11). Explanation of terms: "Kommunal planstrategi" – municipal planning strategy; "Kommuneplan" – KP; "Kommuneplanens samfunnsdel" – the social element of the municipal master plan; "Tematisk kommunedelplan" – thematic KDP; "Arealdelen" – the land-use element of a municipal plan; "Arealdel hele kommunen" – the land-use element of the municipal master plan for the entire municipality; "Kommunedelplan" – KDP; "Reguleringsplan" – zoning plan; "Områderegulering" – area zoning; "Detaljregulering" – detailed zoning; "Gjennomføring" – implementation.

The use of these plans can be flexible, depending on the site and the planning aims for the site. In any case, private developers can propose a zoning plan as a planning application to public authorities. This application is then elaborated and determined through the planning process for zoning (in Norwegian, *reguleringssak*), where the public planners and private developers discuss different aspects of the future development and ascertain the sizes and spatial organisation of the built and open spaces. Once the zoning plan is approved by the municipal authorities at the political level, they become legally obligatory and represent the framework for the next step, which is the process of the building permit application (in Norwegian, *byggesak*). This process comprises the elaboration of the detailed plan for a particular project that leads to the issuance of the building permit. A legally obligatory set of technical requirements for building, called TEK-10, applies at this final stage.

Since the focus of this analysis is multi-family residential projects, certain norms apply. Two sets of norms are taken into consideration. The first are the parking norms, devised and adopted at the municipal level. The second are norms for outdoor areas in residential projects in inner Oslo (in Norwegian, *utearealnormer*) (Oslo kommune, 2012), defining the allowable amounts and spatial organisation of outdoor areas relative to built masses for individual projects in different parts of Oslo's built-up area. It is applied in the zoning processes for residential developments even though it is an informal instrument (i.e. it is not legally adopted, hence not legally obligatory). In these norms, the starting point is the shape and quality of the residential outdoor areas, and it is demanded that the buildings should be designed accordingly.

In sum, the understanding of the planning instruments in this study encompasses plans and the planning norms, both of which are decided on at the municipal planning level. The plans include

- municipal master plan (*kommuneplan* [KP])
- district master plan (*kommunedelplan* [KDP])

- zoning plans, including *reguleringsplan* and *bebyggelsesplan*, defined by PBL 1985, and *områderegulering* and *detaljregulering*, defined by PBL 2008.

The planning norms that have been considered in this analysis are

- norms for outdoor areas in inner Oslo (*utearealnormer*) and
- parking norms (*parkeringsnormer*).

Focus of the analysis regarding Norwegian planning system

According to Andreas Faludi, there are two types of plans: *strategic* and *project plans*, which differ in certain respects:

> Project plans are the blueprints where implementation is unproblematic and outcomes are expected to conform to intentions. Strategic plans are momentary agreement records of various projects considered at different points in time by the participants. The future remains open. Decision makers who use them must *perform*. Analysis of their performance requires case studies. (Faludi, 1989, p. 135)

In the Norwegian planning context we can identify both types (Figure 10), although *strategic plans* could contain certain features of concrete, project plans. Hence, in the Norwegian context they can be considered predominantly strategic (KP and KDP), as they not only refer to general goals for urban development but may also contain specific details regarding physical issues (Børrud & Aarskog Knutsen, 2018). For example, in the 2000s in KPs in Oslo, it was no longer allowed to use maps that only schematically, and thus imprecisely, show the areas intended for densification. In addition to each municipal plan, it is also possible to use regulations (in Norwegian, *bestemmelser*) which are legally obligatory and guidelines (in Norwegian, *retningslinjer*) for defining more precisely the aims for physical features of certain areas.

Current urban development under densification policy is effected by individual projects, and it is at this stage of planning that *project plans* are made. The first such plan is the zoning plan (in Norwegian, *reguleringsplan*), the stage between the strategic goals and the design of actual physical form. At this stage, synthesis of the goals occurs, and a physical output is shaped through a particular planning and design process, in a specific context of a certain part of urban tissue (particular constituted tissue). The spatial scale that zoning plans cover is the aforementioned intermediate scale (see Figure 1) – the scale between a building and an urban block. Design solution adopted at the end of the zoning stage provides a legally binding framework for the final step in the development: building permit application, where design is elaborated and the building(s) are constructed accordingly. In the part of this PhD study that covers design performance, or more specifically the actors' concerns regarding the physical form, the focus is on the zoning stage.

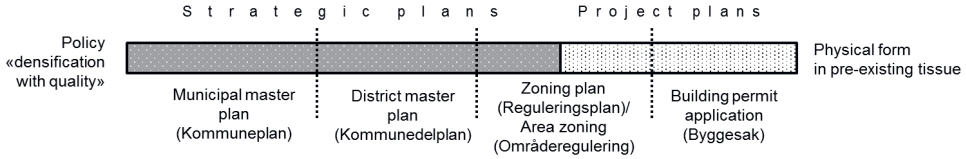


Figure 10. Outline of municipal plans for their character, following Faludi's (1989) types of plans.

2.2.2. Aspect of actors

Actors were addressed through their involvement in the design process at the zoning stage. As the actors represent the different interests always present in the pre-existing urban tissue, their concerns regarding the new design in fact reveal mutual effects between the new built forms and the pre-existing urban tissue, thus helping to explain the new built forms and the transformation of urban tissue. The aim of this part of the analysis is to explore the most important spatial concerns arising in the processes – how the design of new built and open spaces was influenced by the actors who had interests in the pre-existing urban tissue.

More specifically, this part of the analysis focuses on the physical features of new built structures and related concerns expressed by different actors in the processes, their considerations of the broader urban context and the effects of their inputs on the design solution. The analysis covers public planners and actors other than designers (architects) and developers.

The designers' and developers' perspectives are not in focus for two reasons. Firstly, the developers and designers produced the design proposals together, and it was possible to understand their spatially related aims and considerations of the surrounding spatial context from the design (assessing both the design proposals and the already-built structures). The final spatial composition (that was built) was investigated in the part of the study called "design aspects" (explained in Section 2.2.3). Secondly, numerous studies have already dealt with the actors' roles, aims and power relations in the planning processes (see for example Børrud, 2005; Hanssen & Hofstad, 2015; Nordahl, 2015; Røsnes, 2005), and a detailed investigation of the developers' and designers' involvements in the design process would demand a different study.

2.2.3. Design aspect

The analysis of design links to spatial organisation of new developments and their performance in the constituted tissue. As it covers the performance, or more specifically the relations of new structures to the pre-existing urban tissue, this aspect is placed in the procedural part of the analysis, along with the performance of actors. The analytical concepts applied here rely on Westrik's (2002) thinking on approaches in urban design and the design of urban architecture; he considers *function* and *form* as the most important aspects. Moreover, he emphasises the articulation of function and form on the site, as well as considerations of the area's existing characteristics and specific design problems.

Therefore, the following concepts have been devised for the analysis of design in an urban setting in Oslo:

- *articulation* of physical *form* and architectural *function* of buildings and open spaces at the intermediate spatial scale – disposition of new built volumes on the site and their relations to the constituted tissue: buildings, streets and urban blocks; and
- *connections* of new open spaces to other open spaces in the surroundings (including streets), which are essentially based on the abovementioned concept of articulation.

2.3. Research questions

The main question posed in this thesis is as follows:

What are the morphological characteristics of the physical outcomes of densification in Oslo, and what spatially related concerns have influenced the design of those outcomes?

In order to answer this question, it is first necessary to explore the urban tissue that has been transformed through densification. Second, the analysis must cover the new physical structures by which the urban tissue has been transformed. The analysis of new structures is conducted systematically and encompasses their spatial characteristics and relations to the pre-existing tissue into which they are inserted. The next step is to examine the processes of design for new structures, carried out in the framework of the planning processes. The analysis of the planning processes involves procedural aspects relative to spatial aspects: spatial concerns contained in the planning instruments and the involvement of actors in the process and their influence on the design solution.

Therefore, the analysis comprises two main aspects: *spatial* and *procedural*.

The spatial part of the analysis covers physical outcomes across spatial scales, between the scale of a single building and several urban blocks. The following sub-questions are posed here:

1. What types of urban tissue have undergone densification in Oslo?
2. What principles guiding the addition of the new physical structures in the pre-existing urban tissue can be identified at the spatial scale between a single building and the urban block?
3. How are the newly built structures articulated in spatial and functional terms at the scale of the urban block and at the intermediate spatial scale (of the individual intervention project), and how does this articulation relate to the pre-existing urban tissue?
4. Does the densification produce a characteristic architectural type of multi-family residential buildings?

The procedural part of the analysis includes the following sub-questions:

5. Do the formal planning instruments found in the Norwegian planning system contain considerations of the morphological questions of the physical development at the intermediate spatial scale?
6. What spatially related concerns were raised in the design processes for the individual intervention projects, and how did those concerns influence the final design at the intermediate spatial scale?

Table 2. Summary of research sub-questions, the subjects and spatial scale they address and parts of the study that cover them

Main research question: What are the morphological characteristics of the physical outcomes of densification in Oslo, and what spatially related concerns have influenced the design of those outcomes?				
	Research sub-question	**Subject**	**Spatial scale**	**Part of the study**
SPATIAL ASPECTS	1. What types of urban tissue have undergone densification in Oslo?	Analysis of the urban tissue that surrounds the new built structures (constituted tissue)	Urban block	Paper II
	2. What principles guiding the addition of the new physical structures in the pre-existing urban tissue can be identified at the spatial scale between a single building and the urban block?	Analysis of the changes of the urban tissue: spatial vocabulary of densification, types of interventions and investigation of new urban blocks	Between a single building and several urban blocks	Papers I & II
	3. How are the newly built structures articulated in spatial and functional terms at the scale of the urban block and at the intermediate spatial scale (of the individual intervention project), and how does this articulation relate to the pre-existing urban tissue?	Analysis of the physical form of three selected cases relative to the plot, urban block and the constituted tissue types in which they are situated	Intermediate scale – the scale of individual projects (building, plot and urban block)	Paper III
	4. Does the densification produce a characteristic architectural type of multi-family residential buildings?	Typo-morphological analysis of the architectural type	Intermediate scale – the scale of the individual project (building, plot and urban block)	Additional analysis I
PROCEDURAL ASPECTS	5. Do the formal planning instruments found in Norwegian planning system contain considerations of the morphological questions of the physical development at the intermediate spatial scale?	Analysis of the planning instruments applied in the intervention projects and the examination of their relations to the questions of physical form at the intermediate spatial scale	Intermediate scale – the scale of individual project (building, plot and urban block)	Paper III & Additional analysis II
	6. What spatially related concerns were raised in the design processes for the individual intervention projects, and how did those concerns influence the final design at the intermediate spatial scale?	Analysis of design performance in three selected cases in terms of the actors' spatially related concerns and the influence of those concerns on the physical outcomes	Intermediate scale – the scale of individual project (building, plot and urban block)	Paper III

3. Methodology

The methodology of this study has been developed to address both the spatial and the procedural aspects of analysis. The main methodological framework is that of the "embedded case study" within which the urban morphological methodology and analytical concepts have been primarily applied.

The morphological methodology and concepts cover the spatial analytical aspects and partly the procedural aspects. Some of the morphological concepts that cover the spatial aspects have been slightly modified due to the specifics of the planning context that this study addresses. For the procedural part of the analysis, additional methods from social sciences (for example interviews) and concepts from planning theory have been combined with the morphological methodology. This combination has been made with the aim of strengthening the understanding of the procedural aspects of the current urban transformation. The methodology and the particular methods are detailed further in this chapter.

3.1. Case study methodology and urban morphology

As explained earlier, this study is based in the field of urban morphology combined with certain concepts from the planning theory. Urban morphology is a theory with an analytical-descriptive character from which the methodology is derived. It is a study of both the physical structure of cities and the underlying intangible forces that led to the formation of this physical structure. The urban morphological approach has a strong temporal character as it addresses urban development in particular historic periods. Each historic period is characterised by certain conditions (such as planning, social and economic conditions). Hence it can be said that morphological studies are strongly context-dependent as regards temporal and spatial contexts.

Another aspect of the context-dependence in urban morphology can be understood from the standpoint of the Italian morphologist Aldo Rossi, who claimed that "the residential district is (…) a moment, a piece of the city's form. It is intimately bound up with the city's evolution and nature, and is itself constituted of parts, which in turn summarise the city's image" (Rossi & Eisenman, 1982, p. 65). He further stated that "The relationship between the dwelling areas and the primary elements of a city is responsible for configurating that city in a specific way" (Rossi & Eisenman, 1982, p. 95). He defined the primary elements as "those elements capable of accelerating the process of urbanisation in a city" which can be identified by their function and not necessarily by physical artefacts. They constitute the *locus* (site) and *genius loci* (its unique character). The understanding of urban form based on the primary elements (and their relationship with the dwelling areas), *locus* and *genius loci* implies that a morphological study has a high degree of place-specificity, and its primary aim is not that of generalisation. The specificity implies that the methods of analysis need to be adjusted for a particular urban context. Urban morphological studies can cover these contexts in different ways. They can be synchronic – when the physical outcomes of a planning era are studied in different cities or countries (see, for example, Lovra, 2017) or diachronic – when the development of the urban form of one city is studied across different planning eras or in one particular planning era (see, for example, Esfanjary, 2015; Li & Gauthier, 2014). The character of this PhD study is diachronic, as it analyses the development of one city, Oslo, over a certain period of time in the planning cycle defined by the policy of densification. This study can thus provide a good basis for future studies of densification across different cities.

Due to the high place-specificity, the methodology of urban morphology relates to the *case study* methodology, and urban morphology essentially implies the use of this methodology. A case study is a form of qualitative research, though it is also applied in architectural and urban design research. Qualitative research offers approaches suited to the specificities of social sciences where the objects of study are human beings in their social environs. This realm is concerned with human consciousness, language and interaction between people, and it recognises that the researchers themselves are humans. Urban morphology is, in part, inherently qualitative because it understands the built form as a result of human activity.

Yin defines the case study as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003, p. 13). In research on the built environment, case studies are also applied for the purpose of "investigating a phenomenon within a context", aiming to provide a thorough understanding of a central issue that is explored together with other related issues and context (Proverbs & Gameson, 2008). Dissimilarly from other kinds of qualitative research, case study does not require any particular methods for collection and analysis of data. Moreover, it is mainly determined by the theoretical background and goals of the study, making it suitable for a wide range of applications: exploratory, descriptive and explanatory (Yin, 2009). Considering these characteristics of the case study, it is possible to note a significant overlap in methodological stances between case study and urban morphology.

In this PhD study, the phenomenon is the transformation of urban tissue under densification policy and the context is represented by the planning and spatial conditions in Oslo. The urban morphological approach applied here is linked to a variant of case study, a *single-case study*, as the focus is on the city of Oslo. The understanding of the main case (more precisely of the ongoing urban development in Oslo) is deepened by the analysis of a number of *sub-cases*, which are subunits of the main case (Yin, 2003). Such a case-study structure represents an *embedded case study* (see Figure 11). The sub-cases have then been analysed both individually and in relation to each other. The latter is a procedure known as a *cross-case analysis*. Cross-case analyses allow for the deepening of understandings and explanations of cases, as well as for more general categorisations and explanations of the connections between the features of particular cases (Miles, Huberman, & Saldaña, 2014). In this study of Oslo, the analysis of sub-cases could be understood as cross-case analysis, since each case is analysed for its spatial and procedural features, which have been typologised, and the types have been used for more general explanations and conclusions about the transformation of urban tissue in the context of densification.

Following Flyvbjerg's (2006) notions on the strategies for case selection (see Figure 12), the choice of Oslo as the main case in this study of the planning for densification can be considered an "information-oriented selection". Oslo can be considered an "extreme case" (Figure 12) or similarly, according to Yin, "a *unique* case" (Yin, 2003, p. 40), as it is a city with a long-standing implementation of densification policy, with many built structures that resulted from densification and with its own specific planning, physical, topographic and social characteristics.

Certain steps of the analysis have covered a sample of three sub-cases out of the 71 in a detailed investigation of the zoning processes. For the way the sampling of those sub-cases was conducted, they can be considered "maximum variation cases" (Figure 12), since they

were selected in order to cover different principles of addition of built masses applied planning instruments and the contexts throughout the built-up area of Oslo.

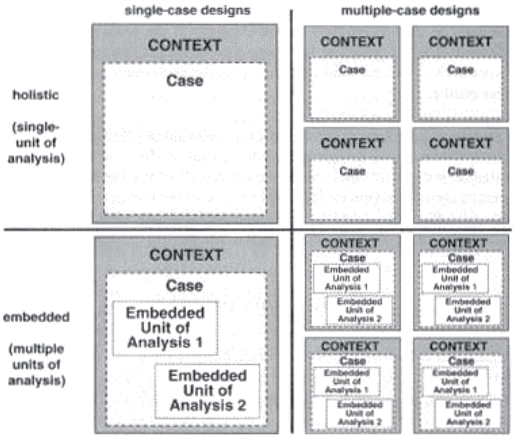


Figure 11. Basic types of designs for case studies (Yin, 2003, p. 40)

At this step, interviews with public planners in charge of the zoning processes have also been employed as a method. Interviews are a commonly used approach in qualitative research. According to Merriam (1997), there are several types of interviews:

- *highly structured or standardised* – with strictly defined formulation and order of questions;
- *semi-structured* – comprising a mix of questions with different degrees of structuring or consisting of the questions which are more flexibly formulated; and
- *unstructured/informal* – a flexible, explorative interview that bears a resemblance to a conversation, with open-ended questions.

Among the different types, semi-structured interviews have been selected which provided a flexibility and openness in terms of the new notions and ideas raised by respondents during the interviews. This was necessary in order to gain exhaustive insight into the topics of interest regarding the zoning planning processes. The use of interviews is further detailed in Section 3.2.2. In conducting the interviews, the ethical rules demanded by Norwegian Centre for Research Data (in Norwegian, *Norsk senter for forskningsdata*) concerning the handling of personal data and the interview data have been followed.

Type of selection	purpose
A. Random selection	To avoid systematic biases in the sample. The sample's size is decisive for generalization.
1 Random sample	To achieve a representative sample that allows for generalization for the entire population.
2 Stratified sample	To generalize for specially selected sub-groups within the population.
B. Information-oriented selection	To maximize the utility of information from small samples and single cases. Cases are selected on the basis of expectations about their information content.
1 Extreme/deviant cases	To obtain information on unusual cases, which can be especially problematic or especially good in a more closely defined sense.
2 Maximum variation cases	To obtain information about the significance of various circumstances for case process and outcome, e.g. three to four cases that are very different on one dimension: size, form of organization, location, budget, etc.
3 Critical cases	To achieve information that permits logical deductions of the type, 'if this is (not) valid for this case, then it applies to all (no) cases'.
4 Paradigmatic cases	To develop a metaphor or establish a school for the domain that the case concerns.

Figure 12. Flyvbjerg's notions on the strategies for the selection of samples and cases (Flyvbjerg, 2006, p. 426)

3.1.1. Main case: Oslo

For several reasons, Oslo is a suitable case for the study of the urban form resulting from densification strategy. Firstly, it is the capital city of Norway, and in early 2000s, it was among the fastest-growing cities in Norway (Falleth & Saglie, 2012) due to intensive building activity. Secondly, the policy of densification has been implemented in Norway for a considerably long time, since it was already adopted in early 1990s (Hanssen, Hofstad, Saglie et al., 2015) as the main approach for urban development. The extent of densification has been intense in Oslo, and today it provides ample data resources for a study of the transformation of urban tissue and the planning practice.

Today, the municipality of Oslo has over 670,000 inhabitants (Statistics Norway, 2019a; Tvedt, 2019), and in the period between 2010 and 2019 its population grew by approximately 100,000. There has been a steady increase of population and a high demand for housing. The population expected by 2030 is 759,158, while by 2040 it is estimated to reach 815,514 (Statistics Norway, 2019b). As such, needs for housing will also continue to grow, along with the pressure on already limited, available land.

The built-up area of Oslo covers 147 km^2 (Tvedt, 2019). Figure 13 displays the map of the municipality of Oslo and the built-up area within it, marked with dark grey. The areas marked with light grey represent the forest belts (in Norwegian, *marka*) and agricultural land north and east of the city. The areas marked with the lightest nuance of grey are the sea (south-west of the city) and numerous lakes (north and east of the city). Urban development is strictly limited, and a border between the forest belt and built-up area was determined in the late 1930s, undergoing only slight changes since (Tvedt, 2019). The forest belt is protected landscape. Densification policy, introduced with the aim of creating conditions for sustainable urban development, demands that in already built-up areas new buildings should be constructed within those borders only. A specific condition in Oslo is that it has been implementing the densification strategy for approximately three decades, while presently its building density is not particularly high compared to that of cities in other geographical contexts (for instance in Asia).

Figure 13. Map of Oslo municipality (delineated with blue lines) with the built-up area (marked with dark grey and delineated with red); source: Statistics Norway (www.ssb.no) – rendered in compliance with the copyright policy of Statistics Norway.

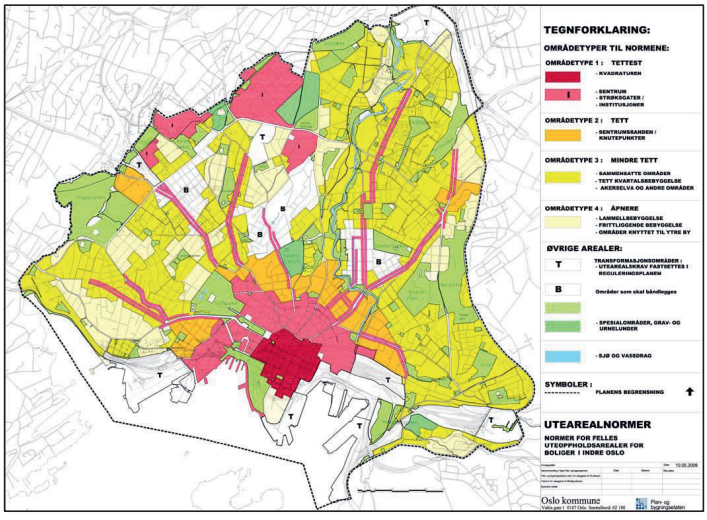


Figure 14. Map of urban tissue types in inner city of Oslo, typologised according to density (Oslo kommune, 2012, p. 19);
dark pink and light pink colours denote the densest, most centrally located urban tissue; orange represents dense urban tissue, yellow denotes less dense tissue; beige denotes the tissue of the lowest density.

3.1.2. Sub-cases and data collection

The main case, Oslo, has been studied through a number of sub-cases, which are individual projects designed and built under densification policy. Following the aforementioned stance of Rossi (Rossi & Eisenman, 1982, p. 95), "The relationship between the dwelling areas and the primary elements of a city is responsible for configuring that city in a specific way", the architectural programme in focus is residential. Given the specific conditions in Oslo, where housing demand has been high due to a constant increase in population and where flats in multi-family buildings make up the majority housing units (Statistics Norway, 2019b), I opted to include new multi-family projects as sub-cases. It is also an architectural programme of considerably high densities, and in that sense it affects physical form more significantly than do other residential types. In further text, I refer to sub-cases as "cases" and "case projects".

As I have already explained in Chapter 2, the cases have been primarily delimited by the timeframe. It was important that the case projects were already built so that it would be possible to visit them on site; hence, I selected the year of completion as a criterion, or more precisely, the year of the issuance of the first use permit (use permits were often issued in stages, as the construction was being finished in stages). I defined the time span between 2004 and 2014. This time span belongs to the period of high building activity in Oslo and thus provides abundant study material. Another reason was that this time span covers the decade prior to the data collection phase for my thesis.

In spatial terms, the main criterion for selection was the amount of built space (i.e. the number of built volumes and storeys), since the aim was to encompass the cases that affect the physical form considerably. Thus, multi-family projects with at least two separate built volumes or one large volume facing minimum two streets, where at least one building is minimum five storeys high (ground floor and four storeys above) have been included. Projects with a single built volume have been excluded, since the amount of new built space they introduce is relatively small, meaning they do not have a significant influence on the density of urban tissue. The criteria regarding the number of storeys are based on Lehman's study (2010) of urban density and compactness, which identified heights between five and seven storeys as the most suitable for the ideal of urban sustainability.

The collection of case data was challenging, as there was no database of projects that could be searched chronologically. For that reason, the starting point in data collection was a brochure, *God boligfortetting in Oslo – eksempelsamling* (*Examples of Good Residential Intensification in Oslo*), published by the Agency for Planning and Building Services of the Municipality of Oslo (Oslo kommune, 2013), which contained a number of good examples of residential projects, according to municipal planners. Further, sources like private registers had to be used. The most valuable was that of Eiendomsverdi, a private company which registers the development and activities of real estate markets in Norway and runs an online database (eiendomsverdi.no, with paid access) on which individual buildings can be searched for by the year of completion or the address. Another useful resource was "Se eiendom", a platform displaying the property data from the national database, buildings, addresses, registered owners and the rights from the cadastre by Kartverket (the Norwegian Mapping Authority). In addition, the web sites of building associations also provided information on the recently built projects. Two of these were used: OBOS (the largest Norwegian cooperative building association, owned by its members) and Selvaag Bolig (one of the largest residential development

companies in Norway). Additionally, it was also necessary to use my own knowledge of Oslo and observations of the urban tissue in the identification of cases.

In the case selection, multi-family residential projects belonging to Fjordbyen have been excluded, as it is a landmark project for waterfront regeneration used in the profiling of Oslo, planned and designed with specially defined goals and already much addressed in research (see, for example, Bjerkeset & Aspen, 2015; Grønning, 2011; Røe, 2015). This study therefore focuses on "ordinary architecture" built in different locations across Oslo's built-up area in order to investigate how other parts of urban tissue in Oslo have been changing. As mentioned earlier, numerous new developments have been built as individual projects, forming "a patchwork pattern of plans…within urban built-up areas" (Falleth & Saglie, 2012, p. 267). Over a hundred cases constructed in the selected period have been identified, and out of them, 71 conformed to all criteria. Some of the projects belonged to the same zoning plan, but they were considered separate cases if they were built in different phases (in Norwegian, *felt*). Hence, each phase (*felt*) was counted as a case on its own, as they were occasionally designed and developed by different teams and constructed at different times.

After creating a list of cases, I visited and photographed each project on the site. This step was crucial for understanding the spatial and functional characteristics of the projects as well as the surrounding urban tissue. Afterwards, I prepared a graphic presentation for each case project, showing the urban block where it is situated and covering the surrounding urban tissue in the radius of 250 m (Figure 15). The surrounding tissue included in this presentation comprises buildings and open spaces reachable at walking distance for most inhabitants, which is within 200–300 m (Thorén & Nyhuus, 1994, p. 23). The graphics were created based on digital maps obtained from the Norgesdigitalt database - FKB-data and Matrikkel-data in UTM32 Euref89 (accessed in February 2014). Digital maps were converted to AutoCAD format, which served as a basis for the production of figure-ground drawings of case urban blocks.

In addition to the present conditions of the case locations, I used historic maps and aerial photos of the previous site conditions in order to assess changes of project sites. It was possible to obtain them from the online database of Finn.no AS (available at kart.finn.no, produced by Agency for Planning and Building Services of Oslo municipality – Plan- og bygningsetaten).

Next, the information about the applied planning instruments in case projects was collected. The source for this stage of data collection was Planinnsyn, the publicly accessible online database of the Agency for Planning and Building Services of Oslo Municipality (in Norwegian, Plan- og bygningsetaten [PBE]). For each case, it was possible to gain insight into planning documents on the process of zoning plan development (in Norwegian, *reguleringssak*). A list of applied planning instruments could be found in those documents, most often in the case documentation prepared for the local government (in Norwegian, *bystyresak*). However, in some cases it was necessary to look also into the building permit application documents (in Norwegian, *byggesak*) to find the information about planning instruments. In this part of the analysis, the focus was on municipal planning, with the awareness that the plans adopted at this level of planning are subordinate to the national policy, PBL and national policy provisions and guidelines (*Rikspolitiske bestemmelser/retningslinjer*, as defined in PBL 1985) or Central government planning provisions / guidelines (*Statlige planbestemmelser/planretningslinjer*, as defined in PBL 2008), depending on the act that applied at the time of zoning.

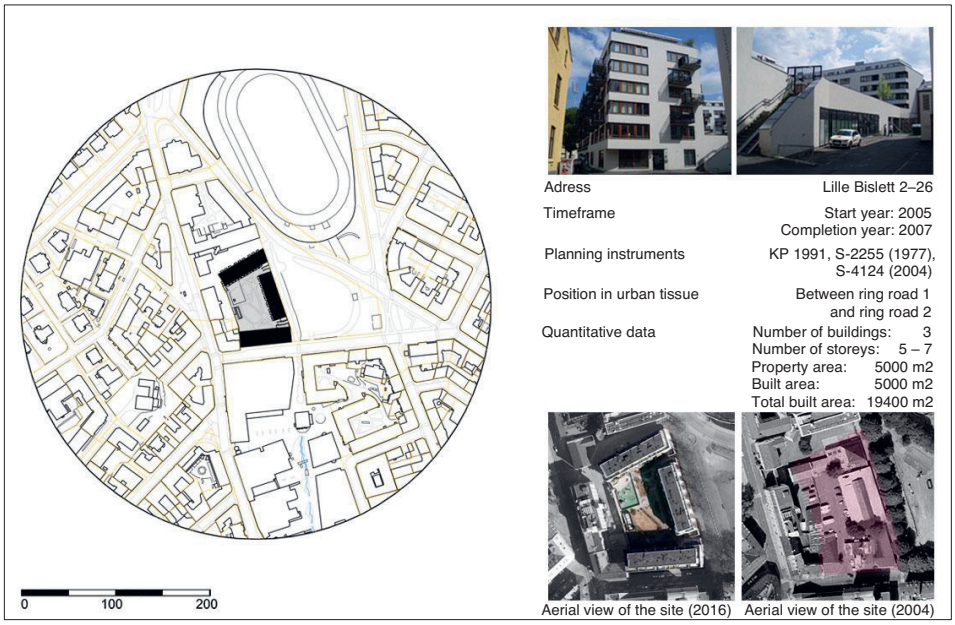


Figure 15. Example of a data sheet with basic case description (image sources: own photos (above), © 2019 Plan- og bygningsetaten, Oslo Kommune (below))

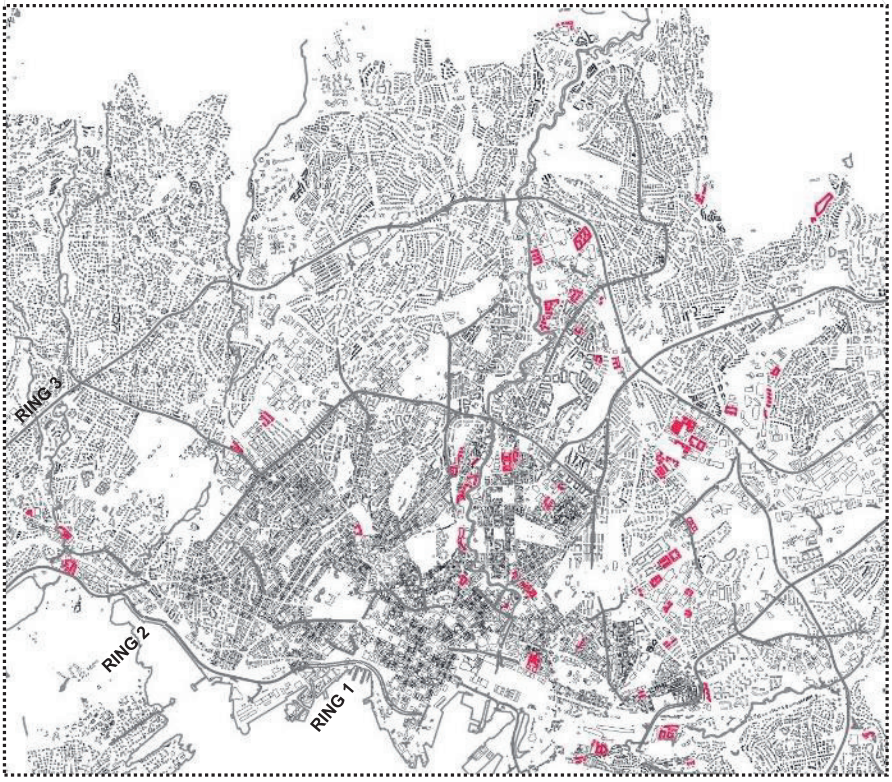
Lastly, I created a data sheet comprising the information on address, timeframe, quantitative data, planning instruments and position in the urban tissue for each case (see Table 3). An overview of cases in the built-up area of Oslo is provided in Figures 16 and 16.1.

Table 3. Summary of initial data analysis, conducted for each case project

Data	Item of analysis	Description / criteria
Address	Address of the case project	Street(s) and house numbers in all buildings
Timeframe	Start year	Year when construction started
	Completion year	Year when first use permit was issued (in Norwegian, *brukstillatelse*)
Planning	Planning instruments applied in the case project	List of plans, for example, municipal plan (e.g. KP 2015), partial municipal plan (e.g. KDP-3), zoning plan (e.g. S-3970)
Position in urban tissue	Situation in the city	Determined relative to ring roads, as the built-up areas between the ring roads vary for the density of urban tissue
	Map of case together with surroundings of 500 m in diameter	A graphic presentation
Quantitative	Number of buildings in the project	Min. 2 buildings or 1 larger volume facing min. two streets
	Number of storeys	At least one of the buildings must have min. 5 storeys
	Property area	Area of plot(s) that the project covers (m²)
	Built area	Footprint area at street level (m²)
	Total built area	Sum of all floor areas (m²)

Figure 16. Map of built-up area of Oslo with 71 cases marked in red
RING1 - ring road 1, which encircles the densest, most central part of urban tissue
RING2 – ring road 2, which encircles the dense, central part of urban tissue, of lower density than within ring road 1
RING3 – ring road 3, which encircles a part of urban tissue less dense than within ring road 2; outside ring road 3, the urban tissue is of lowest density

Figure 16.1. Section of the map with the highest concentration of cases (70 of 71)



3.2. Methods for analyses

The analysis has the physical outcomes of densification as a starting point, and it is based on empirical data. The main research question, *What are the morphological characteristics of the physical outcomes of densification in Oslo, and what spatially related concerns have influenced the design of those outcomes?* has been addressed through two analytical aspects: *spatial* and *procedural*.

Six sub-questions cover these aspects. Figure 17 presents the subjects of analysis covered in each sub-question, while the sub-questions are grouped in accordance with the papers that include them. As the study is based on 71 case projects and as some steps investigate a sample of three projects, the papers and sub-questions are presented accordingly. The structure of this section follows the sub-questions.

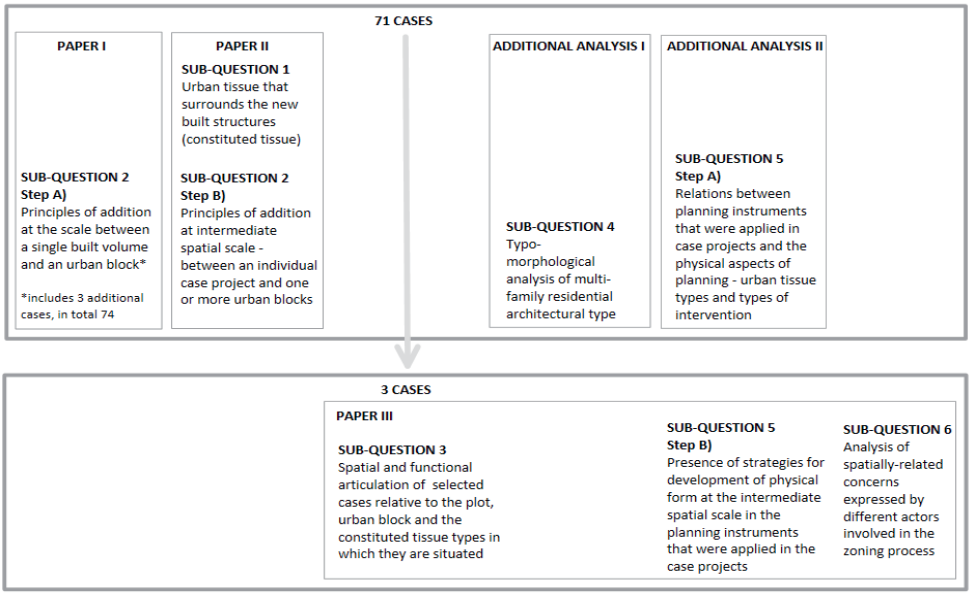


Figure 17. Diagram of the analytical steps covered in sub-questions and papers

3.2.1. Spatial analysis

Sub-question 1: What types of urban tissue have undergone densification in Oslo?

The first step of the analysis included all the collected cases (total of 71 cases) and investigated the urban tissue that has undergone densification (i.e. fragments of urban tissue around each case project and the site where the projects have been situated). Urban morphological perspectives have been applied, and the focus of the analysis has been on the intermediate spatial scale.

In the analysis of urban tissue, the concept of constituted tissue has been employed. For each case, the footprint (figure-ground) shapes and dispositions of buildings that comprise the constituted tissue have been analysed. The patterns formed by the relations between the buildings, the streets and the adjacent open spaces have been assessed for their resemblance to

the pre-modernist and modernist urban tissues (Figure 18). The approach of pattern recognition is applied here. Pattern analysis encompasses the streets and the urban block where the case is situated along with the urban blocks that define the other sides of the surrounding streets. The degree of correspondence to the reference patterns has been identified, and the constituted tissues have been typologised accordingly. In addressing the types of buildings that the constituted tissue types contain, a nuanced approach is applied to housing typologies as they have presented a high degree of typological variation.

Concerning the sites at which each case project is located, the current aerial photos and aerial photos from the past have been analysed in order to investigate the changes of the individual sites. The previous condition has been investigated for the presence of buildings and open spaces.

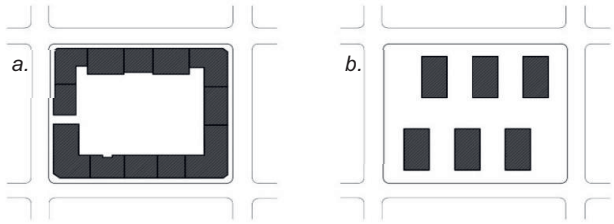


Figure 18. Two reference patterns of urban tissue: a) traditional and b) modernist

Sub-question 2: What principles guiding the addition of the new physical structures in the pre-existing urban tissue can be identified at the spatial scale between a single building and the urban block?

At this stage, two spatial scales have been analysed.

A) The spatial scale between *a single built volume and an urban block*.

The analysis at this spatial scale offers ways of "reading" the built form of densification in spatial and volumetric terms by addressing the principles of addition of new built masses to the pre-existing layers of built form. In so doing, this part of the spatial analysis establishes an architectural vocabulary of densification regarding the multi-family residential programme. The basis for identification of these principles comes from Lehmann's (2010, p. 746) diagram of densification principles (Figure 19) that he devised in his study on the transformation of cities for sustainability. The first aim of this stage of the analysis is to recognise the application of these principles in the context of Oslo. The second aim is to provide instructive insight on how to identify those principles in the urban built-up form – how to "read" the spatial outputs of densification in Oslo, from the perspective of learning from the experience.

The methods applied here consist of site visits and analysis of maps, along with aerial photos (both current and historic) of each case. Concerning the cases, this stage of analysis is an exception, as three additional cases with single built volumes have been included. These cases were found in the brochure *God boligfortetting in Oslo – eksempelsamling* (*Examples of Good Residential Intensification in Oslo*), published by the Agency for Planning and Building Services of the Municipality of Oslo (Oslo kommune, 2013) and used just in this step of the analysis. They are located at the following addresses: 1) St.

Halvards street 75 (district Vålerenga), 2) Parkveien 5 B-C (district Frogner) and 3) Korsgata 5 (district Grünerløkka).

Aside from the principles defined by Lehmann (Figure 19), there appeared another principle that has not been included in this study. It is a so-called "onfill", where a significant number of storeys are added upon an existing building, and it can be considered the addition of a building on top of an existing building. An example of such a project is currently in the zoning stage, and it is previsioned for the location at the address Nydalsveien 32B. This planning initiative proposes an addition of two 12-storey tower blocks on top of an old industrial building. Information on this proposal can be found in the "Planinnsyn" database (see Section 3.1.2.).

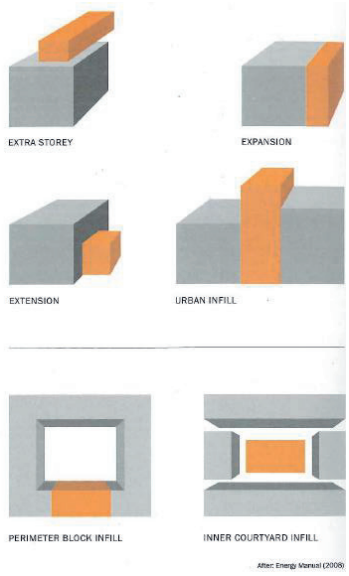


Figure 19. Diagram illustrating various densification and urban infill principles. (Lehmann, 2010, p. 746)

B) The intermediate spatial scale – *between an individual case project and one or more urban blocks*.

A total of 71 cases has been investigated at this stage. The morphological element of urban block has been used as the main point of reference. In this step, the focus has been on the ways the built structures of case projects interact with the pre-existing tissue. These ways, here termed *types of interventions*, have been identified based on the assessment of the relations between the new built structures and the urban block in which they are inserted; more precisely, the relations that the new structures establish with the buildings and streets in the previously existing block.

This stage of the analysis started from the premise that new built structures can be an infill in the pre-existing urban tissue or a part of land-use transformation area, based on the growth patterns exposed by another study on densification in Oslo (Hanssen, Hofstad, Saglie et al., 2015, p. 16):

1. *Transformation: Transformation of industrial / commercial areas (brownfields) into new residential areas (often combined with industry).*
   The changes in the industrial structure in recent decades, from industrial and production to the production of knowledge and services have led to the transformation of the large areas. Such a transformation usually involves a densification with more homes and new, less area-demanding jobs.

2. *Intensification of land use within urban boundaries:*
   - As infill in the existing dense settlement
   - Increased utilisation in established urban structures by means of deeper and higher buildings, for example around transportation hubs.
   - Intensification in dispersed neighbourhoods, for example through the division of land ("apple garden development" – in Norwegian, "*eplehageutbygging*").

3. *Expansion: Construction on undeveloped land within the urban boundary.*
   - Green areas
   - Other unused areas.

Figure 20 presents the spatial interpretation of these growth patterns as devised for the purpose of this analysis.

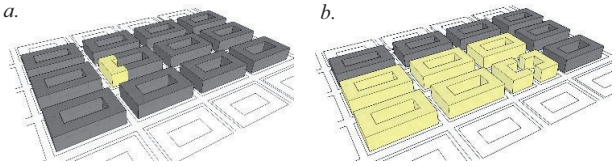


Figure 20. Presumed types of intervention in the urban tissue, presented using the example of traditional tissue type; a) infill, b) part of land-use transformation area.

Sub-question 3: How are the newly built structures articulated in spatial and functional terms at the scale of the urban block and at the intermediate spatial scale (of the individual intervention project), and how does this articulation relate to the pre-existing urban tissue?

The third step of the study details the performance of new built structures in different constituted types. Of the 71 cases, three have been selected for detailed analysis to address this sub-question. The cases are presented in the results and in the Appendix C. The criteria for selection have been based on the results of sub-questions 1, 2 and 5 (see Figure 17) so as to cover different types of constituted tissue, types of intervention and sets of planning instruments. Only one type of the constituted tissue, modernist, has not been encompassed, since the smallest number of cases were built in that tissue type (3 of 71).

In this step, the morphological concepts of the building, street and urban block have been employed. The main concept of *articulation* of the new built structures is understood as the spatial distribution of the physical form and architectural functions at the intermediate spatial scale. Hence at this scale, the analysis of articulation includes the interaction between the new built structures and the constituted tissue, based on:

a) *building-street relations*, which are reflected in the spatial disposition of the new built volumes relative to the adjacent streets;
b) *heights* of the new buildings compared to the buildings in the surrounding urban blocks; and
c) *organisation of open spaces* (i.e. an assessment of whether it is comparable to open spaces in the surrounding urban blocks in terms of size, connections to the surrounding streets and accessibility).

Following these criteria, the relevant categories that can occur are:

1. *integrated*, referring to cases where the new built volumes follow the spatial logic of the surrounding tissue;
2. *segregated*, referring to cases where the new built volumes introduce a different spatial logic compared to the surroundings, by the previously mentioned criteria – moreover, if only one criterion for "integrated" is fulfilled, the built structure is considered segregated; and
3. *semi-integrated*, referring to cases where two out of three criteria for "integrated" are present.

Regarding the articulation of functions, cases have been analysed for the presence of non-residential use and its spatial placement within the new built structure, including the position relative to streets (i.e. whether the non-residential part of the case project is accessible from the adjacent streets).

Sub-question 4: Does the densification produce a characteristic architectural type of multi-family residential buildings?

The final step of the spatial analysis focuses on the smallest spatial scale, that of individual intervention projects. The aim is to explore the building types produced in densification, in the selected period of time. The methodological basis of this part is Kropf's (2014) understanding of built form through relationships between different morphological elements, from building materials to urban tissue (Figures 20 and 21). The spatial organisation of built and open spaces in 71 cases has been analysed and the relationships between the morphological elements that constitute them have been presented diagrammatically, following the logics of Kropf's diagrams. This allowed for a characteristic type to be identified, and a nuanced typologisation has been conducted based on the assessment of the "third dimension" of the new type – namely the position (elevation) of the lowest storey(s) in the cases of new building type relative to the surrounding streets and terrain.

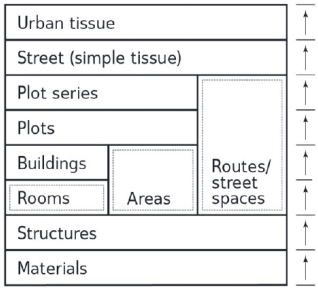


Figure 20. Multi-level diagram showing the position of the route or street space and its relationship to plot series to form the street (Kropf, 2014, p. 50)

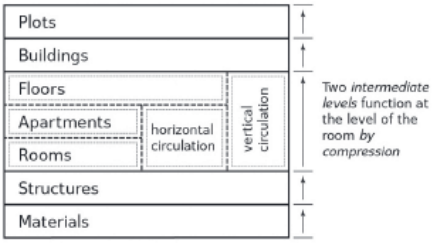


Figure 21. Multi-level diagram of the multi-storey apartment house (Kropf, 2014, p. 52)

3.2.2. Procedural analysis

Sub-question 5: Do the formal planning instruments found in Norwegian planning system contain considerations of the morphological questions of the physical development at the intermediate spatial scale?

This sub-question covers relations between the planning instruments applied in the case projects and the morphological characteristics of the cases and the urban tissue in which they were situated. The objective has been to investigate the planning instruments as the sources of guidance on the design of new physical structures in the implementation of densification policy. Such guidance (i.e. the public planners' intentions for the physical form) is among the forces that explain the morphology of the new built structures.

The relations between the planning instruments and the built form have been explored in two steps.

A) The first step included all 71 cases.

Planning instruments that were applied in each case have been analysed according to the planning legislation, in order to see which of the instruments prescribed by the law were used in each case process and thus understand the application of these instruments regarding the spatial aspects. The valid legal framework was the one that applied at the time of design of each individual project (i.e. the time at which the zoning plans were made). Since a new PBL was introduced in 2008 with considerable differences from its predecessor, it was necessary to take into account two laws: PBL 1985 and PBL 2008. The hierarchy of planning instruments that the laws prescribe for densification interventions is represented in Table 2.

The planning instruments applied in each case have been listed and examined for their presence in the PBL. As in each case there was more than one planning instrument applied, each case had a *set* of planning instruments. These sets were analysed in order to recognise potential patterns – similarities and differences in the instruments that comprise the sets among the cases – and thus identify types of instrument sets. Next, the identified types were analysed in relation to the constituted tissue type in which each case was situated, in order to understand how and whether the sets of planning instruments were related to spatial aspects of planning, namely to particular types of urban tissue that underwent densification. Here, the analytical approach of pattern recognition was applied (as explained in Section 2.1.3).

Concerning the methods for this step, I first read the text of the PBLs from 1985 and 2008, and outlined the planning instruments that the law prescribed. Next, I turned to the main data source in this analytical step, which was Planinnsyn, the publicly accessible online database of PBE. For each case, I looked into the zoning stage and read the documents called "bystyresak" (document presenting the zoning process to the City Council), containing detailed descriptions of the case and the process. In those documents, I searched for the list of planning instruments that had been applied in the process. Occasionally, it was necessary to look for information concerning planning instruments in the case documentation of the building permit stage (in Norwegian, *byggesak*). This search allowed for the creation of a list of instruments for each case that could then be analytically compared to the instruments outlined by the planning laws. Supplementary information about the ways in which the planning system operates in Oslo has been obtained through semi-structured interviews with public planners who were in charge of three case projects I selected out of 71 cases for more detailed analysis (as explained earlier).

B) The second step was a more detailed analysis of the planning instruments, and it included three selected cases, as in sub-question 3.

The planning instruments applied in the three sampled cases have been analysed for the presence of guidelines for developing the physical form at the intermediate spatial scale. Since these cases were sampled from different types of constituted tissue, the analysis of planning instruments could expose considerations of the physical development that the system in Oslo expressed (or not) for different parts of the urban built-up area. This links to the issue of the strategic character of current planning and the ways in which physical development has been handled in densification.

The data sources used here were the same as in the previous analytical step. Starting from the list of planning instruments used in the zoning process of the three sampled cases, I read the text of each planning instrument in search of considerations of physical form at the intermediate spatial scale. The interviews with public planners who were in charge of the zoning processes were a source of supplementary information about the use of the planning instruments both in the selected cases and in Oslo in general.

Sub-question 6: What spatially related concerns were raised in the zoning processes for the individual intervention projects, and how did those concerns influence the final design at the intermediate spatial scale?

This analytical step has been conducted on a sample of three cases, the same cases sub-question 3 has covered. As a reminder, the criteria for the selection of the three cases have been based on the results of sub-questions 1, 2 and 5 (see Figure 17), so that the major types of constituted tissue and all types of intervention and sets of planning instruments were included.

The very first step was to outline the actors who participated in the zoning process, as this sub-question covers spatially related concerns expressed by different actors involved in the zoning process. Next, the aim was to reveal the spatial features most discussed in the processes (i.e. which raised most interest). The actors' considerations of the broader context have also been analysed, and finally the effects of actors' inputs on the final design solution have been assessed.

Two methods have been used in addressing this sub-question.

The first method was document analysis of zoning plan documents, available at the Planinnsyn database (Oslo kommune, 2019b). More specifically, the already mentioned documents called “Bystyresak”, which contained a detailed description of the zoning case, were the most valuable source of information about the actors, the steps in the process, the applied planning instruments, drawings, maps, comments on the proposal given by the other actors and the way those comments had been handled by the public planners and the architects. In the analysis of the comments, the focus was on the spatially related concerns and ideas discussed in the process.

The second method comprised interviews with public planners who were involved in the zoning processes as case officers. The interviews were semi-structured (see Appendix F). This type of interviewing was chosen to secure a certain degree of openness that would allow the respondents to provide the information they found relevant and that may have been unanticipated by the interviewer. This allowance was important as the entire study was empirically based. Interview questions were organised in two groups. The first group covered enquiry about the case projects in terms of the actors’ involvement, the steps in the zoning process and the design-related topics discussed in the processes. The second part concerned the planners’ experiences and reflections on the planning practice in Oslo in general which was used to inform the analysis covered by sub-question 5, as mentioned.

Public planners act as mediators between private and public interests and actions (Oliveira, 2016) and thus have a comprehensive overview of planning processes that makes them a reliable source for a study of such processes. The other actors involved at this planning stage have been analysed in terms of their concerns and inputs regarding physical form in the design processes and the effects of those inputs on the final design solution. As explained in Chapter 2, the aim was not to examine their roles and power relations, but to assess their concerns and understanding of physical form as forces that influence the creation of Oslo’s built form, namely their design performance.

Table 4. Summary of methods by research sub-questions

Main research question: What are the morphological characteristics of the physical outcomes of densification in Oslo, and what spatially related concerns have influenced the design of those outcomes?					
	Research sub-question	**Methods**	**No. of analysed cases**	**Spatial scale**	**Part of the study**
SPATIAL ANALYSIS	1. What types of urban tissue have undergone densification in Oslo?	• Site visits • Analysis of maps and aerial photos (present and historic)	71	Urban block	Paper II
	2. What principles guiding the addition of the new physical structures in the pre-existing urban tissue can be identified at the spatial scale between a single building and the urban block?	• Site visits • Analysis of maps and aerial photos	71 (and additional 3 single buildings)	Between a single building and an urban block & between individual project and several urban blocks	Papers I & II
	3. How are the newly built structures articulated in spatial and functional terms at the scale of the urban block and at the intermediate spatial scale (of the individual intervention project), and how does this articulation relate to the pre-existing urban tissue?	• Sampling of 3 cases from the total of 71 • Site visits • Analysis of maps and aerial photos	3 sampled cases out of the 71	Intermediate scale – the scale of individual project (building, plot and urban block)	Paper III
	4. Does the densification produce a characteristic architectural type of multi-family residential buildings?	• Site visits • Analysis of maps and aerial photos	71	Intermediate scale – the scale of individual project (building, plot and urban block)	Additional analysis I
PROCEDURAL ANALYSIS	5. Do the formal planning instruments found in Norwegian planning system contain considerations of the morphological questions of the physical development at the intermediate spatial scale?	• Document analysis of case documents for 71 cases at the zoning stage and building permit stage • Sampling of 3 cases from the total of 71 • Interviews with public planners in charge of 3 selected case projects • Document analysis of municipal and other plans applied in 3 sampled cases	71 and 3 sampled cases out of the 71	Intermediate scale – the scale of individual project (building, plot and urban block)	Paper III & additional analysis II
	6. What spatially related concerns were raised in the zoning processes for the individual intervention projects, and how did those concerns influence the final design at the intermediate spatial scale?	• Sampling of 3 cases from the total of 71 • Document analysis of case documents for 3 cases at the zoning stage and building permit stage • Interviews with public planners in charge of 3 selected case projects	3 sampled cases out of the 71	Intermediate scale – the scale of individual project (building, plot and urban block)	Paper III

3.3. Discussion of the methodology

This thesis in part depicts my development from practitioner to researcher. Being an empirically based study, the thesis represents the learning process I have followed in developing my thinking from predominantly design-focused to critical and theoretical thinking.

As the nature of this research is strongly empirical, the first challenge I faced concerned data collection. As explained in the theory chapter and the previous sections of this chapter (on methodology), I opted for a particular timeframe and a particular architectural programme (multi-family residential) as the main selection criteria.

Since no single, comprehensive database of projects sorted by their year of completion was available, data collection was to an extent challenging. It was necessary to search for case projects in different sources, and for practical reasons it was also necessary to limit the time dedicated to data search. Additionally, of the cases that had been collected in the allocated time (amounting to over 100), not all complied with the other criteria of selection, so several dozens of cases had to be excluded. For that reason, the study has not encompassed all the cases of multi-family residential projects constructed in the period between 2004 and 2014 in Oslo. This gap in the data affected the results of the study such that it offered a part of the complete picture concerning the changes of urban tissue in Oslo.

The other limitations of this picture have been the selected timeframe in itself, as densification has been implemented for considerably longer time than the analysed 10-year period, and the selected architectural function of multi-family residential buildings which are not the only type of architectural objects built in the past few decades. Therefore, in order to map the addition of new built masses in Oslo even more comprehensively and more precisely, should that be the aim of any future analysis, it would be necessary to combine the results of this study with the data and results of other studies that included other architectural programmes (for instance, Borrud & Syvertsen, 2012; Guttu et al., 1997a).

However, the sample of 71 cases in Oslo that this PhD study comprises is considerably greater than what any of the previous studies of multi-family residential developments has included so far. The data therefore provide a solid basis upon which to draw conclusions about the changes of urban tissue, the relations between the new and pre-existing built structures, and the related planning and design issues occurring at the time of their making.

Concerning the procedural part of the analysis, which has been a more detailed investigation of three selected case projects, the cases have been selected in a strictly defined way based on both spatial (type of constituted tissue and type of intervention) and planning-related (type of planning instrument sets) criteria. The use of such criteria in case selection is different from the previous similar studies of the physical outcomes of densification in Norway, and it emphasises the systematic approach applied in this PhD study.

4. Summary of papers

4.1. Paper I

Title: “Urban form of a densified city”
(published in Norwegian language with the title “Bygningsform og bebyggelsesstrukturer i den fortettede byen”)

Marjanovic, G. (2015). Bygningsform og bebyggelsesstrukturer i den fortettede byen. In G. S. Hanssen, H. Hofstad, & I.-L. Saglie (Eds.), *Kompakt byutvikling: Muligheter og utfordringer*. Oslo, Norway: Universitetsforlaget.

Applying the concepts from urban morphology, this paper explores the spatial principles of densification at the spatial scales between the building and the urban block. The study covered multi-family residential buildings, which were already built in Oslo in the period between 2004 and 2014. The use of real-world empirical data offers a reflection on today’s planning and design practices in the framework of densifying the already built-up city. This paper provides an analytic description of the relations between the pre-existing and the new built structures and points to the main factors that affect the spatial features of the new built masses.

The starting point of the analysis was the principles of densification and urban infill, as defined by Lehmann (2010), who presented those principles at the spatial scale of the *buildings* and the *urban block*, using the perimeter block as a particular type of urban blocks. The scales of buildings and the urban block were chosen as the points of reference in this analysis. Among the data collected for the PhD study, those complying with the mentioned principles have been selected to exemplify the use of those principles in the densification of Oslo. Additional principles have been identified among the cases. The coverage of the new built volumes relative to the urban block in which they are situated was also assessed.

A variety of principles of built mass addition were identified. The coverage of the new structures relative to the urban block varies greatly. At the observed spatial scale, six different principles of the addition of built mass were found: the expansion of a building, urban infill (single built volume inserted in pre-existing urban block), perimeter block infill (single built volume inserted in pre-existing perimeter block), inner courtyard infill, addition of volumes next to existing buildings and entirely new urban blocks.

The main findings include the most influential factors related to the spatial features of the new built structures and the functional questions related to the new structures. The most influential factors are the amount of land available for new buildings and their location in the city’s built-up area, along with the spatial characteristics of the pre-existing built structures. New plan shapes have been identified among the cases, and it is possible to explain them with reference to the designers’ concern for the urban context – previously existing built structures in the immediate surroundings. In terms of uses, there are both monofunctional and mixed-use cases, which is closely related to the structures’ positions in the built-up area of Oslo (e.g. city centre or outer city). Finally, the spatial and functional character of the new residential outdoor spaces has also been assessed, and it was found to be related to the position of the new buildings in the city’s built-up area, but also to the proximity to a public green space.

A distinctive finding was that the morphological element of urban block remains present in new developments and designed in many new forms, as was further explored in later steps of the research.

This paper was published in 2015 as a chapter in the peer-reviewed book "Kompakt byutvikling – muligheter og utfordringer" ("Compact urban development – possibilities and challenges"), which was the output of NFR's (The Research Council of Norway) SUSPLAN project.

4.2. Paper II

Title: "Urban tissue transformation under densification policy: The case of Oslo"

Zurovac, M. (in press). Urban tissue transformation under densification policy: The case of Oslo. *Formakademisk*.

This paper takes a step further in the analysis of changes in the urban tissue of Oslo. It applies urban morphological perspective and addresses the spatial scale at which a building or a group of buildings form a synthesis with other elements of urban tissue, termed *intermediate spatial scale*. It comprises the analysis of physical aspects of urban tissue fragments that have undergone densification and the newly built multi-family residential projects that have been inserted in those tissues. It also addresses the types of interaction between the new built structures and the previously existing urban blocks.

The concepts employed are *constituted tissue*, based on morphological concept of *urban tissue* and used for addressing the pre-existing urban tissue, along with *urban block* and *type of intervention*, covering spatial interaction between the new and the pre-existing and can be *infill* or *part of land-use transformation area*. The main epistemological approach applied is *pattern recognition*, while the analysis is based on layout patterns of traditional and modernist urban tissue types.

The main findings include the following:

- Densified tissues are highly diverse, and four main types have been identified: traditional urban tissue varieties, modernist urban tissue variety, hybrid urban tissue (mixed) and urban tissue in land-use transformation areas. A total of 13 varieties (sub-types) of these types exist.

- Types of intervention are also diverse, and a third type of intervention has been revealed – *entirely new urban block*. The new blocks (28 out of 71 cases) are analysed and typologised for their spatial organisation of built and open spaces, as well as the functional relations to the surrounding streets. The main types are "boundary built", which resemble the spatial organisation of traditional urban blocks, and "hybrid".

One conclusion concerning the densified tissue is that there is a mutual effect between pre-existing and newly built structures, and since the constituted tissues have a high degree of diversity, so do the new structures. Additionally, the more consolidated the pre-existing tissue is, the more predictable the design of new developments will be. Mixed tissues need particular attention. Due to their flexibility, they can support innovative design solutions, although on the other hand, there is also a threat of inappropriate design concepts.

Regarding new urban blocks, it is noticeable that urban block as a morphological element is still used in defining the physical form in urban areas, similarly to practice in the pre-modernist planning eras.

This paper has been accepted for publishing in *Formakademisk* journal, and it is currently in the process of language editing.

4.3. Paper III

Title: "Design performance in planning for densification – the case of Oslo"

Zurovac, G. (in press) Design performance in planning for densification – The case of Oslo. *Nordic Journal of Architectural Research*

This paper focuses on design performance in the zoning processes of multi-family residential buildings. Using three selected cases, a detailed analysis of the processes was conducted. The methods applied have been the analysis of planning documents, interviews with public planners in charge of the zoning processes and the investigation of applied planning instruments. The proposed understanding of design performance in planning covers both the performance of actors in the process and the performance of the new built forms relative to the constituted tissue in which they are situated. Three aspects of design performance in the production of physical form have thus been addressed:

- *planning*, through examination of the applied planning instruments for the presence and kind of strategy for the physical form at the intermediate spatial scale;
- *design*, through analysis of the interactions between new structures and pre-existing tissue, and spatial and functional articulation of new structures on the site; and
- *actors*, through investigation of the concerns they raised in the zoning process and the influence of their inputs on the resulting physical form.

The main findings in the paper, following the three analytical aspects, can be summarised as follows:

- Planning instruments contained a varying degree of strategies for built form. In the centrally located case, a KDP that contained guidelines for the built form was used at the time of zoning. Its use was later discontinued. In the case project situated Ensjø land-use transformation area, several planning instruments provided guidelines for built form. Those instruments were not prescribed by the PBL, and they were created specifically for Ensjø area. The third case, located at the border of Oslo's built-up area, in the outer city, had no planning instruments that provided strategies for built form at the intermediate spatial scale.

- The design of the three cases varied in terms of spatial and functional articulation. The centrally located case was integrated, with a mix of uses distributed vertically (non-residential street storey). The case in the Ensjø area had no pre-existing urban tissue, and it could be considered to be integrated into the greater newly designed ensemble of buildings. The third case was segregated from the surrounding urban tissue, and it had a mix of uses with horizontal distribution.

- Different types of actors were involved in the zoning process, from both the private and the public sector. A number of similar spatially related concerns were raised in the three cases, regarding building heights and densities, outdoor spaces, surrounding public spaces, car access and noise. Public planners expressed concerns for the broader built context, while the quality of the design proposal depended largely on the architects' skills. In all three cases, design proposals had not undergone significant changes throughout the process.

The main conclusions of the paper are that the spatial strategies for built form at the intermediate spatial scale are partial and vary depending on the location of the new buildings. The design approach is highly context-sensitive and often covers only the immediate surroundings. The performance of public planners is a learning process, and it can be characterised as predominantly reactive to private planning initiatives.

This paper has been accepted for publishing in the *Nordic Journal of Architectural Research*, and it is currently in the revision process.

5. Results and discussion

This chapter comprises the findings of the research and the corresponding discussion. In the first six sections, the results are presented and discussed following the research sub-questions posed in this thesis. In Section 5.7., an integrative perspective on the findings is applied to answer the main research question. I conclude with a discussion of the contributions of the thesis and possible topics for further research in Section 5.8.

5.1. Types of constituted tissue

This section covers sub-question 1: *What types of urban tissue have undergone densification in Oslo?*

The first step in the analysis of changes in urban tissue in Oslo was to address the urban tissue affected by densification – constituted tissue, in all 71 cases. Using pattern recognition, the different footprint patterns were identified and marked with different colours (see Figures 23, 24 and 25). All the patterns taken together determined the type of urban tissue in which each case was located. Four main types of constituted tissue have been identified: traditional (pre-modernist) urban tissue, modernist urban tissue, mixed types and transformation types. Each of the types comprises a number of varieties (or sub-types). The exception is the category of modernist tissue (named MOD1), which is essentially a variety of typical modernist urban tissue, because it contains elements other than modernist slabs (Table 5). The most frequently occurring and the most varied is the mixed type, while a considerable number of cases were situated in traditional urban tissue and land-use transformation areas.

Table 5. Types of constituted tissue and their elements, and number of cases situated in each type

Main groups of constituted tissue types	Constituted tissue type	Description	No. of cases in a const. tissue type	No. of cases in group of const. tissue types
TRAD: Traditional urban tissue varieties	TRAD 1	Traditional blocks from 19th and early 20th century	2	**TRAD**: 18
	TRAD 2	Traditional blocks combined with large volumes	16	
MOD: Modernist urban tissue variety	MOD 1	Modernist multi-family blocks or slabs; large volumes; occasionally with linear barrier	3	**MOD**: 3
MIXED: Hybrid urban tissue - mixes of various urban block types, building types and other built elements	MIXED 1	Mix of traditional and modernist urban blocks; occasionally with linear barrier and/or large volumes	7	**MIXED**: 31
	MIXED 2	Single-family houses; multi-family housing blocks/slabs; large volumes	2	
	MIXED 3	Multi-family housing blocks or slabs; large volumes; linear barrier	2	
	MIXED 4	Single-family houses; large volumes; linear barrier	2	
	MIXED 5	Single-family houses; large volumes	4	
	MIXED 6	Large volumes; linear barrier	3	
	MIXED 7	Single-family houses; multi-family housing blocks/slabs	5	
	MIXED 8	Multi-family housing blocks or slabs; large volumes	5	
TRANSF: Land-use transformation areas	TRANSF 1	Tissue subject to transformation; single-family houses and/or multi-family housing	13	**TRANSF**: 19
	TRANSF 2	Buildings removed; street layout preserved; large volumes; tissue subject to transformation	6	
Total number of cases				**71**

The varieties and the mixed types were defined by the presence of building patterns other than the basic patterns (traditional urban block and modernist urban block, Figure 18). First, “large volumes” occurred frequently and represented buildings of proportions significantly greater than those of the housing blocks; large volumes included structures such as educational facilities, factories or warehouses. Second, in many case tissues, there was a railroad, a motorway or a river which physically and functionally divided the urban tissue; such elements were termed “linear barrier” in this analysis. Next, as housing was (and generally is) the most frequent architectural programme, with many variations of building types, it was analysed with a more nuanced approach. Therefore, the following housing types were distinguished: “single-family houses” detached on a private plot, “multi-family housing slabs” with a simple rectangular pattern of modernist housing withdrawn from the street fronts, and “multi-family housing blocks” with more complex plan patterns and various relations to the streets.

The changes of the sites in which projects are situated have also been analysed here, and the results show that 15 of 71 cases were built on vacant land, of which only three were on green spaces. In the remaining cases, new built structures have been mostly built as replacements of lower density buildings on sites where open spaces were composed of partly or entirely sealed surfaces.

A considerable variety of constituted tissue types points to densification taking place in diverse built contexts; indicating an extensive use of available land in the process of densification. This is expected, as it is in compliance with the guidelines for densification issued by Ministry for Environment (Guttu & Thorén, 1996). It mirrors the findings of an earlier study by Børrud and Syvertsen (2012), which encompassed not only residential buildings but also other architectural functions. However, this finding is an important indicator of the complexity of design tasks that densification can entail as well as the growth pattern of densification.

This study covers a number of multi-family residential buildings constructed in the period between 2004 and 2014. Thus, the data analysed here represent a part of the totality of built masses added in the densification, and the growth pattern that can be observed reflects the ways this architectural programme transforms the urban built-up structure of Oslo. Since a considerable number of case projects has been encompassed, it can be concluded that the growth pattern is incremental, occurring in a large diversity of urban contexts across Oslo.

Constituted tissue represents the spatial framework for densification interventions. Its morphological characteristics provide conditions for design of physical structures; therefore these conditions vary by tissue type.

Traditional types of urban tissue are distinct for their fairly consolidated and homogeneous character. Streets, building lines and building heights are usually well profiled and form sizeable homogeneous parts of urban tissue. As traditional types of tissue in Oslo are situated in central areas, the amounts of vacant land are limited, and heritage preservation interests are likely to exist. These features represent a solid framework for the design of new structures.

Another type of tissue that also offers a solid framework is the modernist urban tissue. It is based on strong planning concepts, which established well-consolidated spatial

organisation of buildings and open spaces. Due to such strong concepts, it may be less flexible for the addition of built masses than is traditional urban tissue, which may explain the small number of cases found in this type of constituted tissue. Another reason densification rarely occurs in modernist tissue lies in the ownership structure in modernist housing blocks, where the cooperative building associations ("borettslag" in Norwegian) have great decision power regarding the developments of the neighbourhood (Guttu et al., 1997a).

Regarding the mixed types of urban tissue, they are prevalent in contemporary cities, including Oslo, which is one of the reasons that the majority of analysed cases are located in mixed tissues. They are heterogeneous in character, as they develop as overlays from different planning eras. This analysis shows that mixed urban tissue encompasses a wide range of sub-types, due to different building types and other built objects, their varying patterns of disposition, and diversely defined street fronts. These elements of built form can be only partially consolidated in spatial terms in mixed urban tissue. Due to this heterogeneity and the intensity of densification in mixed tissues, the understanding of potentials and challenges for design that can occur in such urban tissue notably requires an approach other than in consolidated tissues. Potentials and challenges vary depending on the site to be developed. Hence, they are rather unpredictable and need to be analysed specifically and individually for each densification intervention. Such variety of potentials and challenges, on the other hand, provides the conditions for a variety of design solutions, in spatial and typological terms.

Constituted tissue in land-use transformation areas is specific and dissimilar to all other types, offering two kinds of pre-conditions for new physical structures. The first is that new development occurs on a site next to pre-existing built structures that are not planned to be changed. The second applies to cases developed as replacements of previous brownfield facilities, where the site is part of a larger cleared area. Here, the lowest degree of spatial constraints is observed, as the constituted tissue consists of plots and street layout. Since pre-existing buildings have been removed in a larger area, intervention in such cases resembles urban expansion.

Concerning the observations of the changes that particular sites have undergone, the majority of sites where new residential projects have been built were, in fact, already sealed land, occupied by low-density buildings and sealed surfaces. The transformation of such sites is also in accordance with guidelines for densification by the Ministry for Environment (Guttu & Thorén, 1996) and indicates a certain consistency in policy implementation. In quantitative terms, this finding shows that the reduction of green areas has not been particularly high, while the increase of the density of buildings has been drastic. However, this finding does not mean that densification has not affected or reduced green spaces in general, since this study is limited to 71 cases and does not cover all developments since the introduction of densification policy; rather, it points to the importance of *ex post* studies in gaining a more accurate understanding of the effects of densification on the urban tissue, as relevant for the planning practice and the ongoing public and professional debates related to it.

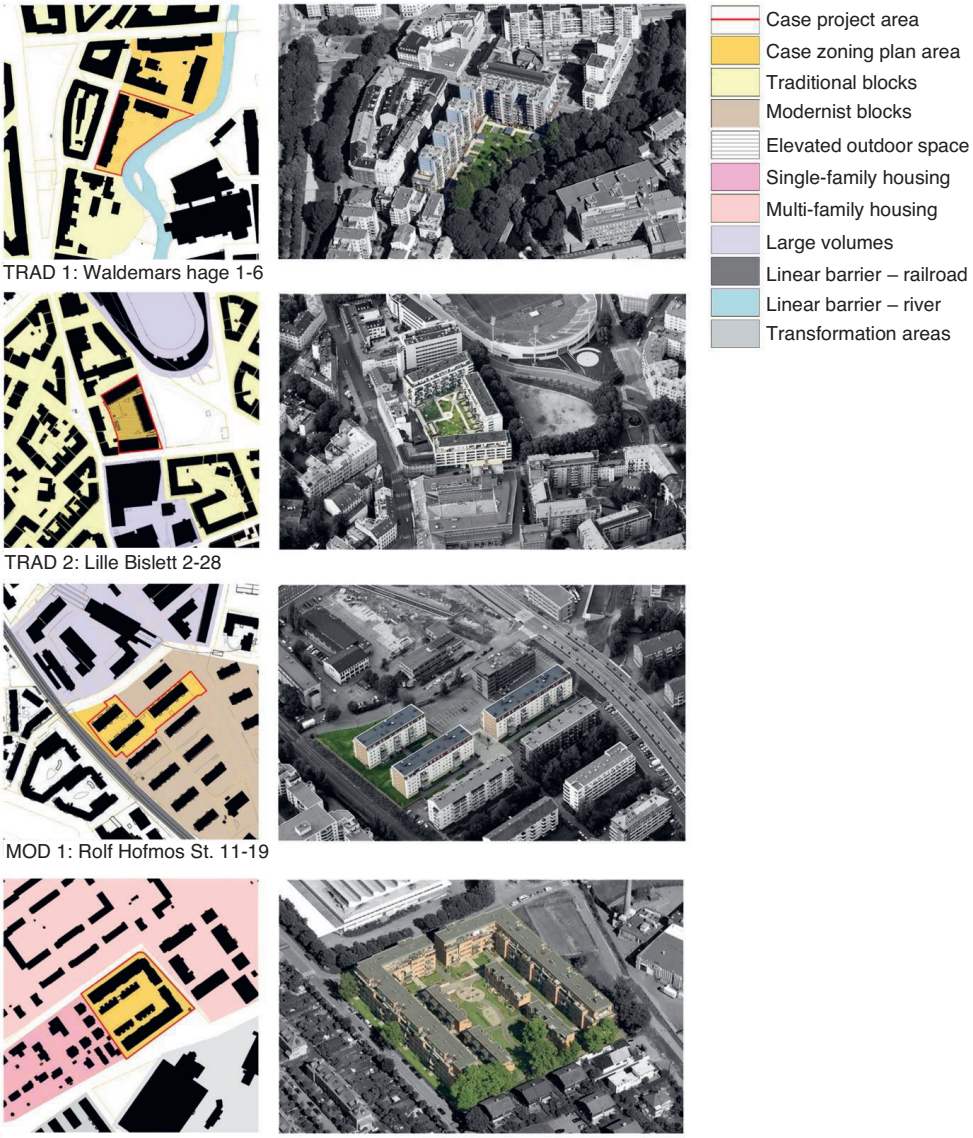


Figure 23.
Examples of analysis of constituted tissue types - variation of traditional (TRAD 1, TRAD 2), variation of modernist (MOD 1) and transformation tissues (TRANSF 1 and TRANSF 2); photo source: ©Blom AS, rendered with permission of copyright owner

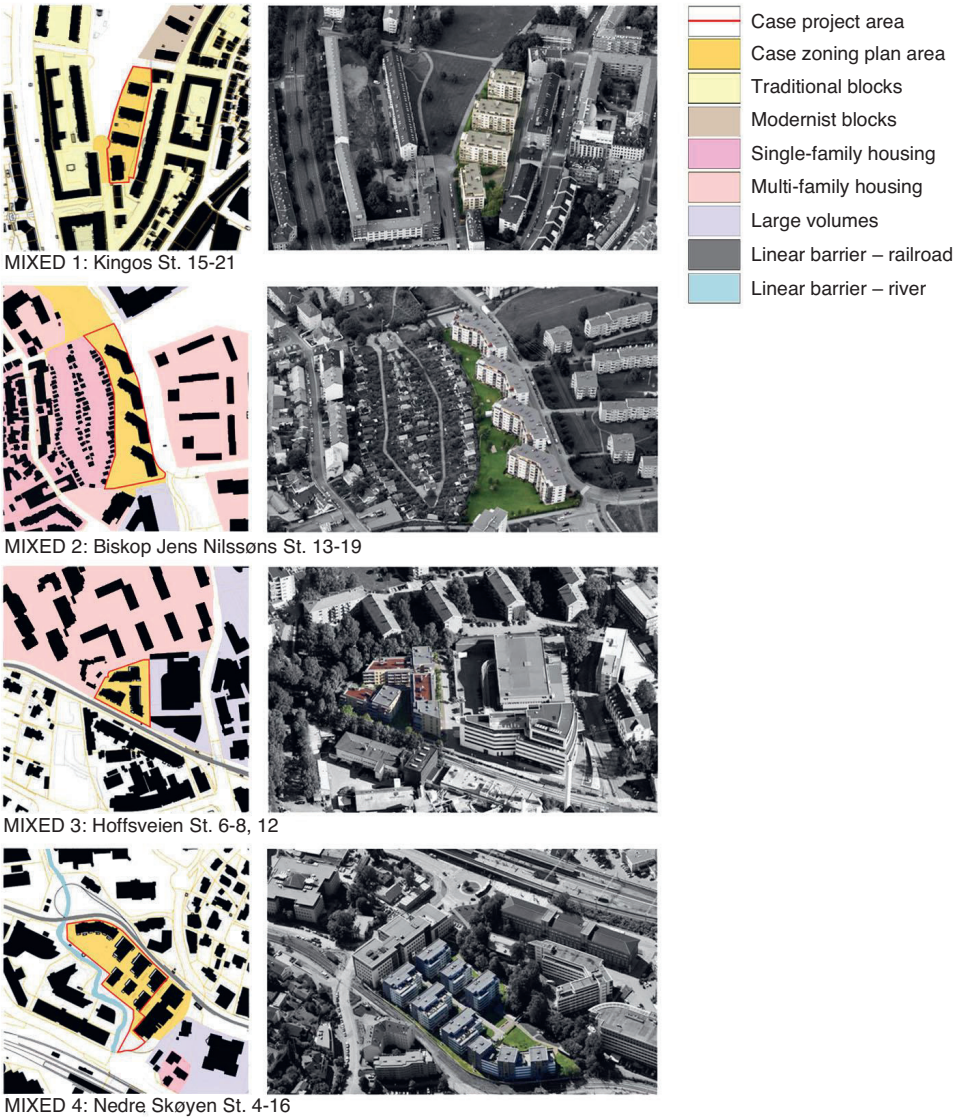


Figure 24. Examples of analysis of constituted tissue types – mixed tissue types (MIXED 1 to MIXED 4); photo source: ©Blom AS, rendered with permission of copyright owner

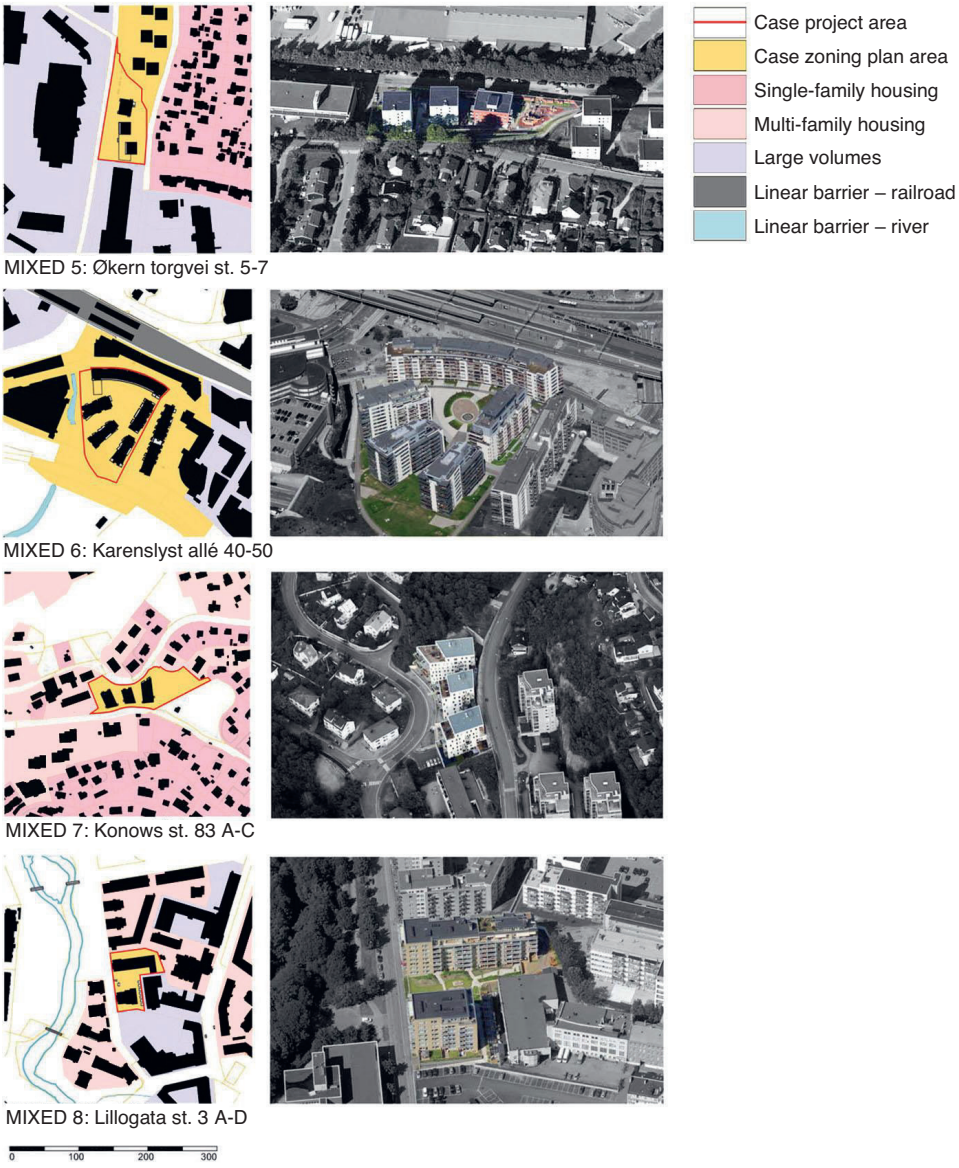


Figure 25. Examples of analysis of constituted tissue types – mixed tissue types (MIXED 5 to MIXED 8); photo source: © Blom AS, rendered with permission of copyright owner

5.2. Principles guiding the addition of new physical structures in pre-existing urban tissue

This section covers sub-question 2: *What principles guiding the addition of the new physical structures in the pre-existing urban tissue can be identified at the spatial scale between a single building and the urban block?*

In order to answer this sub-question, the total of 71 case projects have been analysed. The analysis encompasses slightly different spatial scales and analytical perspectives, and the results are thus presented in different sections.

In section 5.2.1., the starting point of the analysis was the principles of densification defined by Lehmann in his study *The Principles of Green Urbanism: Transforming the City for Sustainability* (2010). The cases in Oslo have been analysed according to those principles. The spatial scale of the analysis was defined by means of morphological concepts (building, plot and urban block) and it was the scale between a single built volume and an urban block.

Section 5.2.2. covers the analysis of cases at the intermediate spatial scale, which is the scale between an individual case project and one of more urban blocks. The key concept here is the urban block, and it is the main point of reference at this stage of spatial analysis.

Since both steps revealed unforeseen results (namely, the entirely new urban blocks produced in densification), the analysis was expanded to explore those results more in detail. Therefore, a more detailed analysis and a typology of the new urban blocks is presented in section 5.2.3.

5.2.1. Spatial scale between a single built volume and an urban block

The initial step in addressing the physical outcomes of densification is a spatial-volumetric analysis of the physical structures of already-built cases. This step identifies principles of the addition of new built masses to the pre-existing urban tissue as a way of apprehending the spatial logics of the densified built form. It focuses on the scale between a single built volume and an urban block.

Using Lehmann's (2010) diagram (Figure 19), four principles have been identified among the cases:

- expansion,
- urban infill,
- perimeter block infill and
- inner courtyard infill.

These principles are presented and illustrated through sample cases (Figure 26), and the coverage of new structure relative to the urban block is quantified as higher or lower than 50%. Additionally, two more principles of addition of the built mass (Figure 27) occur in Oslo:

- the addition of the volumes next to the existing buildings in an urban block and
- the establishment of entirely new urban blocks.

These findings expose a considerable diversity of spatial and volumetric principles of addition for the new built structures, as applied in the densification. The diversity of these principles reflects the richness in the design concepts of the new structures, indicating the complexity of design tasks entailed by densification. More generally, the identified principles point to the relevance of design-related questions in the current planning that is predominantly strategically and process-oriented, as mentioned before.

This analytical description establishes an architectural vocabulary or language of densification. The identified spatial principles of the interaction between new and pre-existing built structures are translated into architectural vocabulary which is:

- *geometric*, covering relations of line, surface and volume, and the complexity of context of a particular plot, which almost invariably has an irregular shape;
- *quantitative*, as it indicates the amount of occupation of the new on the plot, its height and the distances to public open spaces;
- *graphic*, in the sense of the presentation of the geometry and quantitative values. It employs two and three dimensions, and it applies different colours to present the relations between the old and the new; and
- *conceptual* or *verbal*, building up concepts that allow the reader to understand the patterns presented graphically. For instance, cases where the new is occupying the centre of the urban block, the frontage of the plot/urban block, where it is compounded or open, and so on.

This architectural vocabulary of densification suggests that the design-related, architectonic questions in the densification can be varied and that they are closely connected with the immediate urban context. This connection stresses the importance of developing the criteria for densifying a built-up area in the realisation of a compact city, which is relevant to current planning and design practice.

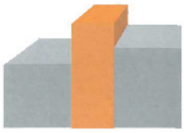
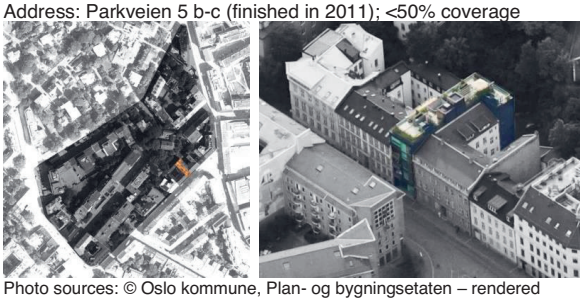
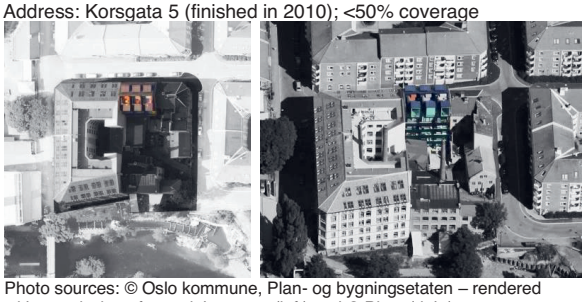
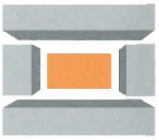
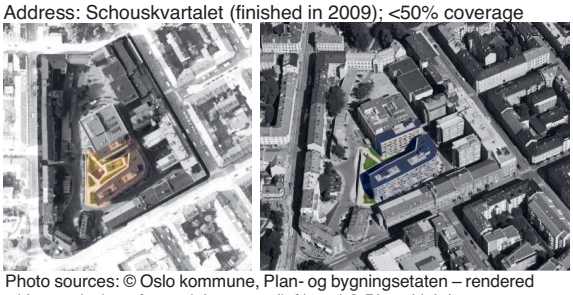
Principles of addition following Lehmann (2010)	Examples of cases
Expansion 	Address: St. Halvardsgate 75 (finished in 2011); <50% coverage  Photo sources: © Oslo kommune, Plan- og bygningsetaten – rendered with permission of copyright owner (left) and © Blom (right)
Urban infill 	Address: Parkveien 5 b-c (finished in 2011); <50% coverage  Photo sources: © Oslo kommune, Plan- og bygningsetaten – rendered with permission of copyright owner (left) and © Blom (right)
Perimeter block infill 	Address: Korsgata 5 (finished in 2010); <50% coverage  Photo sources: © Oslo kommune, Plan- og bygningsetaten – rendered with permission of copyright owner (left) and © Blom (right)
Inner courtyard infill 	Address: Schouskvartalet (finished in 2009); <50% coverage  Photo sources: © Oslo kommune, Plan- og bygningsetaten – rendered with permission of copyright owner (left) and © Blom (right)

Figure 26. Identified principles according to Lehmann (2010) and cases exemplifying them

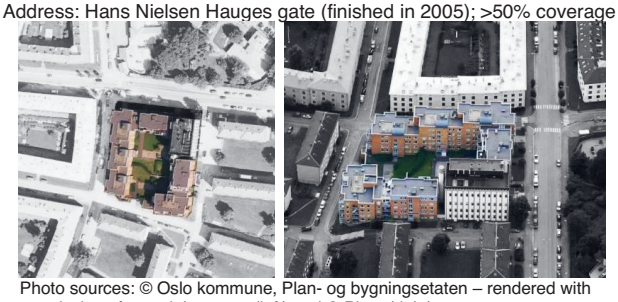
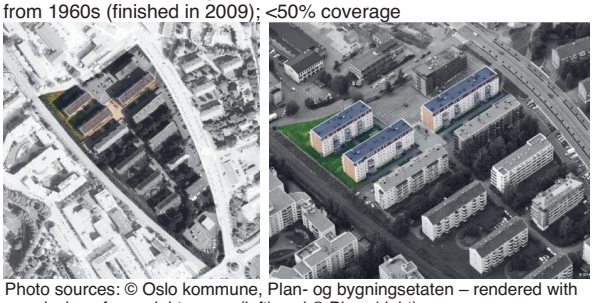
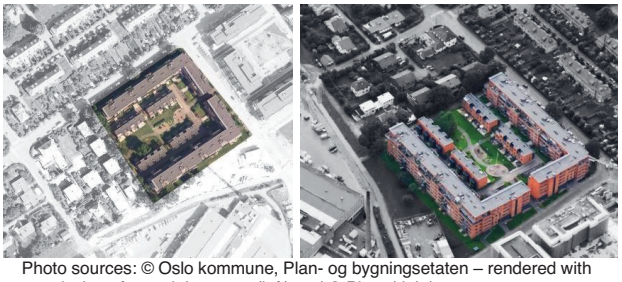
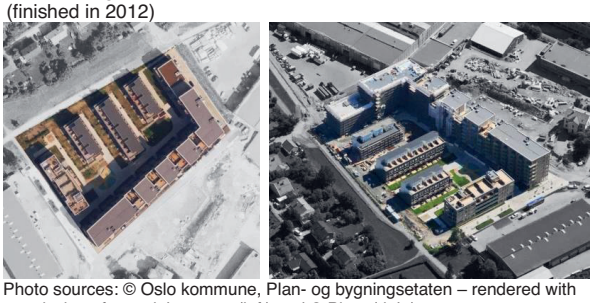
Other principles of addition identified in the analysis	Examples of cases
Addition of volumes next to the existing buildings in an urban block*  *illustrated using the case of a perimeter urban block	Address: Hans Nielsen Hauges gate (finished in 2005); >50% coverage  Photo sources: © Oslo kommune, Plan- og bygningsetaten – rendered with permission of copyright owner (left) and © Blom (right)
	Address: Rolf Hofmos gate 13–19, addition to the modernist block from 1960s (finished in 2009); <50% coverage  Photo sources: © Oslo kommune, Plan- og bygningsetaten – rendered with permission of copyright owner (left) and © Blom (right)
Entirely new urban blocks	Address: Tiedemannsjordet- Bertrand Narvesens vei 1–53, a new block with volumes inside (finished in 2007)  Photo sources: © Oslo kommune, Plan- og bygningsetaten – rendered with permission of copyright owner (left) and © Blom (right)
	Address: Sigurd Hoels vei 44–110, a new block with volumes inside (finished in 2012)  Photo sources: © Oslo kommune, Plan- og bygningsetaten – rendered with permission of copyright owner (left) and © Blom (right)

Figure 27. Other principles that have been identified, in line with Lehmann's thinking (2010) and cases exemplifying them

5.2.2. Intermediate spatial scale

The second step of the analysis of new physical structures covers the intermediate spatial scale, which is in this study understood as the scale on which the new physical structures (that constitute an individual project) merge with the pre-existing urban tissue. The cases are examined for the ways they interact with the pre-existing urban tissue, and the morphological element of urban block is used as a point of reference. As explained in Chapter 3, each analysed case is an individual multi-family residential project comprising at least two separate built volumes or one large volume facing a minimum of two streets. Thus, the spatial scale of this analytical step is between the individual project and the urban block in which it is situated.

Principles of the addition of new individual projects (termed also as intervention in pre-existing tissue) relative to the scale of the urban block are analysed at this stage with the premise that the addition can occur as an infill and as part of land use transformation (Figure 28, a. and b.). The premise has been confirmed, and a third principle has been identified – that new individual projects can correspond to entirely new urban blocks, as is congruent with the previous step of spatial analysis (Figure 28, c.).

In sum, the results encompass the following principles – *types of interventions*:

- *infill*, where buildings constituting an individual project are inserted on a part of the pre-existing urban block (37 of 71 cases);
- *transformation*, where buildings and entirely new urban blocks are built on a larger land-use transformation area, with or without changes of the street structure (17 of 71 cases); and
- *infill as an entirely new urban block* in pre-existing urban tissue (17 of 71 cases).

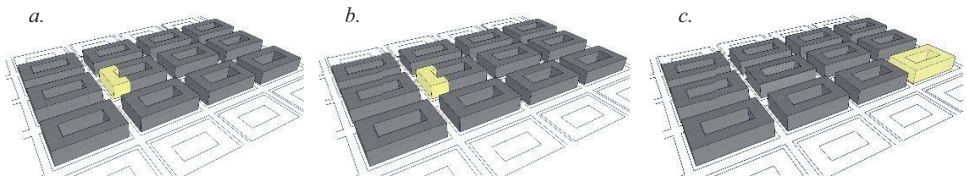


Figure 28. Identified types of intervention (presented using the example of traditional tissue): a) infill as part of urban block, b) as part of land-use transformation area, c) infill as entirely new urban block.

These types of interventions in the pre-existing urban blocks also exhibit diversity, demonstrating the richness of the relations that the new structures create with the pre-existing tissue. The main finding of this step of analysis, infill as an entirely new urban block, indicates that the urban block still plays a significant role in contemporary urban development. This finding is intriguing, particularly given that urban block as an element of urban form has undergone a process of dismantling in the modernist times (as explained in Castex et al., 1989), marked by disruption with traditional urban tissue. For that reason, the next stage of the analysis of new structures addresses the particularities of today's urban block, conceptualised and created in the process of densification.

5.2.3. Urban block in densification

New urban blocks are a significant finding in the emerging, densified urban form. The analysis of new urban blocks reveals that they appear not only in pre-existing urban tissue, but also in land-use transformation areas. Among 71 analysed cases, they constitute a total of 31 (14 of which were found in land-use transformation areas). They have been typologised based on the spatial organisation of built and open spaces. Two main types and a number of sub-types have been identified:

1. "boundary built" urban blocks, where buildings are placed on the edges of the plot (21 of 31 cases) and
2. "hybrid" or combined blocks (10 of 31 cases).

Among the "boundary-built" blocks, the following sub-types are distinguished (Figures 29 and 30):

- *courtyard block* (a variation of perimeter block), where built volumes enclose the inner open space;
- *U-shaped* blocks which are semi-open, with built volumes on three sides (out of four);
- *L-shaped*, open blocks with buildings on two sides;
- blocks that comprise a *combination of these three types*; and
- *slab-block*, composed of the lowest storey that covers the entire plot and parallel built volumes above.

Among the "hybrid" urban blocks, there are two sub-types (Figure 31):

- blocks combined by boundary-built blocks and built volumes placed inside the plot, and
- irregular block, where buildings are placed in a scheme inflected to follow the shape of the plot.

In terms of the functional relations between new urban blocks and the surrounding streets, it is possible to observe the following features:

- The majority of cases have access to residential space from both the adjacent streets and the private outdoor space.
- In most cases, private outdoor spaces are placed at the street level, accessible from the streets; nevertheless, in the inner city they are most often gated, but a view into the courtyard is possible.
- In a number of cases, private outdoor space is placed on the rooftop of the street-level storey, thus is inaccessible and impossible to see from the surrounding streets, increasing its level of privacy.
- In a number of cases, there are no entrances (or only one) from the street level, creating a blind street façade.
- All cases have common garage at the lowest storey(s), most often under the ground and covering the entire plot.

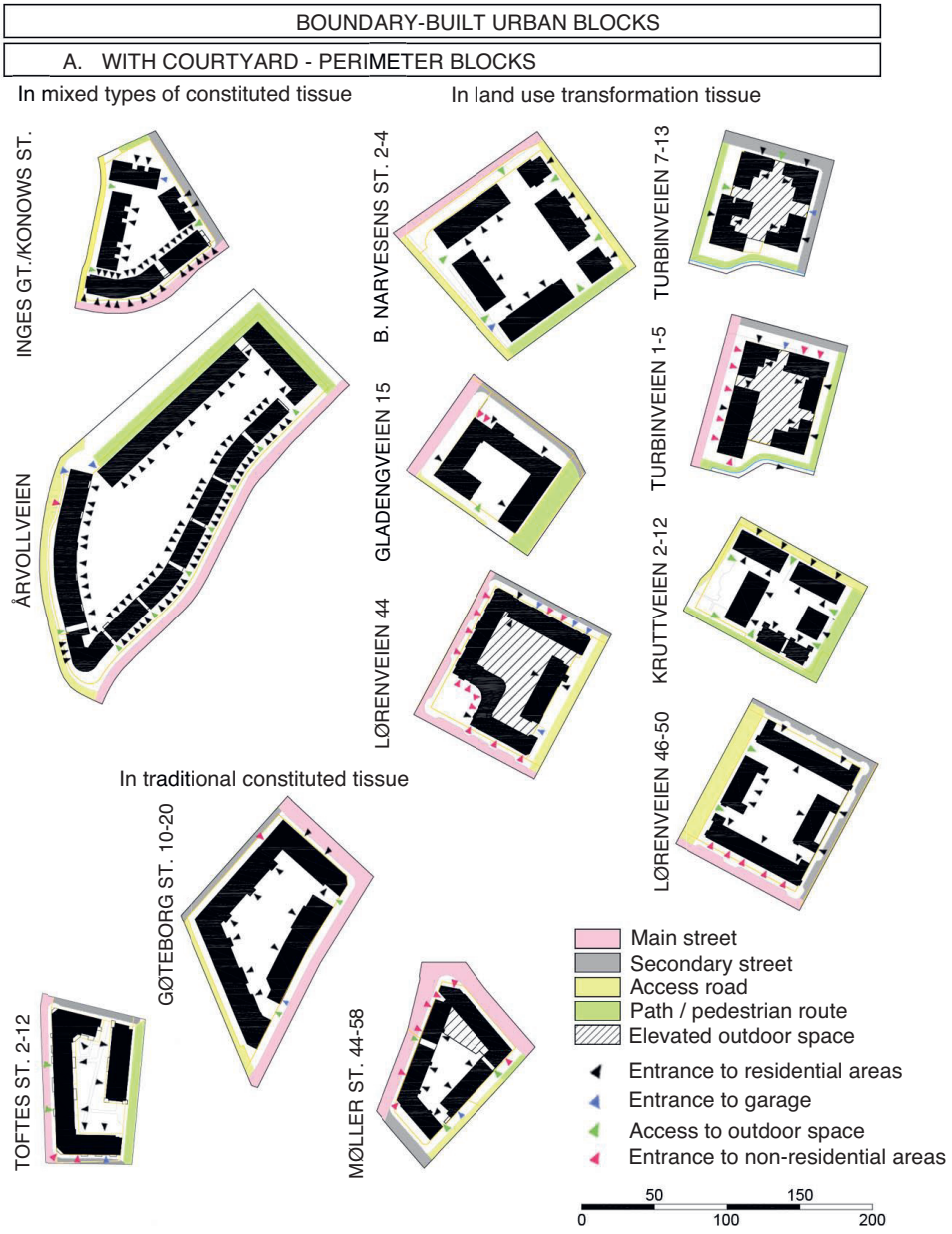


Figure 29. New urban blocks – boundary-built type with courtyard

Figure 30. New urban blocks – boundary-built types: U-shaped, L-shaped, combined and "slab-block"

Figure 31. New urban blocks – hybrid types

The fact that a considerable number of new urban blocks have been identified shows that this morphological element plays an important role in the contemporary urban development of Oslo. This observation has also been made in French and Dutch contexts where the urban block is the dominant element of the historic urban tissue and continues to have an important role in the structuring of the urban tissue today (as presented in Komossa et al., 2005;

Lucan, 2012). New urban blocks in Oslo can be found both as infills in pre-existing urban tissue and entirely new structures in land-use transformation areas, in which the development occurs on previously cleared sites. In such situations, when planners could have opted for virtually any spatial organisation in the design of new built structures, it is curious that the urban block appears so frequently.

Many of the new urban blocks follow the logics of the perimeter block, with built volumes placed along the block boundaries (on three or four sides) and a courtyard serving as a private open space in the middle. However, they are varieties of the perimeter block, as the built mass is always interrupted (discontinued) to a certain extent (see Figure 32). The built mass of the blocks is either a continual volume interrupted in one or more places (Figure 32, example a.) or composed of separate built volumes placed along the block boundaries (Figure 32, example b.).

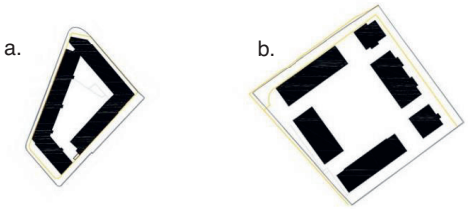


Figure 32. Examples of new urban blocks which are perimeter block varieties (figure-ground representation): a. urban block with continual volume interrupted in one place (the case is located in Møllergata street); b. urban block composed of separate built volumes placed at the plot boundaries (the case is located in Bertrand Narvesens street)

This type of urban block strongly resembles the pre-modernist block and represents a discontinuation with the modernist principles that led to the dissolution of the traditional urban block in mid-20th century (Figure 33). The first such blocks in the post-functionalist era in Norway can be found in the late 1980s (Guttu, 2012), while today they appear in greater numbers.

Figure 33. Aerial view of the example of Grønlands torg (Oslo) from 1990 which Guttu (2012) characterised as a return to the courtyard block (photo source: © 2019 Plan- og bygningsetaten, Oslo Kommune)

There are three possible explanations for this "revival" of the urban block. Firstly, in the visions of compact cities for which densification in Norway aims, there is a reference to the qualities of old towns regarding their vibrancy, mix of uses and density (Hanssen, Hofstad, Saglie et al., 2015). The attainment of these visions may be a reason for the re-emergence of this type of urban block. Secondly, the courtyard form of the new blocks could be explained by the planning norms for common outdoor spaces in residential projects in Oslo (Oslo kommune, 2012). These norms demand the provision of outdoor spaces for residents' use, and courtyard blocks have much potential to meet those demands concerning, for instance, privacy, living qualities, safety for vulnerable user groups (e.g. children), mixed uses, and the legibility of built form concerning the definition of street fronts and the distinction between public

(street) and private space (the courtyard). This observation accords with Selberg's remarks on the courtyard block structure, as stated in Godø (2019). Lastly, reasons for building a courtyard block structure can be pragmatic in nature. Research has shown that potential buyers of the dwellings prefer old-town courtyard block structures (Sjaastad, Hansen, & Medby, 2007). As developers make decisions about investments based on buyers' preferences, this factor may have contributed to the high frequency of courtyard blocks.

However, there are certain potentially problematic points concerning new urban blocks that are designed as varieties of perimeter blocks.

The first point is related to the scale of the buildings and the plot structure. Even though these urban blocks represent a "revival" of the pre-modernist urban form, there is a significant difference in the scale of the buildings that constitute them compared to the pre-modernist tissue. Pre-modernist urban blocks consist of multiple plots and buildings, and each building is coupled with the street such that it has a front façade that defines the street and has direct access from the street (as well as an access to the back of the plot). The plots and buildings are aligned in series, which define (and are defined by) the streets (Figure 34). This interrelation between the plots, buildings and streets together with the small scale of the buildings and plots are among the features that give the traditional urban tissue the liveliness, vitality and diversity of architectural expression (which are among the qualities desired for compact cities today).

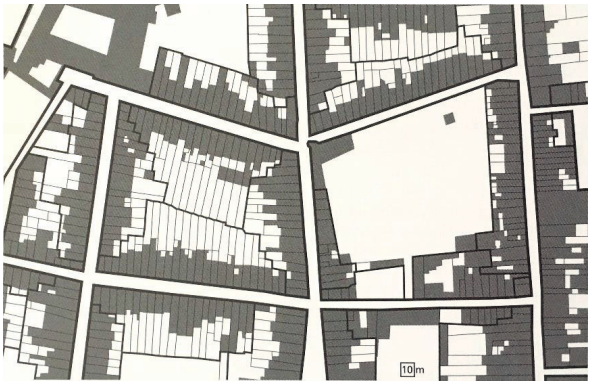


Figure 34. Example of pre-modernist urban tissue where plot series, delineated by the streets, constitute the urban blocks (image by Kropf, 2018, p. 46)

In the new developments, the re-coupling of these morphological elements vis-à-vis the attainment of the mentioned urban qualities can be a challenge. This challenge arises partly due to the plot structure. The new urban blocks are mainly situated on single plots, as the current urban transformation often involves a change of land use from non-residential to residential, thus involving the substitution of larger buildings with residential buildings. In many such cases, a single owner is also the holder of the planning initiative. The single, large plots allow for buildings of a greater scale, and the streets that circumscribe such blocks are no longer defined by the series of plots and buildings. The large plot is often subdivided by new residential projects, but the plot patterns of the subdivisions are not related to the streets. New property lines are instead related to the new, common outdoor spaces, where the new lines delineate the patios that belong to the flats that are placed at the level of the outdoor space.

In spatial terms, common outdoor spaces are not necessarily placed at the same level as the adjacent streets which further emphasises the differences in the structure of new blocks

compared to pre-modernist urban blocks. Consideration of these points is particularly relevant for interventions in the traditional and land-use transformation types of urban tissue. From this analysis (Figure 29), it is possible to observe that among the new blocks there are cases of non-residential uses at the street level. In these cases, numerous entrances open onto the main streets, meaning that the lowest storey is internally subdivided to create a more lively street front in functional terms. However, the design and the scale of the buildings, as well as of the upper storeys, are equally important for the qualities of the new urban blocks.

Furthermore, new urban blocks play a role in the flexibility of urban tissue in terms of the potential future changes. The city inevitably changes over time and undergoes different kinds of structural transformations. The new urban blocks designed as variations of the perimeter block consist of the ensembles of built volumes raised upon a common lowest storey, which in most cases covers the entire plot. As explained earlier, this structure of the new blocks is different from that of the 19th century urban blocks. The pre-modernist blocks are composed of the series of smaller, individual buildings which can be changed in terms of use and structure or even replaced. Due to these structural features, the new blocks do not possess the resilience of the pre-modernist blocks in terms of replacement of their parts, should such a necessity arise at any time. Accordingly, this diminished resilience would apply also to larger masses of urban tissue formed by this type of block (for instance, in land-use transformation areas). This point emphasises the responsibility of developers in the process of densification, and the importance of the qualities of architecture and outdoor spaces that result from densification.

Another issue is that the understanding of the new urban blocks should be broader than the provision of private open spaces for residents and the obtainment of a certain density of housing units. Urban block is a mediator between housing and public space. The block plays a vital role in definition of streets (Kropf, 2006), as reflected in two aspects. The first, as has already been elaborated, is structural, and it is reflected in the ways in which new buildings relate to street fronts in terms of the scale and the openness of the street storey. The other aspect concerns the ways in which new buildings relate to street intersections in terms of the shapes of the corners. These relations reflect the urban character of architecture. The architecture contributes to urban life by providing street fronts with the interior spaces that shape and accommodate human activities (uses of the new spaces) in the street and by using the architectural elements to create legible and distinctive urban tissue.

These considerations are particularly relevant for land-use transformation areas that resemble urban expansion. The absence of buildings in the pre-existing urban tissue demands a careful definition of the new buildings and open spaces in order to obtain the desired qualities of compact urban form. It is problematic that in transformation areas there can occur new urban blocks which have a blind façade facing the core street of the new neighbourhood (a case in Gladengveien 15, Figure 35). Such design has a negative effect on the street space, as the project does not follow general planning intentions which were to create liveliness in the new, transformed street. The reasons for such occurrences likely lie in the actors' interests and goals, further emphasising the responsibility of actors in the

Figure 35. Case project in Gladengveien 15; (photo source: author's own photo).

process of densification and the importance of *ex post* analyses of new built structures to expose problematic points.

Nevertheless, certain examples of new urban blocks do exhibit greater consideration of the streets and public spaces they border, in terms of accentuating the corners and shaping the street profile, though the issue of the building scale arises there as well. Such examples can also be found among the infills, which complement pre-existing urban blocks and add new spatial and aesthetic qualities (Figure 36).

Figure 36. Examples of cases in which the corner was given an accent and shaped differently from other parts of the façade; location of cases: a) Maridalsveien 15–21; b) Peter Møllers St. 5; c) Herslebs St. 17&21–25; d) Toftes St. 2–12; e) Gunnar Schjelderups St. 11A-S; and f) Lørenveien 44. Source: author's own photos

Some urban blocks are composed of different architectural types of residential buildings, where terraced houses are combined with multi-storey buildings (Figures 37 to 39). This combination of types creates the conditions for a diversity of user groups, together with

architectural diversity. Terraced houses are of lower heights, allowing for the addition of housing units while maintaining the sunlight and other environmental conditions demanded by the planning norms. The combination of different architectural types and different possibilities for the placement of the buildings relative to the block boundaries allows for nuanced relations to the pre-existing context. Terraced housing is applied to create a softer transition into pre-existing housing of lower density, as in the cases in Sigurd Hoels Street (Figures 31 and 37) and Bertrand Narvesens Street (Figure 38), or to consolidate the street front (at the same time as the private outdoor space), as in the case in Årvollveien (Figures 29 and Figure 39).

Figure 37. Case project in Sigurd Hoels St. with combined typologies; sources: © Blom AS (left) and author's own photo (right)

Figure 38. Case project in Bertand Narvesens vei with combined typologies; sources: © Blom AS (left) and author's own photo (right)

Figure 39. Case project in Årvollveien with combined typologies; source: author's own photo

5.3. Articulation of newly built structures

This section addresses sub-question 3: *How are the newly built structures articulated in spatial and functional terms at the scale of the urban block and at the intermediate spatial scale (of the individual intervention project), and how does this articulation relate to the pre-existing urban tissue?*

The spatial and functional organisation of the new developments has been addressed through a detailed study of three cases, where the concept of articulation is applied. The cases were selected to cover different types of constituted tissue, interventions, and sets of planning instruments employed in the case processes (planning instruments applied in cases are addressed in detail in sub-question 5).

The analysis of the articulation of new built forms relative to the constituted tissue is addressed through the following criteria:

a) *building-street relations*: the spatial disposition of new buildings in relation adjacent to street fronts;
b) *heights*: of new buildings compared to the buildings in surrounding urban blocks, and
c) *organisation of open spaces*: whether it is comparable to open spaces in the surrounding urban blocks in terms of size, connections to surrounding streets and accessibility.

In compliance with these criteria, the built form can be

1. *integrated*, which refers to cases where the new built volumes follow the spatial logic of the surrounding tissue;
2. *segregated*, which refers to cases where the new built volumes introduce a different spatial logic compared to the surroundings, by the previously mentioned criteria; in addition, if only one criterion for "integrated" is fulfilled, the built structure is considered segregated; and
3. *semi-integrated*, which refers to cases in which two out of three criteria for "integrated" are present.

The results expose that the cases in traditional and land-use transformation tissue resulted in integrated built forms, while the remaining case located in mixed type of urban tissue has a segregated built form (Figure 40).

Concerning the distribution of architectural functions, all three cases have a mix of residential and non-residential uses (Figure 41). In the cases situated in traditional and land-use transformation tissue, there is a vertical distribution of functions. In those cases, the street-level storey accommodates non-residential functions, while the upper storeys host the residential units (flats). In case 3, located in the mixed urban tissue at the outskirts of Oslo's built-up area, there is a horizontal distribution of uses. Hence, the street-level storey mostly accommodates housing (see Figure 41).

This step of the analysis investigates the relations between the new structures and the pre-existing tissue in which they are situated. In the most centrally located case, it is possible to observe that the surrounding urban tissue (a variety of traditional type) has a strong spatial logic of a recognisable relationship between the streets, plots and buildings. The new structure

follows that logic, concerning the definition of the street in terms of building lines, building heights and the organisation of adjacent open space. The open space is private (only for residents), placed inside the urban block and accessible only through buildings. A novelty of this project compared to the constituted tissue is visible in the third dimension, which introduced a street-level storey covering almost the entire plot, and the outdoor space for residents is placed on its rooftop.

The case in the Ensjø land-use transformation area is specific, as it is a part of a larger area, planned as a substitution of brownfield sites. Therefore, the degree of integration could be determined only relative to the other newly planned buildings and the streets around the project site. The qualifier "integrated" indicates not only that the case relates coherently to the surrounding built structures (in terms of the street definition, building heights and open spaces), but also that there was an aim for a coordinated spatial composition in the entire area encompassed in this zoning plan.

As for the case in mixed urban tissue, which was found to be segregated, the spatial logic it introduces differs entirely from the surrounding urban tissue. This difference exposes that mixed tissue types have a considerable degree of flexibility, when it comes to the insertion of new structures.

The interaction between new structures and pre-existing urban tissue is one of the determinants of the densification of urban tissue. It was possible to observe that new and the pre-existing physical structures have mutual effects that are context-dependent. An important finding of this analytical stage is that the more consolidated the constituted tissue is in spatial terms, the more predictable and integrated the new structures will be. The new structures thus contribute to further consolidation of the urban tissue, enhancing its morphological characteristics and ambience. Hence, the existing, constituted urban tissue acts as a force in design for densification. A similar observation was made by Børrud (2005) in an analysis of non-residential projects. On the other hand, in less consolidated, mixed tissues, there is more flexibility, which can be both an advantage and a disadvantage. The flexibility allows for innovative designs to occur, but it can lead to segregated new concepts that can affect the urban tissue in unpredictable ways. For that reason, interventions in mixed urban tissue, the most frequent type of tissue according to the previous steps of this study, should be addressed more attentively during the design (zoning) process, since the tissue itself cannot "act" as a regulator of the form of new structures in the same way that more consolidated tissue types can.

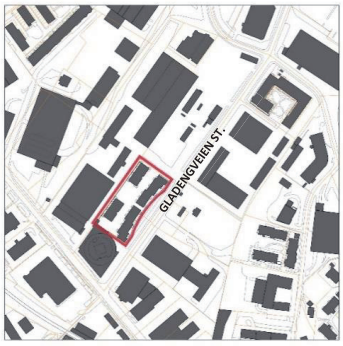
CASE 1

Address: Christian Krohgs street 37, 39A-H, 41
Articulation of built form: Integrated

Photo source: © Blom AS, accessed in 2018; rendered with permission of copyright owner

CASE 2

Address: Gladengveien 4 A-J, 6 A-F
Articulation of built form: Integrated



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CASE 3

Address: Årvollveien 52A-X, 54A-X, 56A-X, 58A-V, 60A-L, 62A-E
Articulation of built form: Segregated

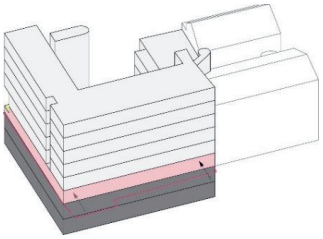
Photo source: © Blom AS, accessed in 2018; rendered with permission of copyright owner

Figure 40. Articulation of built form in three cases: plans and bird's-eye views (aerial views); cases 1 and 2, situated in traditional and land-use transformation tissue, resulted in integrated built forms; case 3, located in mixed urban tissue, has a built form segregated in relation to the surrounding urban tissue

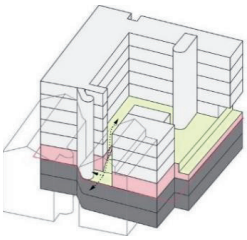
CASE 1

Address: Christian Krohgs street 37, 39A-H, 41
Distribution of architectural functions: Vertical

View from Christian Krohgs St.

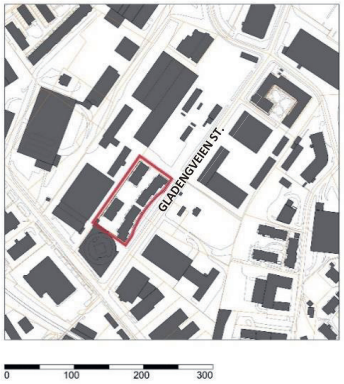


View of the courtyard and the neighbouring buildings

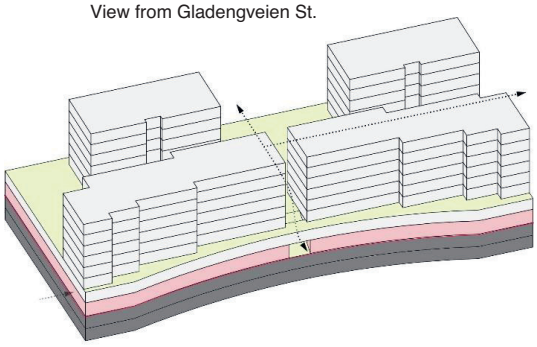


CASE 2

Address: Gladengveien 4 A-J, 6 A-F
Distribution of architectural functions: Vertical



View from Gladengveien St.



CASE 3

Address: Årvollveien 52A-X, 54A-X, 56A-X, 58A-V, 60A-L, 62A-E
Distribution of architectural functions: Horizontal

View from Årvollveien St.

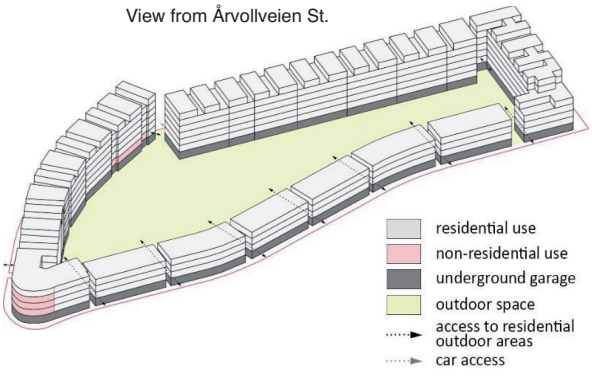


Figure 41. Distribution of architectural functions in three cases: plans and isometric schemes; cases 1 and 2, situated in traditional and land-use transformation tissue, have vertical distribution of functions, with non-residential street storey; case 3, located in mixed urban tissue, has a horizontal distribution of functions

5.4. Architectural type of multi-family residential buildings resulting from densification

This section covers sub-question 4: *Does the densification produce a characteristic architectural type of multi-family residential buildings?*

This part of the analysis of the physical outcomes of densification was focused on the spatial scale of an individual project. Out of 71 analysed cases of multi-family residential developments, five have been built as single-volume infills in pre-existing urban tissue, facing a least two streets. Thus, nearly all cases have been built as assemblages of buildings, here termed "building complexes" (66 of 71 cases). As the previous analytical steps exposed, an individual project covers either a part of the pre-existing urban block or an entirely new urban block (see Paper II in Appendix B). The same applies to the building complex. A building complex varies in size, since it can comprise anything from two to 20 built volumes or more.

In order to identify the type, it has been necessary to analyse the spatial structure of each case. The analysis of the organisation of built and open spaces in the case projects is based on Kropf's understanding of the built form, expressed in the multi-level diagram of the multi-storey apartment house. The results expose common features among the cases. The most frequently occurring common feature is the lowest storey (or storeys) that stretches across the entire plot, connecting all the built volumes above and hosting a parking garage for the residents. Common outdoor space for residents is almost invariably placed on the rooftop.

Of the total of 71 cases, only five cases were not built with such a lowest storey. The spatial structure of the 66 cases which do have that type of lowest storey is represented in Figure 42. The number of cases that have such spatial organisation indicates that densification has been producing a characteristic architectural type of a multi-family residential programme. This way of structuring built volumes resembles the "podium type", found in North America and Asia (see for example Chicago Department of Planning & Development, 2017; Newall, 2008; Walsh, 2013), though in Oslo this type has a somewhat different organisation of built and open spaces and significantly lower heights.

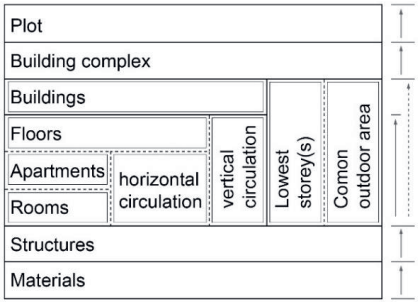


Figure 42. Multi-level diagram of multi-family residential buildings in compact city of Oslo, following Kropf's diagram (2014). The dotted arrow (on the right side) indicates the spatial level at which several buildings are joined by the lowest storey (and common outdoor area on its top) to form a "building complex".

The lowest storey(s) can relate to the surrounding topography in different ways, being completely or partly underground or being entirely above the ground/street level. The different relations between the lowest storey and the surrounding streets are presented in Figure 43.

These differences determine the variants of the podium type. Figures 44 to 50 show examples of these variants.

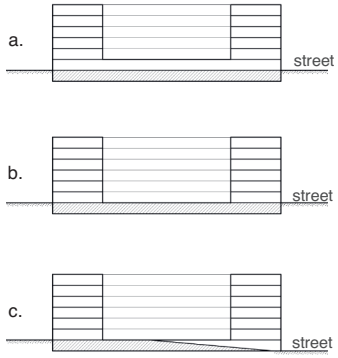


Figure 43. Illustration of the possible varieties of the podium type, determined by the positions of the lowest storey relative to the terrain:

a. lowest storey above street level – podium type

b. lowest storey entirely under the ground – variation of podium type

c. lowest storey partly under the ground/above street level – variation of podium type.

The variant marked a. in Figure 43 is the main podium type and of 66 cases, 11 fall into this group (see examples in Figures 44, 45 and 46). Figures 47 and 48 present a case in which the lowest storey(s) is entirely under the ground (corresponding to variant b. in Figure 43). Out of 67 cases, 26 belong to this category. Figures 49 and 50 present a case where the lowest storey is partly under the ground due to the sloped terrain (corresponding to variant c. in Figure 43). This variant encompasses 26 of 67 cases. Another three cases are "combined" because they have a part of the "podium" storey above the ground and another, lowest storey below the ground.

Figure 44. Examples of the main podium type (with the lowest storey above the street-level); location of cases: Grenseveien 50–58 (left) and Helga Vaneks vei 1–3 (right); image sources: author's own photos

The presence of the lowest storey(s), which accommodates parking garage, can be explained by the planning norms that are applied in the densification. Parking norms prompted the plan for the lowest storey, while the demands for outdoor space for residents (expressed in "Norms for outdoor areas" (Oslo kommune, 2012)) determined the organisation of the built and open spaces above. One of the aims in densification is more efficient use of available land, for both economic and environmental concerns, which on smaller sites results in this kind of compaction of uses and physical structures. Hence, there is a number of "podium type" building complexes in Oslo with two (or even three) lowest storeys, one of which is at the street level and covers the entire plot. Such spatial organization increases the exploitation of the plot even further and results in an outdoor space elevated above the level of the surrounding streets.

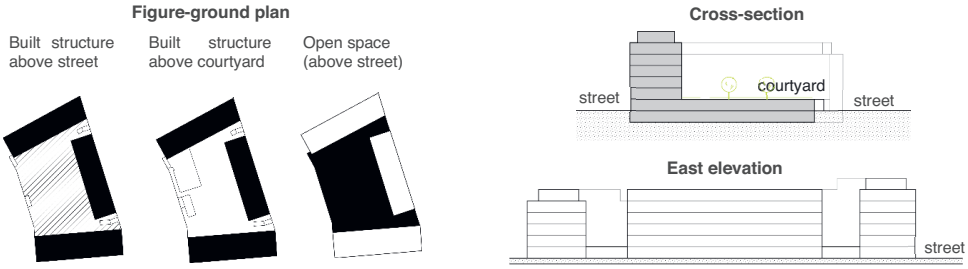


Figure 45. Example of podium type – plan drawings (within zoning plan limits) and sections showing built and outdoor spaces relative to the surrounding streets; case located in Lille Bislett 2–26

Figure 46. Views of the case in Lille Bislett 2–26 from the street level; source: author's own photos

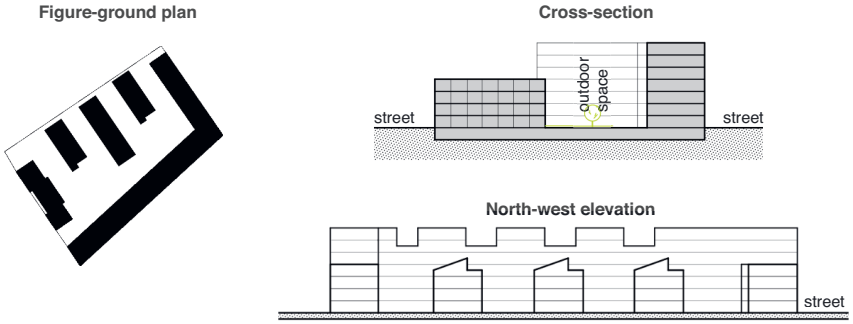


Figure 47. Example of variation of podium type with the lowest storey entirely under the ground – plan drawing (within zoning plan limits), section showing built and outdoor spaces relative to the surrounding streets, and north-west elevation; case located in Sigurd Hoels vei 42–110

Figure 48. Views of the case in Sigurd Hoels street 44–110; source: author's own photos

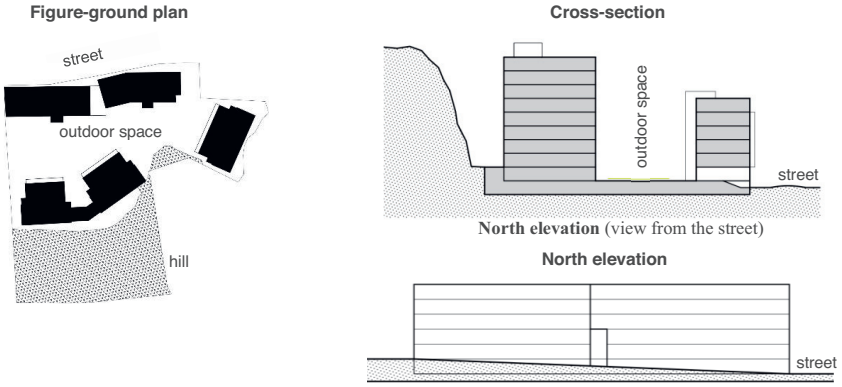


Figure 49. Example of variation of podium type with the lowest storey partly under the ground/above street level – plan drawings (within zoning plan limits), section showing built and outdoor spaces relative to the surrounding street, and north elevation – view from the street; located in Ekebergveien street 5 A–E

Figure 50. Views of the case in Ekebergveien 5 A–E; source: author's own photos

The podium type can be problematic in terms of relations to the street. It can create blind façades with a negative effect on street dynamics, which was also identified as a problem and criticised in earlier studies of the physical outcomes of densification (see, for example, Guttu & Schmidt, 2008). Examples of such cases are presented in Figures 51 and 35. Designing the podium storey is one of the complexities of the design task and demands a detailed understanding of the site and its surroundings. An urban morphological structural approach can facilitate this understanding and contribute to the quality of design outcomes (Standal, 2018).

The common outdoor area for residents in these building complexes is placed on the rooftop of the lowest storey, so greening in these areas has to be planted over a sealed surface which can impose limitations on plant varieties that can be used. The fact that the outdoor/green areas are placed over the built structure (podium storey) makes them artificial and raises further questions about this building type, such as the question of the environmental impact of the types that almost invariably seal the entire site area.

The podium type has been also identified among multi-family residential projects in other cities in Norway: Trondheim, Bergen, Stavanger and Kristiansand (Guttu & Schmidt, 2008, p. 11). For that reason, the podium type can be considered a typical physical outcome of planning for densification in Norway generally, not only in Oslo.

Figure 51. Blind street-level that podium type occasionally creates; case projects located in Turbinveien 9–13 (left and middle) and Turbinveien 4B–24 (right); image source: author's own photos

A study by Pranlas-Descours (2016) reveals similar mixed-use projects (including multi-family housing) in other countries in Europe, designed with the same logic as is the podium type in Oslo. For instance, in a recent housing development in Bregenz (Austria) called "Am Hafen", the spatial concept includes two underground parking storeys that stretch across the entire site and the mixed use buildings that are placed above the parking storeys (Figure 52).

A similar spatial organisation can be found in the French context. One such case, presented in Lucan's study (2012), is a mixed-use complex in Paris: Issy-les-Moulineaux, ZAC des Bords-des-Seine (the Concerted Development Zone, in French, *Zone d'Aménagement Concerté* [ZAC]), urban block D (Figure 53). It has an underground parking storey that covers the entire site, while the buildings and open spaces are built on top of it. This example covers an entire urban block, and its size is slightly greater than those of the analysed cases from Oslo. Its morphological structure corresponds to the structure of the podium type (Figure 42) identified in the Norwegian context. A study of the patterns of recent housing developments in Vienna and several other cities in Europe and North America (Kuzmich, 2011) shows that the underground parking storey has become a common feature in housing projects, although its coverage of the site differs, so not all the new multi-family residential types can be considered podium types.

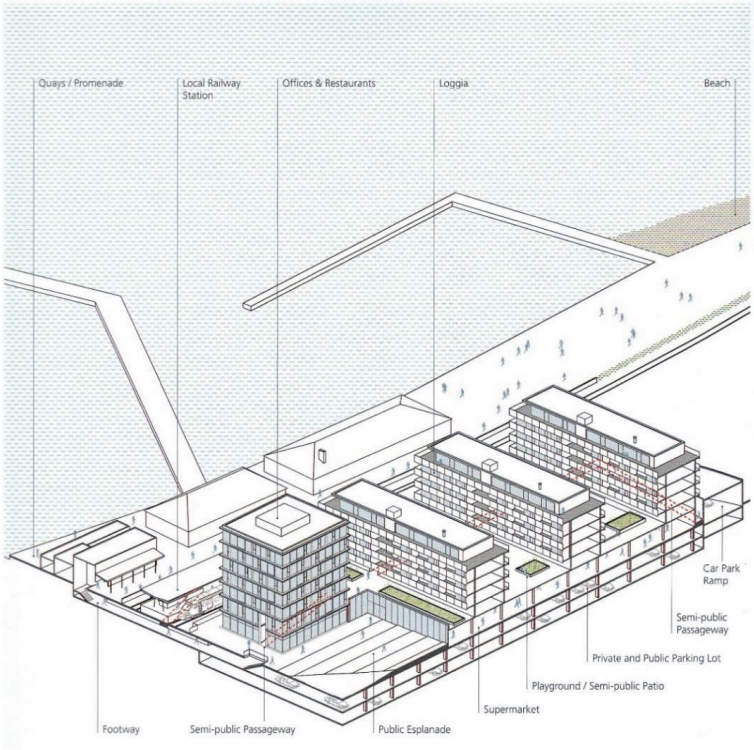


Figure 52. Mixed-use project "Am Hafen" in Bregenz, Austria (Pranlas-Descours, 2016, p. 158)

Figure 53. ZAC des Bords-des-Seine, urban block D; bottom left – plan of the underground parking storey; upper left – plan of the standard storey (Lucan, 2012, p. 64)

5.5. Planning instruments and spatial considerations

This section covers sub-question 5: *Do the formal planning instruments found in Norwegian planning system contain considerations of the morphological questions of the physical development at the intermediate spatial scale?*

In the procedural part of the analysis, planning instruments employed in 71 case projects at the municipal planning level have been analysed (see Appendix E). The results show that in each case a set of planning instruments is applied. Four sets of instruments have been identified:

- Set P1 – municipal master plan (KP), district master plan (KDP), zoning plan (*reguleringsplan*) and building permit application (*byggesak*) for an individual project;
- Set P2 – municipal master plan (KP), district master plan (KDP), planning programme for Ensjø (*planleggingsprogram*), guiding plan for public spaces (*veiledende plan for offentlige rom* [VPOR]), guiding principles for handling of stormwater (*veiledende prinsipplan for overvann* [VPOV]), zoning plan (*reguleringsplan*) and building permit application (*byggesak*) for individual projects;
- Set P3 – municipal master plan (KP), zoning plan (*reguleringsplan*) and building permit application (*byggesak*)
- Set P4 – municipal planning strategy (*kommunal planstrategi*), municipal master plan (KP), district master plan (KDP), detailed zoning plan (*detaljregulering*) and building permit application (*byggesak*).

Next, the sets of planning instruments have been examined relative to the types of urban tissue and intervention types of the corresponding cases. No particular relations between the instruments and these physical aspects could be discerned, except in the cases planned in the land-use transformation area of Ensjø. This lack of relations leads to the conclusion that in the densification of the constituted tissue types other than the transformation tissue, planning instruments did not provide guidance on the physical aspects of interventions.

Planning instruments contained in these sets have also been investigated for the presence of strategies for physical form at the intermediate spatial scale. This investigation was conducted over the selection of three cases, the same cases covered by an earlier stage of the spatial analysis (in sub-question 3). The results showed that in the analysed timeframe, the urban tissue in the inner city was addressed in the planning system, as there was a KDP for the inner city. It contained the spatial principles for the design of new buildings in the centrally located urban tissue, but its application has been discontinued. As for the Ensjø transformation area, new instruments for guiding the physical aspects of intervention were devised locally, at the municipal level, and thus they do not appear in the PBL. Such new instruments clearly indicate that the planning practice has recognised the need to attend to the physical aspects of current development, which would lead to the establishment of a closer connection between the planning and design.

5.6. Spatially related concerns in zoning processes

This section addresses sub-question 6: *What spatially related concerns were raised in the design processes for the individual intervention projects, and how did those concerns influence the final design at the intermediate spatial scale?*

Another aspect that the procedural part of analysis covers is spatially related concerns discussed by the actors in the zoning processes. This stage has been addressed through the detailed analysis of three selected cases (the same cases as in sub-question 3). The actors who provided comments on the physical form have been listed, their inputs have been analysed for the topics they targeted and the frequency of their occurrence. Finally, the influence of those inputs has been noted.

The types of actors were the same in all cases: public planners, private actors (proposal initiator or developer as well as architect) and other actors. In the last category, it was possible to distinguish public (other municipal or county sectors) and private parties (neighbours, representatives of different associations, etc.). The modes of the involvement of other actors were regulated by mechanisms of public participation, and it was possible to outline the stages at which they provided comments on the proposal.

This stage of the analysis exposed details concerning the thematic aspects in which different actors influenced the design. The most-discussed topics have been identified in each case (Figures 54 and 55).

The following concerns raised in the zoning processes have been identified in all three cases:

- building heights,
- density,
- accessibility in outdoor spaces,
- positions of buildings relative to the surrounding buildings and public spaces (streets or squares),
- car access, and
- the issue of noise in buildings and outdoor spaces.

On the other hand, it was also possible to observe case-specific concerns related to particular sites: the question of the preservation of trees in case 1, the access to parking and arrangement of balconies and architectural functions in case 2, and the use of buildings in case 3. These concerns point, again, to the mutual relations between the new structures and the constituted tissue, stressing the importance of developing a thorough understanding of the pre-existing urban tissue in the zoning processes.

Clearly, in the design of new buildings, the architects (private planners) who represent developers play a vital role. In the zoning process, they cooperate with public planners to ensure that the design proposal complies with public interests. Through the mechanisms of public participation in the planning process, other actors (both from the public and private sectors) provided comments and inputs regarding the proposal. In all analysed cases, all actors' inputs were treated equally and could influence the design output, regardless of whether the actors had a legally obligatory status or not. The different stakeholders raised a variety of spatially related issues. Some of the inputs occurred in each case, such as remarks on the universal design posed by Norwegian Association of the Disabled (in Norwegian, *Norges handikapsforbund*). The demands of the public authorities, such as county governor or municipal sectors, have an obligatory character, and while municipal plans may have provided scarce guidance for physical form at the intermediate spatial scale, the inputs of other municipal (and county) sectors addressed this scale having a basis in other legal and technical regulation (such as the traffic regulations and heritage preservation interests). Traffic regulations have been found to play a significant role in all analysed cases, particularly in case 3, which had no KDP.

This stage of the analysis also covered the actors' considerations regarding a wider spatial context, such as the urban block, neighbourhood and entire city. These considerations can be traced indirectly through the role of public planners, which to a certain extent discredits the criticism of public planners' lack of such considerations (as exposed by Oliveira, 2016 and Fainstein, 2005). The task of public planners in the zoning processes has been to assess the design proposals based on the intentions expressed in overarching municipal plans, on the one hand, and the inputs from the other actors who held different levels of obligation, on the other hand. The planners' consideration of the wider context in Oslo is further emphasised by concern for the effect of new buildings on the townscape, viewed from a distance (in Norwegian, *fjernvirkning*, found in case 3). The assessment of this effect involves the broader neighbourhood and even the entire city. An important factor observed in this analysis is tacit knowledge that public planners have as a basis, as the public planners in all three cases had the educational background in architecture. This knowledge indicates that public planners in Oslo possess the skills to understand and link different spatial scales and the awareness of both the broader spatial context and the particular site and its surroundings. Such skills provide a basis on which to ensure that the incremental transformation of urban tissue complies with the general goals of urban development.

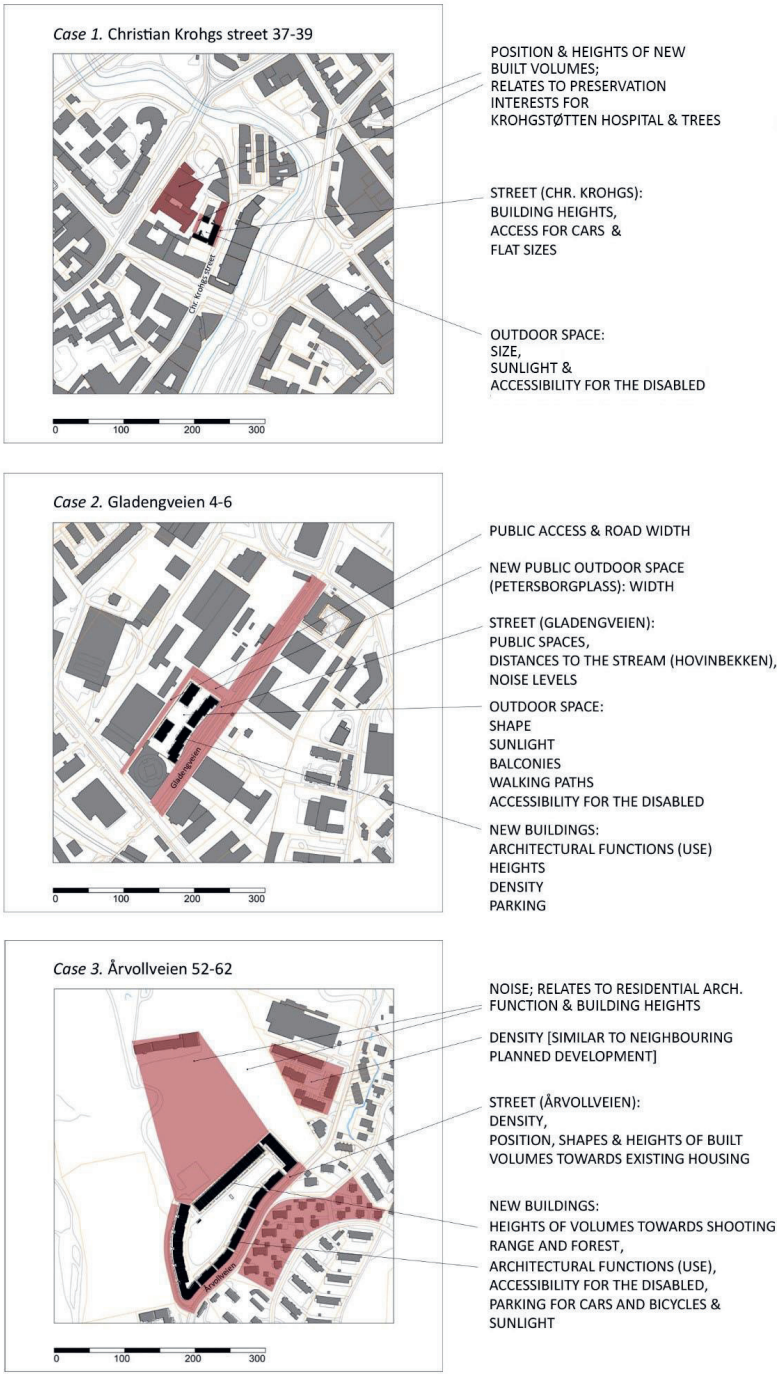


Figure 54. Overview of spatially related topics discussed in zoning processes

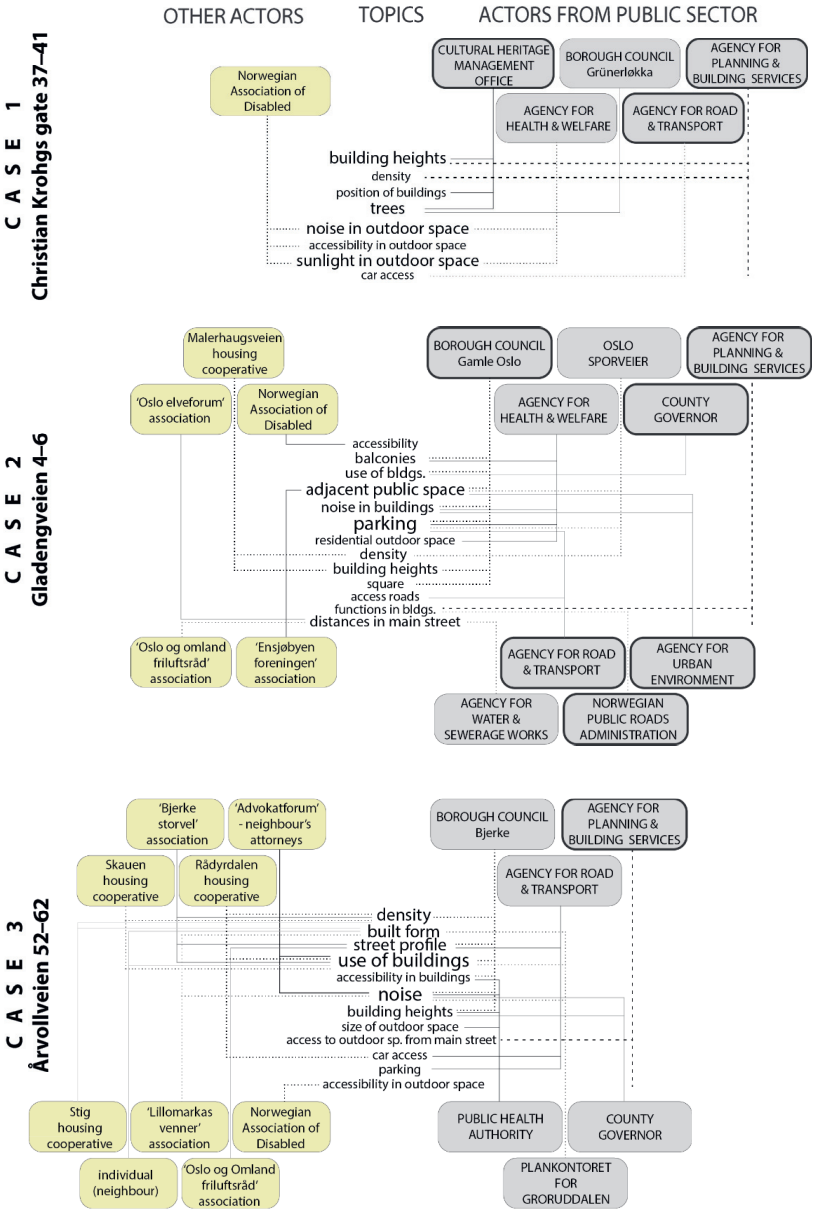


Figure 55. Spatially related topics and actors that raised them; actors whose inputs affected the results are bolded

5.7. Synthesis of the findings

This section contains a discussion across research sub-questions to answer the main research question posed in the thesis: **What are the morphological characteristics of the physical outcomes of densification in Oslo, and what spatially related concerns have influenced the design of those outcomes?**

The implementation of densification policy comprises a specific planning and design context, as new developments occur in already existing built-up areas. Densification thus differs significantly from previous expansion-dominated governance cycles, facing the task of intervening in particular spatial contexts, which in turn demands different planning approaches. Using the case of Oslo, this study has exposed the interdependence between these contexts and the new structures that transform the urban tissue. Much as the context provides a structural basis for the conceptualisation and design of new structures, the new structures affect the spatial and functional features of the context.

A considerable diversity of pre-existing spatial contexts, namely constituted tissue types, has been identified in this study. The observed interdependence, together with the planning aims for more efficient use of available land, explain the diversity of physical outputs of densification in structural terms at the analysed spatial scales. The addition of new built volumes in diverse spatial contexts (different urban tissues) occurred with diverse design concepts, resulting in different degrees of integration into the pre-existing urban tissue. The degree of integration is closely related to the spatial characteristics of the pre-existing urban tissue and the presence of the guidance in the planning instruments regarding the spatial development.

Regarding the morphological features of the new developments, urban block is no longer used as a primary element for developments, as it was in pre-modernist eras. Nevertheless, it occurs rather frequently in the densification, though for pragmatic reasons of maximisation of land use or conformance to the pre-existing spatial context. It does, however, introduce a different spatial organisation between the plot, built volumes and access, compared to the traditional urban tissue. It often occurs as a monolithic structure (with few interruptions of the built mass), erected on a single plot in which buildings are de-coupled from the streets in terms of access. The presence and the spatial distribution of non-residential functions depend on the location of new urban blocks in the constituted tissue. The built form of the new blocks is also strongly influenced by the demands for the provision of open spaces for residents expressed in the planning norms, reflecting a distinctive social concern for the provision of living qualities in the current planning. The provision of spatial and functional qualities is also driven by users' preferences (Børrud, 2005), which are crucial for developers' decisions.

Planning norms are of great importance in the densification of urban tissue. The norms concern the physical design and dimensioning of new structures, and they are employed at the zoning stage and the stage of building permit application. In Oslo, both informal and legally obligatory norms are applied. Norms for outdoor spaces, which demand the provision of common outdoor areas for residents and provide specifics for different densities of urban tissue, are used in practice even though they have not been adopted at the political level. They have a substantial effect on the new built structures, and it can be said that the new built forms are subordinated to the provision of open spaces. Parking norms are another crucial factor in the design of new built forms in the zoning processes. They are a set of quantitative norms, and

their application is obligatory, as they are politically adopted (and revised periodically) at the municipal level. Parking norms are among the norms with the greatest impact on physical outcomes, due to their quantitative character (Thorén et al., 2000). The application of both of these norms led to the emergence of a particular architectural type, here termed "building complex". Such a complex is a variety of the "podium type", compacted in order to accommodate all necessary functions, maximise the use of available land and respond to the context. As this study exposes, numerous interventions in diverse constituted tissues entail such a type. Their effect in the densification of Oslo's built-up area is fragmentary, causing an incremental addition of built masses. A "building complex" can be considered a fractal of densification, which in itself is compact, reflecting in its small scale compactness as the aim for the entire (compact) city.

The spatial outcomes of densification depend not only on the effects of the context, but also on the actors' performance in the design process. The built form of new developments is decided at the zoning plan stage through cooperation between public planners, developers and private planners (architects). The performance of actors in the zoning process includes both the architectural design (but not a detailed elaboration), mainly dependent on the developer's aims, and the planning goals and approaches, from the public planners' side. The expertise and skills of the architects and public planners play an important role, while the public planners' approaches also rely on planning instruments to a great extent. In Norway, densification policy coincided with a shift towards neo-liberal planning (Falleth & Saglie, 2012). Therefore, planning became market-oriented and the initiative of private actors has become the dominant driving force in urban transformation. Based on the analysed cases, the way that public planners handle zoning proposals is reactive, and it is not uncommon that the private initiatives propose a different use of the site than intended by municipal plans (for instance, from public institution to residential, as in case 1, or from light industry to residential, as in case 3); such a shift can affect the entire surrounding area in unanticipated ways. This finding accords with the results of Børrud (2005). At the same time, the role of public planners has changed from design and construction to coordination and negotiation in the planning process (according to the interviewed public planners), in line with the findings of Thorén, Pløger, and Guttu (2000, p. 17) and Salamon (2002). The task of public planners today is to ensure that new developments comply with overall goals for densification as well as with technical and other requirements for the site (e.g. heritage protection or water and sewage demands imposed by other sectors in the municipality).

Covering the particular timeframe between 2004 and 2014, this study captures a stage in the evolution of the planning approaches in the implementation of densification policy in Oslo. As the results reveal, in the observed timeframe the formal planning instruments (i.e. the instruments defined by the law) did not necessarily provide guidelines for built forms or qualities, and neither did they address the particular urban tissue types in the city nor the spatial scale of the individual interventions. However, planning in Oslo has increasingly attempted to attend to the design and spatial aspects of development in particular areas of the city. This intention indicates that through practice and numerous public and professional debates on new housing developments, the need to improve the system concerning the implementation and concretisation of densification has been perceived. Planning for densification has involved a learning process, and approaches to planning have changed with practical experience. The observed tendency towards the inclusion of spatial concerns in the planning instruments is the effect of the physical development on the evolution of the planning system, and it could be considered a counter-effect that the architectural design and physical urban development have exerted on the planning approaches. This dynamic is linked to the aforementioned gap between

the urban planning and design, and it indicates that urban planning could benefit from developing the concerns for the spatial context in which it operates. This finding mirrors the claims of Fainstein (2005), who criticised planning as a discipline for the lack of context-related concerns.

These changes have been mainly reflected in locally adopted planning instruments, but also in the change of the PBL in 2008 – specifically the introduction of the tool "area zoning" (in Norwegian, *områderegulering*). Area zoning is a place-making device intended for the transformation of a larger area and the coordination of property and functions in view of achieving more coherent development in that area. The 2008 act also demanded a legally obligatory land use plan for the entire municipality (Jørgensen & Thorén, 2012), and in the elaboration of the municipal master plan (KP) from 2015, more precise maps of the areas intended for densification have been provided (see Oslo kommune, 2015). This KP even contains guidelines for the heights of buildings and the degree of density in specific locations in the city. According to the interviewed public planners, the instrument for place analysis (in Norwegian, *stedsanalyse*) used at the outset of zoning processes has also become obligatory since 2015. The other new planning instruments (the locally adopted instruments as well as those defined by the law of 2008) allow public planners to be more specific concerning the built forms and provision of guidelines for the areas covered by the municipal plan (e.g. VPOR for a number of areas in Oslo, such as Løren/Økern, Haraldrud or Hasle). However, the same could be achieved with the already existing instrument district master plan (KDP) which is prescribed by the law, although its definition and adoption take a considerably longer time, which works to the advantage of the new, locally adopted instruments. The application of area zoning, place analysis, VPOR and planning programme comprise the "Oslo model", as public planners dubbed it (Nyrnes, 2016); these planning instruments, together with norms for outdoor spaces, make Oslo a specific planning context within Norway.

With respect to the transformation of urban tissue in other contexts, instruments similar to Norwegian area zoning can be identified in planning legislation and practice. In the French context, for instance, architecture and urban planning are closely connected, and there is a long tradition of city building. It is possible to note the differences in approaches to urban transformation compared to the planning in Oslo. The instrument called the Concerted Development Zone (in French, *Zone d'Aménagement Concerté* [ZAC]) is defined for a particular segment of urban tissue (area larger than one urban block) which is either vacant or intended for transformation. ZAC, which is a legally defined planning instrument (Lucan, 2012), provides an operative framework for both the spatial and functional formation of architectural objects and open spaces in that part of urban tissue – zone, covering a particular spatial scale (which corresponds to the *intermediate scale* that this study focuses on). The zoning is defined in compliance with the overarching plans for urban development. ZAC also defines the organisational structures for the actors and investments and integrates the different planning objectives and demands (e.g. for heritage protection or infrastructure) for the zone. The design is defined in steps – first in volumetric terms, covering disposition of open spaces and built volumes in the entire area, and later in more detailed designs of each urban block and individual building. The heterogeneous character of the surrounding urban tissue in spatial and typological terms is recognised in the layout of the plan, and the areas designed in ZAC are aimed to match the heterogeneity without imitation. Architectural design is an integral part of urban planning, and teams of architects are engaged in each design step (for the entire zone, for each urban block and for individual buildings). In that way, the development of the entire zone is organised hierarchically, with one chief architect, resulting in a varied but coordinated design solution. This kind of plan – which integrates the spatial, contextual and organisational

issues – allows for a higher degree of predictability in the process regarding the design, qualities of the outcomes and the economic aspects of the development.

Similar experiences can be found in the Netherlands, which also has a long tradition of urban planning and design. In the Dutch planning context, architecture is understood as urban fabric, and in order to achieve the urban character of architectural objects, it is important to define visions and plans for the neighbourhood (Robinson, 2017). In the densification in Norway, one goal is to attain of urban qualities in the new developments, and in that sense, both the French and the Dutch experiences could aid in developing closer links between architecture and urban planning. The aforementioned "Oslo model" is an indicator that thinking about densification in Norway is already moving towards more integrative approaches. As densification is such an intense process, with large amounts of built masses designed and constructed, and since it is a learning process, as this study has shown, the planning cycle of densification is an opportunity for Oslo to further develop the conception of architecture as engaging with urban fabric and creating a dense, compact city with desired spatial and functional qualities.

5.8. Concluding remarks and directions for further research

Returning to the central aims of this study – to explore the transformation of urban tissue at the intermediate spatial scale and to examine the different considerations of physical form among the actors – the following primary observations can be summarised.

A substantial part of the analysed new built structures that have been added to the pre-existing urban tissue were planned as individual projects, designed at the intermediate spatial scale: between a building and an urban block. As building activities in Oslo have been intense and since housing has been in great demand, multi-family housing architecture has played a vital role in the transformation of urban tissue. This analysis reveals that the architecture of these new projects is greatly influenced by the pre-existing urban tissue, the site, the norms and demands for private outdoor spaces for residents, heritage concerns and municipal planning goals. Undoubtedly, the developer's goals for each project and the designer's ideas and proposals are at all times the basis, and the mentioned factors function alongside those goals and ideas in the process of designing/zoning. In each analysed case were numerous public and private actors who provided different inputs during the public hearing process. Among the most frequently raised concerns were building heights, building densities, outdoor spaces, and adjacent public open spaces. However, neither of the design proposals had undergone significant changes, which could indicate two things. The first possible explanation could be the high level of designers' skills, while on the other hand, this lack of change could indicate public planners' insufficient preparedness to deal with densification projects at the time of planning.

The current planning for densification is a learning process, where planning instruments and design approaches evolve in accordance with public planners' experiences. This thesis captures a stage in this process and contributes to it by providing systematic insight into the outputs created so far and the challenges that occur in the design of built forms. Another contribution is to the theory of urban morphology, as it provides evidence for current developments and emerging urban forms.

As a considerable number of case projects have been collected in this research, the data could be used as a starting point in further studies, deepening knowledge of different topics

and addressing different spatial scales. For instance, studies could investigate residents' experiences of the new buildings and adjacent outdoor areas, technologies applied in multi-family housing areas, the economics of building processes and the potentials for innovation in terms of green technologies. At the scale of the city, as mentioned before, the results could be combined with those of other similar studies of Oslo in order to gain a more complete overview and generate new knowledge from a broader *ex post* analysis of the built outcomes and the growth pattern of densification.

An urban morphological approach could be applied more extensively, both concerning the spatial results of densification and the planning approaches. Further studies could thus cover the spatial outcomes of the new planning instruments (area zoning, VPOR and Planning programme) and the application of the instruments in the design of the recently developed areas in Oslo. The results of this PhD study have exposed actors' skills and interests as an essential factor in the zoning processes, stressing actors' responsibilities in establishing the emerging, dense urban form. Therefore, the actors' understanding of design-related questions and awareness of the importance of their actions in the densification process could be explored further. In view of strengthening the links between architecture and urban planning, the roles of architects and landscape architects in the zoning processes could be investigated more in detail, namely in terms of the design methods that they apply in different urban contexts and their perception of the morphological questions related to urban fabric. Comparative studies of urban design and urban intensification in other countries and planning traditions could contribute in terms of sharing the experiences and further refining the design and planning approaches in Oslo and other Norwegian cities.

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Appendices

Appendix A : Paper I

This paper was published in Norwegian language, as chapter 13 in the book *Kompakt byutvikling: Muligheter og utfordringer*. Here I provide both Norwegian and English versions.

Norwegian version

Bygningsform og bebyggelsesstrukturer i den fortettede byen

Gordana Marjanovic

Mye er sagt og skrevet om "kompakt by"-modellen og om fortetting innenfor allerede utbygde områder, men de romlige resultatene av denne utviklingen og den faktiske fysiske utformingen av den kompakte byen har fått forholdsmessig lite oppmerksomhet.

Det finnes en rekke studier som ser på bærekraftig bygde, urbane omgivelser både på bygnings- og kvartalsnivå. De fleste av disse studiene, f.eks. Sonne (2009), er normative; de gir veiledende prinsipper for framtidig praksis. Det foreligger også mange studier av hvilke kvaliteter fortettingspolitikken kan lede til. Det er derimot få studier der en har forsøkt å forstå på hvilken måte kvalitetene, positive eller negative, har sammenheng med de overordnete bebyggelsesstrukturene. Det er derfor viktig å studere romlige forhold skapt av fortettingspolitikken for å få en bedre oversikt over den nåværende utviklingen og foreslå mulige forbedringer.

Formålet med dette kapitlet er å analysere fysisk form som et resultat av denne planleggingspolitikken basert på studier av Oslo. Jeg skal videre forsøke å forklare hvordan fortetting skjer, og hvordan de gitte betingelsene bidrar til ulike fysiske former. Mer spesifikt er spørsmålene følgende: *Hvilke fortettingsmåter kan identifiseres i Oslo, og hvilke faktorer er det som påvirker den romlige utformingen av de nye bebyggelsesstrukturene i fortettingsprosessen?* Dette vil bli belyst med flere eksempler på nylig bygde boligkomplekser i Oslo kommune. Hovedvekten er lagt på bebyggelsesformene, mens bokvaliteter i den kompakte byen dekkes i kapittel 12.

Studier av fortetting ved hjelp av bymorfologisk teori og metode

Dette kapitlet er basert på *bymorfologi*, studiet av byers fysiske form. Det fokuserer på forholdet mellom bebyggelsesstrukturene, og på forholdet mellom åpne og bebygde arealer. Det analyserer også hvordan disse formene har sin opprinnelse i historie, topografi og ulike sosioøkonomiske faktorer. Kapitlet studerer den kompakte byens form med utgangspunkt i *typomorfologi* (Aymonino 1977, Panerai, Castex et al. 2004), som har å gjøre med bygningenes størrelse, volum og form. Her anvendes tilnærmingen på resultatene av den pågående fortettingen på kvartals- og bygnings nivå. Med *kvartal* menes her en gruppe tomter avgrenset av gater (Çaliskan 2013).

Fortettingsmåter

Fortetting kan skje på mange måter, men det er vanlig å skille mellom følgende hovedtyper:

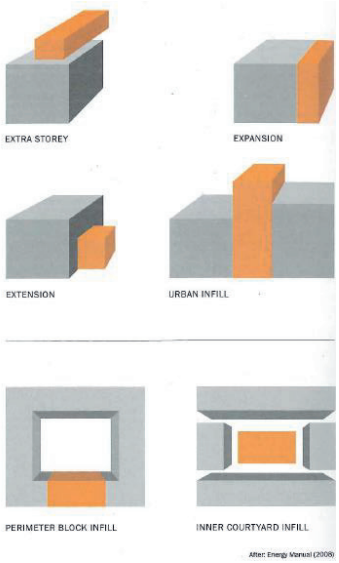
- *Transformasjon: Omskaping av industriområder/ næringsområder (brownfield) til nye områder for bolig (ofte kombinert med næring).*
- Endringene i næringsstrukturen de siste tiårene, fra industri- og produksjon til kunnskaps-, service- og tjenesteproduksjon, har medført at store arealer blir transformert. Slik transformasjon innebærer vanligvis en fortetting med flere boliger og nye og mindre arealkrevende arbeidsplasser.

Intensivering av arealbruk innenfor tettstedsgrense:
I: Som innfylling (infill) mellom eksisterende tett bebyggelse
II: Økt utnyttelse i etablerte bystrukturer, gjennom dypere bygninger og bygging i høyden, for eksempel rundt transportknutepunkter.

III: Intensivering i spredtbygde nabolag, gjennom for eksempel fradeling av tomt (eplehageutbygging).

Ekspansjon: Bygging på ubebygd mark innenfor tettstedsgrensen.
Grøntareal
Annet uutnyttet areal

I denne studien ser jeg på fortetting med utgangspunkt i transformasjon og intensivering fordi mesteparten av fortettingen i dag foregår på denne måten. Dataene blir analysert både på kvartalsnivå og med hensyn til de bygningene som inngår i kvartalene. Fig. 13-1 presenterer de viktigste prinsippene for *intensivering*.



Figur 13-1 *Skjema som illustrerer ulike fortettings- og innfyllingsprinsipper. (Lehmann 2010)*

Figur 13-2 *Fortetting av kvartal med omsluttende bebyggelse ved utskiftning av dets bestanddeler der nye bygninger er innpasset ved siden av en eksisterende (eng. «perimeter block», i henhold til Lehmanns tankegang)*

Dette er eksempler på fortetting av én kvartalstype, den der bygningene i større eller mindre grad omslutter hele kvartalet, på engelsk kalt «perimeter block». Det fins også andre typer, f.eks. kvartaler typiske for modernismen med lamellbygninger og parallelle volumer, kvartaler med uregelmessig form, og dessuten en lang rekke variasjoner av kvartaler med omsluttende bebyggelse. Fortetting av disse ulike kvartalstypene vil anta ulike former. Med andre ord er *fortettingens fysiske form* begrenset av *kvartalstypen.*

Når det gjelder analysen av fortettingens *omfang*, dvs. hvor mye av det nye som legges til, kan vi si at det er to grunnleggende måter å fortette en eksisterende form på: *Tilføyelse* av nytt i det eksisterende og total *endring* av kvartalet. Når det gjelder tilføyelse av nytt, er det forskjeller med hensyn til *hvor mye* det nye utgjør, dvs. *omfanget* av det nye. Ser vi på fortettede bygningsformer i grunnplaner, kan vi skille mellom tilfeller der mindre enn 50% av kvartalet er dekket av det nye (f.eks.

fortettingsprinsippene i fig. 13-1), og tilfeller der de nye bygningene dekker mer enn 50% av kvartalets areal (f.eks. fig.13-2). Total endring av kvartalet betyr, selvfølgelig, at den nye bygningsformen utgjør 100%.

For å oppsummere, når man analyserer *fysisk form* i bebyggelse som er fortettet, handler det primært om *kvartalstypen*, dvs. utforming og romlig organisering av det eksisterende og det nye som er kommet til. Når man skal analysere fortettingens *omfang*, dvs. foreta en *kvantifisering*, inngår en vurdering av mengden av det nye i kvartalet.

Metoder brukt for å studere fortetting i Oslo.

Hovedmetoden anvendt i denne studien er *"sammensatt casestudie"* (eng. *embedded case study)* (Yin 2003), der hovedcaset er Oslo by. Oslo er for tiden en av Europas raskest voksende byer og er en av de norske byene som størst grad har implementert fortettingspolitikken. Denne byutviklingspolitikken ble valgt tidlig, allerede i på slutten av 1980-tallet. Politikken har dermed vært gjennomført i et betydelig tidsrom, og den har stor innflytelse på planleggingsbeslutningene.

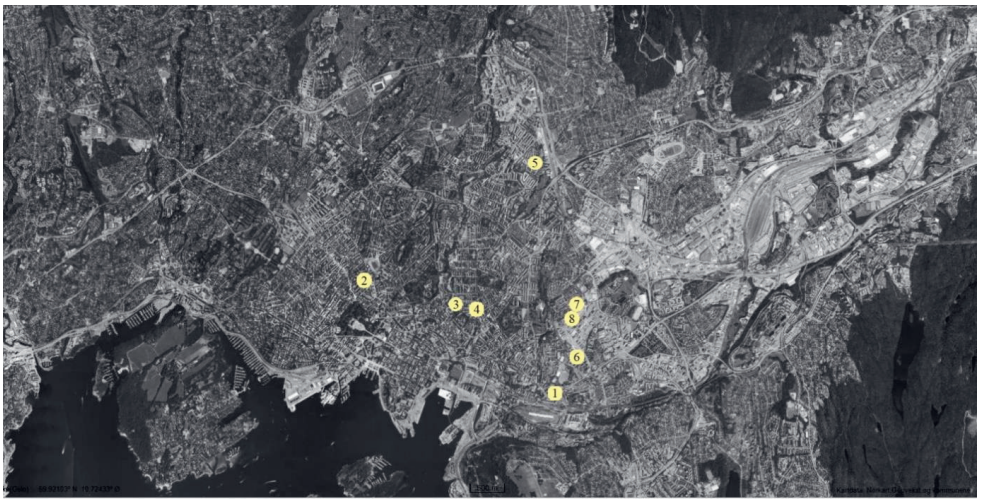
Innenfor Oslo byggesone har vi valgt et antall boligkomplekser som delcase for å studere hvordan kompakt byform skapes i dag. Delcasene omfatter boligbygg og boligkomplekser bygd de siste ti årene. Dette har vært en periode med intensiv byggeaktivitet i Oslo, med en klar "kompakt by"-orientering. Casene ble identifisert ved hjelp av flere ulike ressurser, blant annet Oslo kommunes planleggingsavdeling, Eiendomsverdi og nettsidene til OBOS og Selvaag bolig. Hvert case er blitt evaluert gjennom befaringer, studier av planer innhentet fra Oslo kommunes planleggingsavdeling og ved hjelp av kart fra Google, Finn.no og Bing. I dette kapitlet presenteres åtte case som skal illustrere fortettingsprinsippene og vise hva slags fysisk form som ble resultatet.

Årsaken til at jeg har valgt boligprosjekter, er at boliger utgjør den viktigste delen av bybebyggelsen, og at boligprosjektene i særlig grad reflekterer utviklingen av byen (Rossi, 1982). Kriteriene for valg av case og presentasjonen av fortettingsprinsippene er basert på Lehmanns (2010) begreper. De første seks casene som er presenterte i det etterfølgende er valgt for å illustrere fortettingsprinsipp 2 nevnt foran, *intensivering*. Casene viser hvordan den eksisterende kvartalsforming har påvirket den nye bebyggelsen. De to siste eksemplene viser fortettingsprinsipp 1, *transformasjon*. Her inngår analyser av planformer og de romlige faktorer som har påvirket helt nye kvartaler.

Hvert case er illustrert grafisk – med flybilde og fugleperspektiv. Informasjonen om hvert av dem blir dessuten oppsummert i en tabell som gir oversikt over følgende: Adresse, byggeår, kvartalstype, fortettingens omfang, totalt antall etasjer og avstand til offentlige grøntområder. Casene blir analysert med hensyn til planform, og typene blir vurdert. De er også valgt med tanke på å skulle illustrere ulike fortettingsgrader.

Dataanalyse og resultater

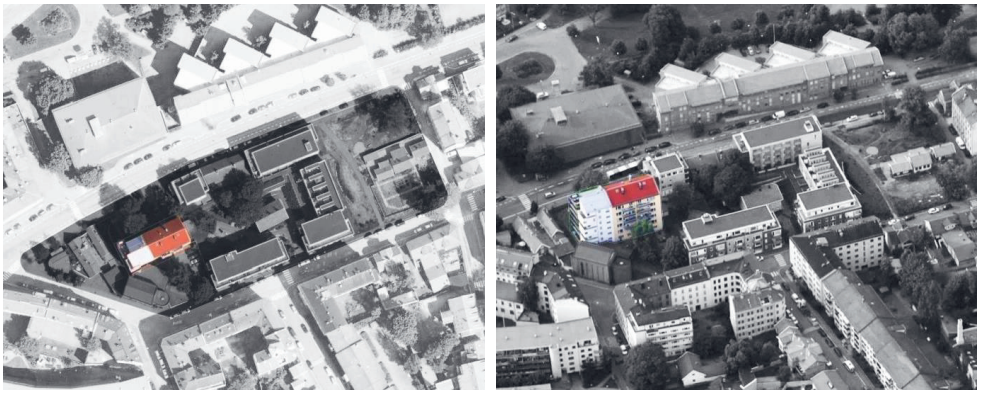
Blant de allerede nevnte fortettingsprinsippene, kan man finne eksempler på følgende i Oslo: *Utvidelse*, *innfylling*, *innfylling av indre gårdsrom* og *tilføyelse av nye bygninger ved siden av et eksisterende bygning*. Dessuten er det oppført et stort antall helt nye boligkvartaler ved transformasjon av tidligere industri-/næringsområder. De antar ulike former, og karakteristiske
eksempler vil bli presentert her.



Figur 13-3 *Kart over Oslo og casenes beliggenhet innenfor byen (Foto: © Kartverket)*

Utvidelse (Expansion i Fig.13-1)

Et eksempel som illustrerer *utvidelse* som fortettingsmåte, finner vi i St. Halvards gate 75 i Gamlebyen (nr. 1 i fig. 13-3). Dette er en utvidelse av en bygning i seks etasjer fra 1952 (Vålerenggata 2B), der utvidelsen følger den gamle bygningens veggliv (ytterveggens ytre flate) høyde og takform (fig. 13-4). I forhold til hele kvartalet er dette et lite tillegg til det bebygde området, mindre enn 50%.



Adresse	St. Halvards gate 75; bydel Vålerenga
Byggeår	2011
Kvartalstype	Blandet
Fortettingens omfang	<50%
Antall etasjer	6
Avstand til offentlig grøntområde	100 m

Figur 13-4 *Utvidelse – ny bygning i St. Halvards gate 75 (ferdigstilt i 2011); Foto øverst: © Oslo kommune, Plan- og bygningsetaten. Gjengitt med tillatelse fra rettighetshaver. Foto nederst: © Blom.*

Innfylling (Urban infill i Fig.13-1)

Denne bygningen ligger i Parkveien 5 B–C i Homansbyen, et område fra 1800-tallet (nr. 2 i fig. 13-3). Den er plassert mellom de eksisterende bygningene på en tidligere ubrukt tomt og er et eksempel på et innfyllingsprosjekt (Fig.13-5). Bygningenes grunnplan følger eiendomsgrensene og høyde er

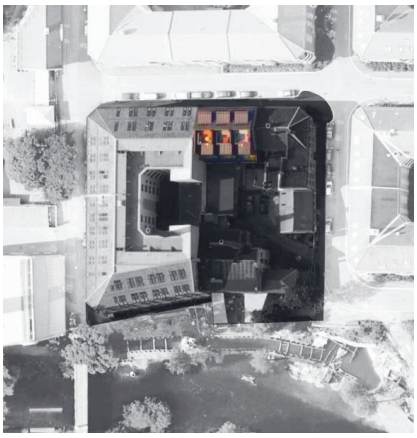
tilpasset nabobygningene. Taket er flatt og brukes som felles uteområde, mens første etasje inneholder tekniske rom og parkering. Kvartalet er stort og består av blandet og delvis omsluttende bebyggelse (gatefrontene er delvis definert av en sammenhengende rekke av bygninger). Omfanget av dette innfyllingsprosjektet er langt under 50 prosent av hele kvartalet.

Figur 13-5 *Innfylling – en ny bygning i Parkveien 5 B–C (ferdigstilt i 2011); To foto øverst: © Oslo kommune, Plan- og bygningsetaten. Gjengitt med tillatelse fra rettighetshaver. Foto nederst: © Blom.*

Adresse	Parkveien 5 B-C; bydel Frogner
Byggeår	2011
Kvartalstype	Blandet med elementer av kvartal med omsluttende bebyggelse
Fortettingens omfang	<50%
Antall etasjer	5
Avstand til offentlig grøntområde	170 m

Innfylling i et kvartal med omsluttende bebyggelse (Perimeter block infill i Fig.13-1)

Dette caset ligger i Korsgata 5 på Grünerløkka, et av byens sentrale, tettbygde områder (nr. 3 i fig. 13-3). Kvartalet er fra 1800-tallet. Det har veldefinerte gatefasader på fire sider (med unntak av en liten del i et av hjørnene), og det er et åpent gårdsrom i midten, der det er mindre bygninger som ikke brukes til boliger (Fig.13-6). Formen til det nye volumet følger formene til de tilliggende bygningene både når det gjelder veggliv, høyde og takform. Omfanget av denne fortettingen er mindre enn 50%.



Adresse	Korsgata 5; bydel Grünerløkka
Byggeår	2010
Kvartalstype	Kvartal med omsluttende bebyggelse
Fortettingens omfang	<50%
Antall etasjer	6
Avstand til offentlig grøntområde	60 m

Figur 13-6 *Innfylling av kvartal med omsluttende bebyggelse – en ny struktur i Korsgata 5 (ferdigstilt i 2010); Foto øverst: © Oslo kommune, Plan- og bygningsetaten. Gjengitt med tillatelse fra rettighetshaver. Foto nederst: © Blom.*

Innfylling i indre del av gårdsrom (Inner courtyard infill i Fig.13-1)

Et ganske unikt eksempel på *innfylling i indre del av gårdsrom* finner vi i Trondheimsveien 2 D–G (Grünerløkka), et kvartal kjent som Schouskvartalet (nr. 4 i fig. 13-3). Kvartalet som den nye bygningen inngår i, er større enn andre kvartaler på Grünerløkka. Det nye boligkomplekset består av to volumer (Fig.13-7). Det har en tydelig definert form, og er plassert nærmest eksisterende bygninger som har samme høyde. Første etasje inneholder ikke-boligfunksjoner, og uteområdet befinner seg på taket til denne etasjen.

Adresse	Trondheimsveien 2D–G; bydel Grünerløkka
Byggeår	2009

Kvartalstype	Kvartal med omsluttende bebyggelse med bygninger inni
Fortettingens omfang	<50%
Antall etasjer	7
Avstand til offentlig grøntområde	100 m

Figur 13-7 *Innfylling i indre gårdsrom – Schouskvartalet (ferdigstilt i 2009); Foto øverst: © Oslo kommune, Plan- og bygningsetaten. Gjengitt med tillatelse fra rettighetshaver. Foto nederst: © Blom.*

Tilføyelse av nye bygningsvolumer ved siden av eksisterende bygninger

Et eksempel på et nytt kvartal bygd ved siden av en eksisterende bygning som ikke brukes til boliger (Fig.13-8), finnes i Hans Nielsen Hauges gate på Torshov (nr. 5 i fig. 13-3). Kvartalet er utformet med en underjordisk garasje, og det private uteområdet ligger på taket av den. Det nye kvartalet følger gatelinjene og definerer gatefasaden tydelig. Organiseringen ligner den man finner i et kvartal med omsluttende bebyggelse, fordi volumene følger gatelinjene og der det finnes et åpent gårdsrom. Omfanget av fortettingen er over 50%.

Figur 13-8 *Nytt kvartal med eksisterende bygning i Hans Nielsen Hauges gate (ferdigstilt i 2005); Foto øverst: © Oslo kommune, Plan- og bygningsetaten. Gjengitt med tillatelse fra rettighetshaver. Foto nederst: © Blom.*

Adresse	Hans Nielsen Hauges gate 29 A–D, Kyrre Grepps gate 19 A–B og Roveruds gate 12; bydel Åsen
Byggeår	2005
Kvartalstype	Variant av kvartal med omsluttende bebyggelse
Fortettingens omfang	>50%
Antall etasjer	4–7
Avstand til offentlig grøntområde	140 m

Kvartaler med lamellbebyggelse og parallelle volumer er vanlige i Oslos eksisterende bebyggelsesmønster. De kjennetegnes av de lange, jevnbrede rektangulære volumene som gjentas med omtrent samme avstand, og av de lineære uteområdene mellom volumene. I noen av dem har det vært rom for fortetting. Dette er tilfellet for Rolf Hofmos gate 13–19 (nr. 6 i fig. 13-3), der det er lagt til tre nye bygninger (Fig.13-9). De er i høy grad påvirket av det eksisterende sterkt definerte modernistiske kvartalet. De tre nye volumene følger den samme romlige organiseringen som var der fra før. Et nytt element er garasjen som er bygd under de nye bygningene og også under bakkenivå. Taket på garasjen brukes som utendørs grøntområde. De tre nye volumene inneholder kun boliger, i likhet med de gamle bygningene. Omfanget av fortettingen er <50%.

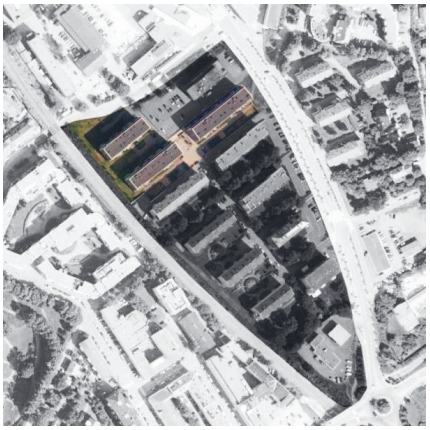
Helt nye kvartaler

Mange av boligområdene som er bygd i det siste, er helt nye kvartaler bygd på tidligere industri-/næringsområder. De er bygd etter *transformasjonsprinsippet*. Her vil to eksempler på kombinerte kvartalstyper bli presentert.

Det ene eksempelet er Tiedemansjordet (Fig. 13-10), et nytt kvartal i Bertrand Narvesens vei på Ensjø (nr. 7 i fig. 13-3). Dette er det første boligprosjektet bygd i den vestre delen av Ensjø og ble ferdigstilt i 2007. (Oslo kommune 2013)

Det ytre volumet er U-formet, har fem etasjer og definerer sammenhengende gatefasader på tre sider. Kvartalet er åpent mot det tilliggende villaområdet. De indre volumene er lavere, med tre etasjer og rommer boenheter for enkeltfamilier. Dette skaper en gradvis overgang mot området med villaer. Den lavere høyden på bygningene inne i kvartalet balanserer den fysiske tettheten i hele kvartalet. Dette bidrar også til mer sollys og mer rommelige utearealer.

Boligkomplekset i Sigurd Hoels vei 44–110 på Ensjø (nr. 8 i fig. 3) er et annet eksempel på et tett nytt kvartal (fig. 11). Den romlige organiseringen er lik den i det forrige caset når det gjelder beliggenhet i det eksisterende bebyggelsesmønsteret, den fysiske strukturen og skalaforholdene inne i bebyggelsen. Det ytre sjuetasjes volumet definerer gatefasaden på én side. På de andre tre sidene er volumene lavere (de har fire etasjer), fordi kvartalet vender mot et villaområde med lav tetthet. Her er plasseringen mer åpen, og volumene ligner en lamellstruktur. De tre volumene inni kvartalet rommer rekkehus for enkeltfamilier.



Adresse	Rolf Hofmos gate 13–19; bydel Ensjø
Byggeår	2009
Kvartalstype	Kvartal med parallelle volumer
Fortettingens omfang	<50%
Antall etasjer	6–7
Avstand til offentlig grøntområde	400 m

Figur 13-9 *Rolf Hofmos gate 13–19, utvidelse av det modernistiske kvartalet fra 1960-tallet (ferdigstilt i 2009); Foto øverst: © Oslo kommune, Plan- og bygningsetaten. Gjengitt med tillatelse fra rettighetshaver. Foto nederst: © Blom.*

Adresse	Bertrand Narvesens vei 1–53; bydel Ensjø
Byggeår	2007
Kvartalstype	Variant av kvartal med omsluttende bebyggelse og volumer inni
Fortettingens omfang	>50%
Antall etasjer	4–6
Avstand til offentlig grøntområde	450 m

Figur 13-10 *Tiedemannsjordet – Bertrand Narvesens vei 1–53, et nytt kvartal med volumer inni (ferdigstilt i 2007); Foto øverst: © Oslo kommune, Plan- og bygningsetaten. Gjengitt med tillatelse fra rettighetshaver. Foto nederst: © Blom.*

Adresse	Sigurd Hoels vei 44–110; bydel Ensjø
Byggeår	2012
Kvartalstype	Variant av kvartal med omsluttende bebyggelse og parallelle volumer inni
Fortettingens omfang	>50%
Antall etasjer	4–7
Avstand til offentlig grøntområde	280 m

Figur 13-11. *Sigurd Hoels vei 44–110, et nytt kvartal med volumer inni (ferdigstilt i 2012); Foto øverst: © Oslo kommune, Plan- og bygningsetaten. Gjengitt med tillatelse fra rettighetshaver. Foto nederst: © Blom.*

Dette kvartalet er, med sin definerte gatefasade og et indre område helt fylt opp av parallelle bygninger med samme fysiske formuttrykk, m.a.o. en kombinasjon av et kvartal med omsluttende bebyggelse og et kvartal med parallelle volumer.

For å oppsummere, presenterer de studerte delcasene et betydelig mangfold av anvendte fortettingsprinsipper i Oslo. Dette indikerer en storvariasjon i bygningsformer i det nye som bygges, både når det gjelder bebyggelsestyper, bygningenes størrelse og høyde, og antallet beboere. For det meste er utbyggingene gjennomført på kvartalsnivå, enten ved at man har lagt nye volumer til de eksisterende, eller ved at man har oppført helt nye komplekser, som dermed (om)danner hele kvartalet. I begge case med helt nye kvartaler (nr. 7 og nr. 8 i fig. 13-3) er det større volumer plassert langs hovedgatelinjene, mens det samtidig er mindre volumer inni kvartalet. De kombinerer gatefasadeorganiseringen fra kvartaler med omsluttende bebyggelse med prinsippet om innfylling i indre gårdsrom. Dette er eksempler på større utviklingsprosjekter og planer fra Ensjøbyen, et lovende transformasjonsområde i Oslo med funksjonsblanding og mange nye boliger.

Tabell 13-1 *Case og analyser – oppsummering*

Fortettingens omfang	Ref	Fortettingsmåte	Kvartalstype	Adresse
Nytt <50%	Fig.13-1	Utvidelse – bygningsnivå	Blandet type	St. Halvards gate 75
		Innfylling	Blandet type med elementer av kvartal med omsluttende bebyggelse	Parkveien 5 B–C
		Innfylling i et kvartal med omsluttende bebyggelse	Kvartal med omsluttende bebyggelse	Korsgata 5
		Innfylling i indre del av gårdsrom	Kvartal med omsluttende bebyggelse med bygninger inni	Trondheimsveien 2 D–G
		Tilføyelse av nye bygningsvolumer ved siden av eksisterende bygninger	Kvartal med parallelle volumer (lameller)	Rolf Hofmos gate 13–19
Nytt >50%	Fig.13-2	Tilføyelse av nye bygningsvolumer ved siden av eksisterende bygninger	Variant av kvartal med omsluttende bebyggelse	Hans Nielsen Hauges gate 29 A–D
		Helt nytt kvartal	Variant av kvartal med omsluttende bebyggelse og volumer inni	Bertrand Narvesens vei 1–53
		Helt nytt kvartal	Variant av kvartal med omsluttende bebyggelse og parallelle volumer inni	Sigurd Hoels vei 44–110

Formen på alle de nye prosjektene varierer etter ulike fysiske faktorer i omgivelsene, samt etter sosioøkonomiske faktorer, f.eks. planleggingskrav, investorkrav, teknologiske krav, formgivernes preferanser osv. Dette kapittelet har ikke sett på alle disse faktorene, men har primært rettet søkelyset mot romlig og funksjonell organisering og på forholdet til eksisterende bebyggelsesmønstre.

Drøfting

Studien har avdekket et stort mangfold av fortettingsprinsipper for det som er nybygd i Oslo de 10 siste årene. Dette innebærer også at den nye bebyggelsen har bidratt til stor romlig variasjon. I det etterfølgende blir følgende tema tilknyttet fortettingen drøfte, både for å forklare hva som har påvirket resultatet og hvilke kvaliteter som er skapt:

1 Tilgjengelig areal
2 Betydningen av eksisterende bebyggelsesstruktur for de romlige resultater i fortettingen
3 Nye planformer på grunnplan
4 Funksjonsblanding
5 Uteområder i boligbebyggelse

Når det gjelder de romlige faktorene, er omfang av *tilgjengelig areal* det grunnleggende og viktigste aspektet i fortettingsprosessen. I de allerede tett bebygde områdene er det selvfølgelig få ledige tomter til bygging, så transformasjon av tidligere industri-/næringsområder gir muligheter for utvikling i større skala. Her kan de nye bygningene påvirke byens form i større grad enn i de tette sentrale områdene. Arealbruken er maksimert i nye kvartaler, og de aller fleste nye bygningene er bygd på et

sammenhengende garasjerom i den nederste etasjen, og strekker seg over hele eiendommen, enten under eller på bakkenivå.

Når det gjelder *eksisterende bygningsformer*, er det verdt å merke seg at de i høy grad påvirker de nye formene, noe som er i samsvar med studiene til Børrud og Syvertsen (2012). Dette gjelder ikke bare innfyllinger, men også helt nye kvartaler. Et eksempel på det siste er de to casene som er innpasset i villabebyggelse der de nye kvartalene har en mer åpen struktur mot den eksisterende og langt mindre tette bebyggelsen. De eksisterende bygninger påvirker også høyden på de nye volumene. Dette gjelder særlig for innfyllingsprosjekter i eksisterende bebyggelse. I de helt nye kvartalene er de indre volumene lavere, ikke bare av hensyn til den omkringliggende bebyggelsen, men også for at det skal komme sol inn i kvartalet.

Grunnplanene i de nye kvartalene i Oslo er i all hovedsak varianter av kvartalet med omsluttende bebyggelse. Mange av de nye kvartalene har også bebyggelse i gårdsrommene, for at arealbruken skal bli mest mulig effektiv, og for at beboertettheten skal bli så høy som mulig. Det er interessant å merke seg at disse indre volumene skaper en kombinasjon av leilighetsblokker og rekkehus (fig. 13-10 og fig. 13-11). Dette er en ny, hybrid kvartalstype der det tilbys forskjellige slags boliger, slik at det er plass til ulike beboerprofiler og livsstiler. Det er dermed også en kvartalstype som bidrar til å oppfylle ett av hovedmålene med kompakt byutvikling, nemlig sosialt mangfold.

Casene valgt i studien representerer nye boligprosjekter. Mange av dem rommer ikke bare boliger, men også andre funksjoner, som kontorer, barnehager, butikker og kafeer. De oppfyller dermed en annen målsetting med kompakt byutvikling: *Funksjonsblanding*. Mange av de nylig bygde kompleksene er imidlertid rene boligkomplekser, noe som skyldes deres beliggenhet innenfor den overordnede bystrukturen. De som ligger sentralt, har nesten alltid andre funksjoner enn boliger i første etasje. Denne blandingen av funksjoner er noen ganger også reflektert i bruken av uterommet i boligkomplekset. For eksempel kan en del av gårdsrommet settes av til en barnehage. Dette er vanlig i allerede tette, sentrale områder, men ikke så vanlig i de helt nye utviklingsområdene.

Et viktig element i kompakte byer er *uterom* i boligområdene. Den typomorfologiske tilnærmingen gir innsikter ikke bare i bygningstyper, men også i tilliggende uteområder (Moudon 1989). Ved å se på størrelsen på uterommene og på uterommenes funksjoner kan man vurdere hvor godt egnet de er for ulike aktiviteter. De lineære rommene fungerer hovedsakelig som "korridorer" for tilgang til leilighetene, mens de mer åpne, rektangulære rommene kan gi plass ulike aktiviteter, som f.eks. møtesteder, lekeplasser, sitteområder osv. Analysen av casene viser at felles tilgjengelige ute områder finnes i de nye formene, selv om arealet per beboer kan diskuteres i lys av tetthet. Omfanget av felles uteområder ser ut til å være begrenset i de nye bygningsprosjektene, og det foregår i dag i fagdebatten en diskusjon om minstekrav. Det er også verdt å nevne at mange av utearealene er bygd på garasjetak, noe som kan være begrensende for beplantning. Et annet spørsmål er i hvilken grad nærhet til offentlige grøntområder kompenserer for små felles utearealer og høy tetthet. Her viser det seg at alle de analyserte casene ligger mindre enn 500 m fra offentlige grøntområder. Dette er i samsvar med beregningsmåten som Oslo kommune (2010) har benyttet i utkastet til grøntplan for å identifisere dekningsgrad for mellomstore parker. Mangelen på felles grønne uteområder kompenserer derfor muligens noe ved at det finnes offentlige parker i nærheten.

Generelt, er det ikke mulig å snakke om en tett eller kompakt byform som en enkelt løsning. Hva som anses som tett eller kompakt, er kontekstavhengig. Svaret vil variere avhengig av hvor man befinner seg i byen, for eksempel i sentrum eller i utkantområder. Det kan også være forskjeller mellom ulike byer, det være seg i samme land, i forskjellige land eller på forskjellige kontinenter. Det som anses som tett og kompakt ett sted, for eksempel i Skandinavia, er ikke nødvendigvis slik et annet sted, for eksempel i Asia. Dette skyldes at begrepet tetthet avhenger av en rekke faktorer, både de romlige som vi allerede har vært inne på, og andre spørsmål, som planleggingskrav, kulturbakgrunn eller personlig oppfatning. Bygningstetthet er et kvantifiserbart begrep, og ulike parametriske verktøy er blitt utviklet for å måle dette, og på den måten beskrive od karakterisere ulike byområder (for eksempel, Spacemate utviklet av Pont og Haupt i 2004). Tetthet handler også om beboertettheten i et bestemt område. Uavhengig av hvilken form for tetthet man velger, handler det om planvedtak i den aktuelle konteksten.

Konklusjon

Den eksisterende bygningskonteksten spiller en viktig rolle når vi skal skape nye bygningsformer. Graden av og typen fortetting avhenger av beliggenheten i bystrukturen. Formen på den kompakt byen avhenger i stor grad av det som eksisterer, bokstavelig og fysisk og/eller med hensyn til utformingsprinsipper. Den nye bebyggelsesstrukturene har en stor variasjonsbredde, som ofte kombinerer tidligere kjente former. I tillegg er et viktig mål å maksimere arealbruken og samtidig gi nok plass til alle funksjonene et boligkvartal skal inneholde, både i bebyggelse og uterom.

Oslos kompakte byform er en av mange eksisterende kompakte former. Formene på fortettingsprosjektene vi finner her, skiller seg fra andre case som følge av forskjeller i eksisterende bebyggelsesmønstre, forskjeller i tillatte tettheter (f.eks. p.gr.av krav til solinnfall som har sammenheng med breddegraden) og forskjeller i hensyn til omkringliggende kvartaler. Den kompakte byen kan anta uendelig mange former, og det finnes ikke en enkelt formel for hvordan den skal utformes.

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English version

Urban form and built structures in the dense city

Gordana Marjanovic

Though much has been written about the "compact city" model and the densification within the already built-up area, insufficient attention has been paid to spatial results of this development and the actual design of the physical form of the compact city.

There are numerous studies of the sustainable built and urban forms both at the level of building and urban block. Most of these studies are of prescriptive character, providing guiding principles for future practice, e.g. Sonne (2009). There are many studies of the qualities resulting from the densification policy. There are, however, few studies aimed for understanding the ways in which the qualities, positive or negative, are related to greater urban built structures. It is thus of importance to study the spatial relations created by the densification policy in order to obtain a better overview of the current development and suggest possible improvements.

The aim of this chapter is to analyse the physical forms resulting from this planning policy in the context of Oslo. Further, it aims to explain how densification occurs and under which conditions it takes particular forms. More specifically, the research question is: *What ways of densification can be identified in Oslo, and what are the factors influencing the spatial formation of the new built structures in the process of densification?* This will be illuminated using several examples of recently built residential complexes in the municipality of Oslo. The focus is on the built forms, while the housing qualities in compact city context are covered in chapter 12.

Studying densification using urban morphological theory and methods

This chapter is based on *urban morphology*, which studies the physical form of cities. It focuses on the relationships between the built structures, and between the open and the built spaces. It also analyses the origins of these forms from the aspects of history, topography and numerous socio-economic factors. This chapter studies the form of compact cities from the viewpoint of typo-morphology (Aymonino 1977, Panerai, Castex et al. 2004), concerning the scale of buildings in the urban context. Here, this approach is applied to the results of the ongoing densification at the spatial level of the urban block and the subordinate built structures. The *urban block* is understood as a group of plots circumscribed by streets (Çaliskan 2013).

Densification of urban fabric

Densification can occur in many ways, but the following main types are often distinguished:

- *Transformation: Transformation of industrial / commercial areas (brownfield) into new residential areas (often combined with industry).*
  The changes of the industrial structure in recent decades, from industrial and production to production of knowledge and provision of services have led to transformation of large areas. Such transformation usually involves densification with more homes and new, less area-demanding jobs.

- *Intensification of land use within urban boundaries:*

I: As infill in the existing dense settlement.
II: Increased utilisation in established urban structures by means of deeper and higher buildings, for example around transportation hubs.
III: Intensification in dispersed neighborhoods, for example through the subdivision of plots (in Norwegian, "*eplehageutbygging*" – "*apple garden development*").

- *Expansion: Construction on undeveloped land within the urban boundaries.*
  Green areas
  Other unused areas.

In this study, densification is explored from the viewpoints of transformation and intensification, as the data are selected from the transformation areas and the infills in the existing urban fabric. The data are analysed at the level of the urban block and the buildings that constitute it. Fig. 13-1 presents the main principles of *intensification.*

These are examples of densification of only one type of urban block – perimeter block. There are also other types of urban blocks, such as modernist with parallel built volumes, blocks of irregular shapes, and a range of variations of the perimeter block. Densification of the different types has different physical forms. In other words, the physical *form of densification* is defined by the *urban block type*.

Concerning the analysis of *extents* of densification, i.e. how much of the new built mass is added, we could state that there are two basic ways of densifying an existing built form: *addition* of new built masses into the existing built form, and total *replacement* of urban block. Concerning the addition of new built masses, there are differences in how much the new constitutes – the *extent* of new built masses. Looking at the densified built form in plan layout, we could distinguish the cases where less than 50% of the urban block area is covered with the new buildings (e.g. densification principles in Fig. 13-1), and cases in which new buildings occupy more than 50% of the block area (e.g. Fig. 13-2). Total replacement of urban block, evidently, means 100% of the new built form.

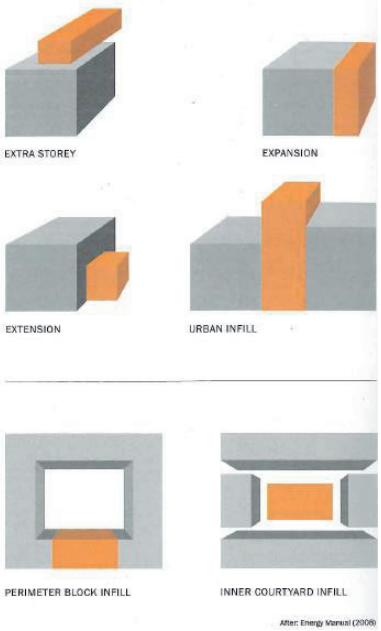


Figure 13-1 *Diagram illustrating various densification and urban infill principles (Lehmann 2010).*

Figure 13-2 *Densification of perimeter block by replacement of its parts – addition of new objects next to an existing building (in Lehmann's line of thought)*

To sum up, the analysis of the physical *form* of densified structures primarily regards the *type* of blocks, i.e. design and spatial organisation of the pre-existing and the new physical forms. The analysis of the *extents* of densification entails *quantification*, i.e. assessment of the amount of the new in a block.

Methods applied in analysis of densification in Oslo

The main method applied in this work is *embedded case study* (Yin 2003), in which the main case is the city of Oslo. It is currently one of the fastest growing cities in Europe and one of Norwegian cities that has been implementing the densification policy to a high degree. This planning orientation was adopted early, already in late 1980s. The policy has thus been implemented for a significant amount of time and it has a strong influence on the planning decisions.

Within Oslo, a number of residential complexes have been selected as sub-cases for the study of the ways compact urban form is being created. The sub-cases comprise residential buildings and complexes built in the past ten years. This is a period of an intense building activity in Oslo, with a clear "compact city" planning orientation. The cases were collected by using a variety of sources, such as Agency for Planning and Building Services (PBE) of Oslo Municipality, Eiendomsverdi[1] and web pages of OBOS[2] and Selvaag bolig[3]. Each case has been evaluated through site visits, plans obtained from the PBE and maps from Google, Finn.no and Bing. For the purpose of this chapter, eight cases are presented in order to depict the principles of densification and the resulting physical forms.

The reason for selecting residential architectural programme is that it constitutes the essential part of urban fabric, which to a high degree reflects the development of the city (Rossi, Eisenman et al. 1982). Criteria for selection of cases and representation of the densification principles are based on Lehmann's (2010) concepts. The first six cases are selected to illustrate the aforementioned densification principle number 2, *intensification*, i.e. to show the influence of pre-existing built forms on the new buildings. The last two examples present densification principle number 1, *transformation*. They involve the analysis of plan shapes and corresponding spatial factors that influenced the entirely new blocks.

Each case is presented graphically – with aerial view and bird's-eye view images. In addition, information on each case is summarised in a table as follows: address, year of completion, urban block type, extent of densification, total number of storeys and distance to the nearest public green space. The cases are analysed for their plan shapes, and their types are assessed. The cases are selected in order to depict different extents of densification.

Data Analysis and results

Among the already mentioned principles of densification, the examples of the following principles can be found in Oslo: *expansion*, *infill*, *inner courtyard infill*, and *addition of new buildings next to an existing building*. Also, a large number of new residential areas were built as brownfield transformation, with the entire urban blocks being newly designed. The blocks have different forms, and characteristic examples are presented here.

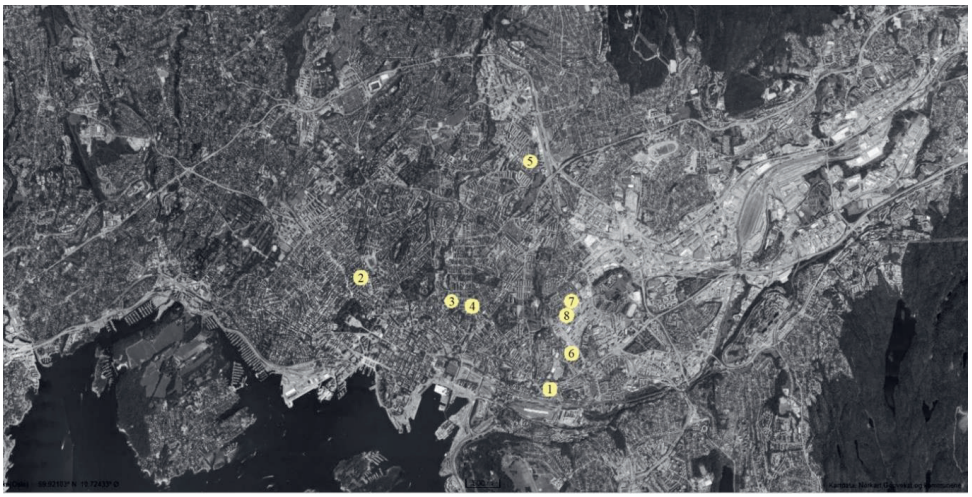
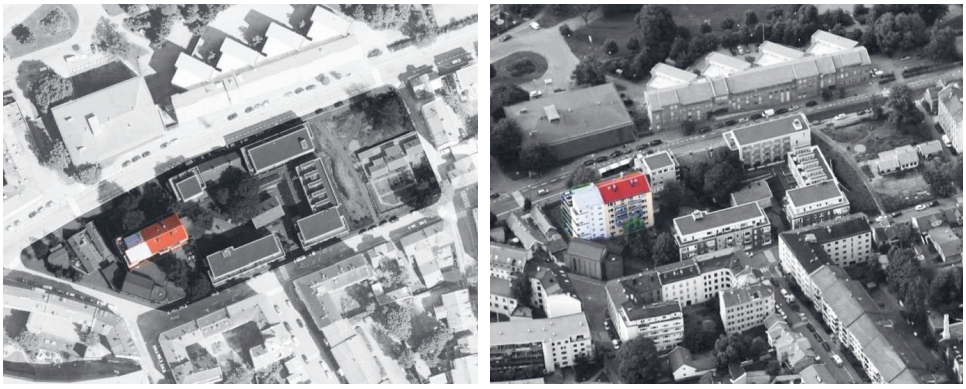


Figure 13-3 *Map of Oslo and situation of cases within the city (Photo: © Kartverket)*

Expansion

An example which illustrates expansion as a way of densification is situated in 75, St. Halvards Street, in the historic part of Oslo, Gamlebyen (no. 1 in Fig. 13-3). It is an extension of a six-storey building from 1952 (address Vålerenggata 2B) and the new built volume follows the wall alignment in plan layout, and the height and the roof shape of the old building (Fig.4). In relation to the entire urban block, this is a small addition of the built mass, less than 50%.



Address	St. Halvards Street 75
Year of completion	2011
Block type	Mixed
Extent of densification	<50%
Number of storeys	6
Distance to public green space	100m

Figure 13-4 *Expansion – new building in St. Halvards Street 75 (completed in 2011); Photo left: © Oslo kommune, Plan- og bygningsetaten. Rendered with permission of copyright owner. Photo right: © Blom.*

Urban infill

This building is located in Parkveien, 5 B–C in Homansbyen, an area dating from 1800s (no. 2 in Fig. 13-3). It is a case of an infill structure, inserted between pre-existing buildings on a previously empty plot (Fig. 13-5). The layout of the building plan follows the property lines. It is aligned in plan and height with the adjacent buildings. The roof is flat and it is used as the common outdoor area, while the ground floor level accommodates technical rooms and parking garage. The urban block is large and of mixed type with elements of perimeter block (street fronts partly defined by continuous rows of buildings). The extent of this infill relative to the urban block is far below 50%.

Figure 13-5 *Urban infill – a new building in Parkveien 5 B-C (completed in 2011); sources: finn.no and Bing maps. Two photos above: © Oslo kommune, Plan- og bygningsetaten. Rendered with permission of copyright owner. Photo below: © Blom..*

Address	Parkveien 5
Year of completion	2011
Block type	Mixed with elements of perimeter block
Extent of densification	<50%
Number of storeys	5
Distance to public green space	170m

Perimeter block infill

This case is located in 5, Korsgata in Grünerløkka, one of the central, densely built areas (no. 3 in Fig. 13-3). The urban block dates from 1800s. Its street fronts are well defined on four sides (with an exception of a small part in one of the corners) and it is open in the middle, where smaller buildings of non-residential use are situated (Fig. 13-6). The shape of the new volume follows that of the adjacent buildings – their wall alignment in plan layout, heights and the roof shape. The extent of densification in this case is less than 50%.

Address	Korsgata 5
Year of completion	2010
Block type	Perimeter block
Extent of densification	<50%
Number of storeys	6
Distance to public green space	60m

Figure 13-6 *Perimeter block infill – a new structure in Korsgata 5 (completed in 2010); Photo left: © Oslo kommune, Plan- og bygningsetaten. Rendered with permission of copyright owner. Photo right: © Blom.*

Inner courtyard infill

A rather unique example of *inner courtyard infill* can be found in Trondheimsveien 2 D-G (Grünerløkka), a block known as Schouskvartalet (no. 4 in Fig. 13-3). The urban block, in which the new structure was inserted, is larger than other blocks in Grünerløkka district. The inserted residential complex consists of two built volumes (Fig. 13-7). It has an expressively defined form, and it is placed closer to the pre-existing buildings of similar heights. The ground level accommodates non-residential functions, and the outdoor space is located on its rooftop.

Address	Trondheimsveien 2D-G
Year of completion	2009
Block type	Perimeter block with volumes inside

Extent of densification	<50%
Number of storeys	7
Distance to public green space	100m

Figure 13-7 *Inner courtyard infill – Schouskvartalet (completed in 2009); Photo left: © Oslo kommune, Plan- og bygningsetaten. Rendered with permission of copyright owner. Photo right: © Blom.*

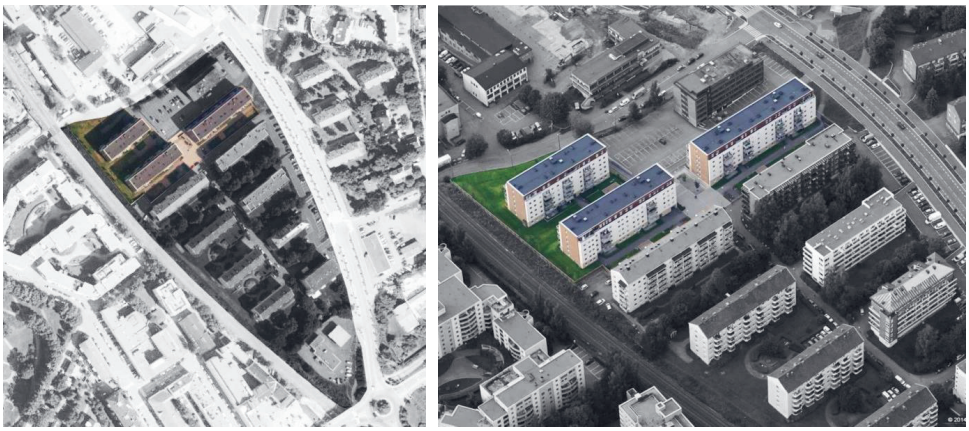
Address	Hans Nielsen Hauges Street 29 A-D, Kyrre Grepps gate 19 A-B and Roveruds gate 12
Year of completion	2005
Block type	Variation of perimeter block
Extent of densification	>50%
Number of storeys	4 - 7
Distance to public green space	140m

Figure 13-8 *New block with existing building in Hans Nielsen Hauges gate (completed in 2005); Photo left: © Oslo kommune, Plan- og bygningsetaten. Rendered with permission of copyright owner. Photo right: © Blom.*

Addition of new built volumes next to existing buildings

An example of the new buildings constructed next to a pre-existing building of non-residential use (Fig. 13-8) is situated in Hans Nielsen Hauges Street in Torshov, Oslo (no. 5 in Fig. 13-3). The building is designed with an underground garage, the rooftop of which is used as the private outdoor space. The new structure follows the street lines and defines the street front consistently. By this organisation, it resembles perimeter block where the volumes are distributed on the edges, and the middle of the urban block is left open. The extent of densification is above 50%.

Considering the existing urban patterns of Oslo, it is common to find modernist type of blocks. They are characteristic for the elongated rectangular volumes with the same widths, repeated at regular distances, and linear outdoor spaces in between. In some of these blocks, densification has taken place. This is the case in Rolf Hofmos Street 13-19 (no. 6 in Fig. 13-3), where three new buildings were added (Fig. 13-9). The new buildings were greatly influenced by the pre-existing, strongly defined modernist block. Three new volumes were added following the same rules of spatial organisation. A new element is the garage built below the ground level. Its rooftop is used as outdoor green area. The new built volumes are solely of residential function, identical to the old buildings. The extent of densification is <50%.



Address	Rolf Hofmos Street 13-19
Year of completion	2009
Block type	Variation of modernist block
Extent of densification	<50%
Number of storeys	6 - 7
Distance to public green space	400m

Figure 13-9 *Rolf Hofmos St. 13-19, extension of the modernist block from 1960's (completed in 2009); sources: finn.no and Bing maps; Photo left: © Oslo kommune, Plan- og bygningsetaten. Rendered with permission of copyright owner. Photo right: © Blom.*

Entirely new blocks

Many of the recently built residential areas are entirely new blocks, erected on former industrial areas. They were built following the principle of *transformation*. Here, two examples of the combined block types will be presented.

Such example is Tiedemansjordet (Fig. 13-10), a new urban block in Bertrand Narvesens Street in Ensjø (no. 7 in Fig. 13-3). This is the first residential project built in the west part of Ensjø, in 2007 (Oslo kommune 2013).

The outer volume is U-shaped, with five storeys, defining continuously the surrounding street fronts on three sides. The block is open towards the neighboring villa area. The inner volumes are lower, with three storeys, accommodating single-family housing units. This creates a gradual transition towards the area with villas. The lower height of the built volumes inside the block balance the physical density of the whole urban block, allowing also for the sunlight and spaciousness of the outdoor spaces in between.

The residential complex in Sigurd Hoels Street 44–110 in Ensjø (no. 8 in Fig. 13-3) is another case of a dense new block (Fig.11). Its spatial organisation is similar to the previous case regarding situation in the existing urban pattern, physical structure, and the scale of new buildings. The outer seven-storey volume defines the street front on one side. On the other three sides, the volumes are lower (four storeys high), as the block faces a low-density villa area. This is where their disposition is more open, and the built volumes resemble modernist slab structure. Three volumes inside the block accommodate single-family terraced houses. This urban block is a combination of the perimeter block – with defined street fronts, and the parallel built volumes – following the principles of modernist blocks.

Address	Bertrand Narvesens Street 1-53
Year of completion	2007
Block type	Variation of perimeter block with volumes inside
Extent of densification	>50%
Number of storeys	4 - 6
Distance to public green space	450m

Figure 13-10 *Tiedemannsjordet – Bertrand Narvesens St. 1-53, a new urban block with volumes inside (completed in 2007); Photo left: © Oslo kommune, Plan- og bygningsetaten. Rendered with permission of copyright owner. Photo right: © Blom.*

Address	Sigurd Hoels Street 44-110
Year of completion	2012
Block type	Variation of perimeter block and modernist type inside
Extent of densification	>50%
Number of storeys	4 - 7
Distance to public green space	280m

Figure 13-11 *Sigurd Hoels St. 44-110, a new block with volumes inside (completed in 2012); Photo left: © Oslo kommune, Plan- og bygningsetaten. Rendered with permission of copyright owner. Photo right: © Blom.*

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Table 13-1 *Cases and analyses – summary*

Extent of densification	Ref	Principle of densification	Urban block type	Address
New < 50%	Fig.13-1	Expansion – level of building	Mixed type	St. Halvards St. 75
		Urban infill	Mixed type with elements of perimeter edge	Parkveien 5 B–C
		Perimeter block infill	Perimeter block	Korsgata 5
		Inner courtyard infill	Perimeter block with volumes inside	Trondheimsveien 2 D–G
		Addition of volumes next to the existing	Modernist block (slabs)	Rolf Hofmos St. 13–19
New > 50%	Fig.13-2	Addition of volumes next to the existing	Variation of perimeter block	Hans Nielsen Hauges St. 29 A-D
		Entirely new block	Variation of perimeter block with volumes inside	Bertrand Narvesens St. 1–53
		Entirely new block	Variation of perimeter block and modernist type inside	Sigurd Hoels St. 44–110

To summarise, the data present a notable diversity of densification principles applied in Oslo. This indicates a large variety of built forms among the new structures in terms of building types, sizes and heights of buildings, and numbers of inhabitants. Mostly, the interventions entail the spatial level of the urban block, either as addition of new volumes to the pre-existing ones, or as entirely new complexes, which thus (re)form the entire urban block. In both cases of the entirely new urban blocks (no. 7 and no. 8 in Fig. 13-3), larger volumes were placed along the main street lines and smaller volumes were placed inside the block. They combine spatial organisation of street fronts as in perimeter block with the inner courtyard infill principle. These are examples from greater developments and plans from Ensjøbyen, which is an up-and-coming transformation area of Oslo, with numerous new residential and mixed-use areas.

Built forms of the analysed new structures vary according to different spatial factors from their surroundings, along with socio-economic factors, such as planning requirements, investors' demands, technological demands, designers' preferences and so forth. This chapter has not considered all these factors, but it has primarily focused on spatial and functional organisation, and the relations between the new developments and the pre-existing urban patterns.

Discussion

The study has revealed a large variety of densification principles among the structures built in Oslo in the last 10 years. This means that the new buildings have contributed to great spatial variation. In this section, the following topics related to the densification are discussed, both to explain the influences on the built results and the qualities that have been created:

1. Available land
2. Significance of the existing built structure for spatial outputs of densification
3. New plan layout forms
4. Mixed use
5. Outdoor areas in residential buildings.

Concerning the spatial factors, the elementary and most influential aspect in the densification process is the amount of *available land*. Evidently, in the already dense areas there is scarce vacant land available for construction, and thus the transformation of brownfield areas provides opportunities

for development at a larger scale. It is there that the new structures can influence the form of the city to a much higher degree than in the dense central areas. The area use is maximised in new blocks, and a vast majority of new structures are built upon a continuous garage room, placed at the lowest storey that stretches across the entire property, either below or at the ground level.

Considering the *existing built forms*, it is notable that they largely influence the new forms, as was concluded also in the study by Børrud and Syvertsen (2012). This applies not only to infills but also to the entirely new urban blocks. Examples of the new blocks are the two cases inserted in villa areas; hence the new blocks have a more open structure towards the pre-existing, significantly less dense areas. The pre-existing buildings also influence the heights of the new built volumes. This especially applies to infill cases. In the entirely new urban blocks, the inner volumes are lower not only because of the surrounding built areas, but also to allow for the sunlight inside the new block.

Regarding the *plan shapes* of the new blocks in Oslo, most of them are variations of the perimeter block. Many of them have volumes in the middle part as a way to maximise the use of the available land and increase density of inhabitants. An interesting finding comes from here, as the presence of built volumes within the block creates a combination of multi-storey housing and single-family terraced housing (Fig. 13-10 and Fig. 13-11). This is a new, hybrid type of block, as it combines different types of housing, allowing for different profiles of inhabitants and different lifestyles within the same spatial ensemble. This is, hence, an urban block type that contributes to achieving one of the main goals of compact urban development – social diversity.

The cases selected for the study are newly built residential buildings. Often, along with housing, they accommodate other functions, such as offices, kindergartens, shops and cafés. They thus fulfill another aim of the compact development – *mixed use*. However, many of the newly built complexes are purely residential, and this is due to their location within the general urban structure. Those placed centrally have a non-residential ground floor level, almost as a rule. This mix of functions is occasionally also reflected in the use of outdoor spaces within the residential complexes; for instance, a part of the courtyard can be allocated to a kindergarten. This is usually the case in the already dense, central areas, and not so much in the entirely new developments.

An important concern in compact cities are *outdoor spaces* in housing areas. Typo-morphological approach provides insights not only into the building types, but also the adjacent outdoor spaces (Moudon 1989). By analysing the proportions of outdoor spaces and their functions, it is possible to assess their suitability for various activities. The linear spaces serve mainly as “corridors” for access to the dwellings, while the more open, rectangular spaces can host different activities – meeting points, playgrounds, seating, etc. The analysis of cases shows that common open areas are present in the new developments, though their amount of area per inhabitant can be discussed in relation to density. Apparently, the open areas are limited in the new developments, and there is an ongoing professional debate on the minimal requirements for outdoor spaces in residential projects. It is also worth mentioning that the common outdoor spaces are often built on garage rooftops, which can be a limitation for greenery. This relates further to the question of whether the proximity of new residential areas to public green spaces can compensate for the insufficient outdoor spaces and high densities. All cases analysed in this study are located within the distance of 500m from the public green areas, as recommended by Oslo Municipality (2010) for middle-sized parks in the draft of Green Plan. The lack of common green outdoor spaces might be compensated to a limited degree by the presence of public green spaces nearby.

In general, it is not possible to speak about a dense or compact urban form as a single solution. The notions of density and compactness are highly context-dependent. The perception varies depending on the situation in the city, for example in the city centre or at the outskirts. There can also be differences between different cities, be it in the same country, in different countries or on different continents. What is thought to be dense and compact in one place, for example, in Scandinavia, is not necessarily so in another, for instance, in Asia. This difference occurs because the notion of density depends on a range of factors, both the spatial ones that have already been elaborated on, and other issues such as planning requirements, cultural background, or even individual perception. Building density is a quantifiable concept and different tools have been developed for measuring it (for example, Spacemate, developed by Pont and Haupt in 2004). Density can also refer to density of inhabitants in a certain area. In both terms, the aimed levels of density are a matter of planning decision in a particular planning context.

Conclusion

The existing built context plays the major role in creation of new built forms. The degree and type of densification depend on the position in the urban fabric. The form of the compact city relies greatly on the existing forms, both literally and physically, and/or in terms of design principles. The new built structures have a large variety of shapes, often combining the previously known forms. In addition, an important goal is to maximise land use and at the same time provide sufficient space for all the functions a housing complex is to contain, both in buildings and outdoor spaces.

Oslo's compact urban form is one of many existing compact forms. Built forms of densification projects we find here differ from other cases, due to the different pre-existing patterns of built form, different allowed densities (e.g. due to sunlight requirements for a given latitude) and different considerations for the surrounding urban blocks. Compact city can take infinitely many forms, and there is no single formula for how it should be designed.

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Image sources: Finn.no and Bing maps

Notes:

[1]Eiendomsverdi is a company that registers the activities and development of real estate markets in Norway (www.eiendomsverdi.no)

[2]OBOS is the largest Norwegian cooperative building association, owned by its members (www.obos.no)

[3]Selvaag bolig is one of the largest residential development companies in Norway (www.selvaag.no)

Appendix B : Paper II

Author: Gordana Zurovac

Urban tissue transformation under the densification policy
The case of Oslo

Abstract
Based on the case of Oslo, this paper focuses on the physical results of the implementation of the densification policy in Norway. By applying the urban morphological approach, the paper examines transformation of urban tissue at the intermediate spatial scale (buildings – plot – street – urban block). It covers 71 cases of multi-family residential buildings and analyses the pre-existing tissues where they occur as well as the principles of intervention. The results reveal a myriad of tissue types (mixed tissues being dominant) and a significant number of entirely new urban blocks. Tissues are investigated in terms of conditions and challenges, and new blocks are analysed for their morphological characteristics and application in densification.

Keywords: densification, urban tissue, urban block, urban transformation, Oslo

Introduction

Over the past few decades, planning theory has taken a direction towards social sciences, distancing itself from its common roots with architecture and engineering. This has created a gap between planning and design (urban and architectural) to the disadvantage of both fields (Palermo & Ponzini, 2010). At the same time, planning has branched out into two major paths as new planning challenges have been identified and new approaches have been adopted accordingly. First, since the Brundtland report "Our Common Future" was published in 1987, numerous countries in Europe and the world have directed their planning goals towards sustainability (Organisation for Economic Co-operation and Development, 2012; McCormick, Anderberg, Coenen, & Neij, 2013). In spatial terms, it has become largely accepted that the containment of the urban sprawl together with a more efficient use of the existing built-up areas could ensure the attainment of the sustainability goals. Therefore, more effective use of existing urban areas, termed *densification* (or intensification), has become a common urban development approach (Hernandez-Palacio, 2014). Second, the approach known as "strategic spatial planning" has been adopted in many European contexts and is considered to be the most appropriate means to meet the identified challenges (Albrechts, 2004; Palermo & Ponzini, 2010).

Regardless of the gap created by the distancing of planning theory from architecture and urban design and by the adoption of a strategic approach to planning which does not primarily deal with the structural issues of the urban form, physical structures in urban spaces are a substantial part of the results of planning activities. As in the current densification of urban areas this entails the design and insertion of new structures into a previously existing built-up structure, the question of actual interventions and physical transformation, together with the approaches and challenges in the design and planning for sustainable development, comes to the fore. The fact that densification is an ongoing process further emphasises the relevance of this question, both for practice and research.

The urban form is approached differently in different fields of research. In one tradition, the urban form is considered at the large spatial scale, the scale of the city or urban agglomerations, and is understood as a question of coordinating transportation, densities and land use (see, for example, Stead and Marshall, 2001; Jabareen, 2006; Næss & Andrade, 2013). Other fields of research cover the micro-scale (the scale of buildings), concentrating on issues such as energy efficiency, technology, building types or the effects the different building types produce in the urban tissue in terms of microclimate, densities and urban change in general (see, for example, Dahl, 2014; Futcher, Mills, Emmanuel, & Korolija, 2017).

However, the understanding of the urban form as a structure, across spatial scales, including its numerous facets (for example, planning and social forces), is found in the analytical-explanatory tradition of *urban morphology*, which thus far has managed to bridge the aforementioned gap in a comprehensive manner. The morphological approach focuses on analytical explanations of built structures at different scales, considering the time of their making as well as their functioning, underlying planning forces and conditions. Thus, the scope of urban morphology provides the

necessary tools to study of the current urban transformation and explore the question that consequently arises regarding performance in urban planning and design, the characteristics and challenges of the planning context where the implementation of densification policy is taking place.

The fundamental analytical concept applied in this study is *urban tissue*, which can "provide an essential foundation for understanding the structure and complexity of the built environment as well as for creating, transforming and managing it" (Kropf, 2011). More specifically, the focus is on urban block and street as elements of the urban tissue. This was inspired by a study on the evolution of the urban block – "Urban Forms: The Death and Life of the Urban Block" by the French morphologists Castex, Depaule and Panerai (1989) – which explores the physical changes of this element of the urban form together with the social and other forces that have caused those changes. A number of more recent morphological studies have also addressed the urban block, covering its changes in particular contexts (see, for example, Rådberg, & Friberg, 1996; Komossa, Meyer, Risselada, Thomaes, & Jutten, 2005; Oikonomou, 2016) and its role in ongoing transformations of the urban tissue, as well as its potential to facilitate the space for economic activities and to provide lively public spaces (Komossa, 2009), methods for the assessment of block densification (Curie, Perret, & Ruas, 2010) and characteristics of the perimeter block as a particular type (Kropf, 2006). A recent article, "Er karré passé?" ["Is the Urban Block Passé?"] (Godø, 2019), has analysed the physical features of new developments at the scale of the urban block, providing an insight into the potentials that different built structures have for meeting the densification goals in Norway. Special consideration was given to the traditional urban block through a debate regarding its capacity to handle contemporary demands for living and urban qualities in dense cities, though without a clear conclusion on how these qualities are to be achieved in the newly designed blocks.

Other morphological studies of contemporary urban changes provide analytical descriptions of specific transformation projects within cities, with a focus on their effects on the cities in physical and demographic terms, and of certain planning and organisational aspects (see, for example, Dündar, 2001; Güzey, 2014; Racine, 2016). In the French context, similarly to the Italian and Spanish contexts, the understanding and the handling of the urban tissue are deeply rooted in urban morphology (Kropf, 2011), which is also visible in the planning practice. One study that virtuously addresses recent changes in the urban form is "Où va la ville aujourd´hui? Formes urbaines et mixités" ["Where is the city going today? Urban forms and mixes"] by Jacques Lucan (2012). Based on morphological thinking, it provides an explanation of the current intensification (an approach that is analogous to densification) of built-up areas that integrates the aspects of planning, development and architecture and identifies the "macro-block" as a distinguishable result of urban transformation. Intensification is part of the current urban planning approaches along with urban redevelopment or regeneration in other contexts as well, such as the UK (Beundermann, Hall, & Vrolijks, 2009). There, morphological studies have been conducted to fill the policy gap concerning design control in urban redevelopment processes (see, for example, Hall, 1997) as well as to point out the opportunities and challenges in intensification through the development of typo-morphologically based scenarios (Beunderman et al., 2009).

This paper is part of a broader study which aims to investigate another planning context where densification has been dominant, Norway, using Oslo, its capital, as a case study. Oslo exemplifies a long implementation of the densification policy. Norway adopted densification as a strategy in the early 1990s and, shortly afterwards, declared the goal to achieve qualities (such as urbanity and high living qualities) in the process, –naming the strategy "densification with quality" (Gutty & Thorén, 1996). Due to a great demand for densification and the subsequent intensive building activity in this period, Oslo provides abundant material to study the results of the densification policy implementation. Still, a comprehensive, "ex-post" analytical overview of built results has not yet been done, despite the fact that what is created today affects the future and that such analyses contribute to raising the awareness about the effects that the new built structures have on the urban built-up areas. To an extent, morphological research on the transformation of the urban tissue has covered planning under densification in Norway (Guttu, Nyhuus, Saglie, & Thorén, 1997; Thorén, Pløger, & Guttu, 2000; Schmidt & Thorén, 2001; Schmidt, 2007; Guttu & Schmidt, 2008) together with certain qualities of physical outputs, mainly in multi-family housing developments, though based on a small number of case projects and processes of intervention. Børrud and Syvertsen (2012) have also contributed by discussing changes in the entire built-up area of Oslo in the period of 1985–2010, examining the

character and distribution of interventions and the effects of the new built structures on different contexts as well as on the urban transformation as a whole.

In another publication, Børrud (2012) has elaborated on the spatial and design issues that densification brings. She has emphasised the importance of context-specific premises for densification as a process that produces physical structures in an existing city. Consequently, she has argued that a solid understanding of the characteristics of existing structures that are undergoing transformation, together with the conditions for their change in terms of the socio-cultural, economic and design aspects, is a necessary basis for a shift in thinking which densification requires compared to the previous planning eras that dealt with urban expansion. Børrud has highlighted the potentials of urban morphology as a potent stance for understanding both the context and the possibilities for design, which corresponds to Çalişkan and Marshall's (2011) and Kropf's (2011) perspectives. The thoughts of Sir Richard Rogers further explain this issue: "A major development in the last 20 years is a much greater consciousness of the morphology of cities – that buildings need to fit in, and even if they contrast, you have to be conscious of what they contrast with." (Rogers, 2009 as cited in Kropf, 2011, p. 393)

The purpose of this study is based on this line of thought, with the aim to take a step further by concentrating on the characteristics of the transformation of the urban tissue at the spatial scale of individual interventions and covering a larger number of interventions. More specifically, the aim of this paper is to examine the physical changes in the urban tissue and provide a more comprehensive overview and analytical explanation of the results of densification as an ex-post evaluation. This study provides an extensive basis for examining further questions on densification and urban change.

Theoretical perspective and research questions

As mentioned previously, *urban morphology* is the theoretical perspective that provides the necessary stance and analytical concepts for addressing the transformation of the urban tissue under the densification policy.

To begin a morphological analysis, it is necessary to define the spatial scale within the urban tissue upon which the study of densification is to focus. For that purpose, Moudon's understanding of the modularity of built landscape has been used as a basis (Figure 1). This study of Oslo addresses the scale on which a building or a group of buildings form a synthesis with other elements of the urban tissue, here termed the *intermediate spatial scale*. In traditional tissues, this scale is recognised in the relation between the building, the plot and the street; in the modernist tissue, it is reflected in the various building schemes consisting of freestanding buildings in open spaces. In the densification process, this scale is the instance where the individual interventions are (trans)forming the previously existing urban tissue both in terms of buildings and open spaces (plots, streets and other outdoor areas), the scale where planning and design take effect in the physical urban space.

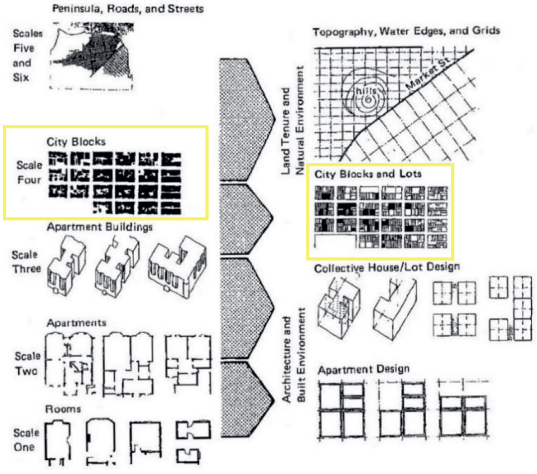

Figure 1. Modularity in the built landscape (Moudon, 1994/2007) describes the different spatial scales and the ways a building fits into the urban tissue. The intermediate scale between the whole city and a single building is marked in yellow.

Considering all the individual interventions in the urban tissue together, it is possible to observe a *growth pattern* of urban development under densification. In Oslo, this growth pattern is mainly characterised by the intensification of the use of previously existing, delimited urban tissue, either via the insertion of new developments into the existing tissue or via brownfield transformation of land use in larger areas (Hanssen, Hofstad, Saglie, Næss, & Røe, 2015). These processes produce certain physical outputs, which in this study encompass the individual interventions and the pre-existing urban tissue where they are situated.

To examine the physical conditions in the urban context – the segments of the pre-existing urban tissue which are undergoing densification – this study applies the concept of *constituted tissue*. This concept is directly linked to the theory of urban morphology and relies on its definition of the urban tissue (or *urban fabric*) as the "ensemble of aggregated buildings, spaces and access routes" in a city (Larkham & Jones, 1991, p. 80). The analysis also covers the spatial relations between the new and the pre-existing through identification of *types of interventions*, determined by the way the new buildings are added into the pre-existing tissue at the intermediate spatial scale. The morphological element of the urban block, which is part of urban tissue, is applied here as an analytical tool. An urban block can be defined in various ways. In this study, the definition of urban block is based on Leon Krier's understanding (Krier, 1984/2007): an urban block is an entity that consists of one or more adjacent plots, surrounded by planned and unplanned paths, roads and streets on all sides, with buildings located on the plot(s).

One of the central approaches in knowledge acquisition in urban morphology (Sheer, 2015) is *pattern recognition*, primarily employed in tissue analyses. Urban tissues are composed of sets of buildings, plots and streets distributed in certain ways and forming patterns. In this study, this way of thinking is applied to the physical aspects of individual interventions through the recognition of patterns among their constituted tissues and types of interventions. This brings about a synthesised view of the ways that particular types of intervention relate to different constituted tissue types, allowing for analysis of how constituted tissue is treated in design approaches as well as for an analysis of the physical results themselves at the level of the urban block.

To explore this interface between pre-existing urban tissue and new built structures inserted into it, as part of the broader analysis of the planning context in Norway, the following research question is posed: How has densification policy changed the urban tissue in Oslo?

In order to answer this, the two following sub-questions are posed:

- What kinds of urban tissues are undergoing densification in Oslo?
- What types of physical results can be found at the intermediate spatial scale?

Methodology and data

Cross-case study and data collection

In order to collect the necessary data, the first step was to look closely into the segments of the urban tissue that have undergone transformation as a result of the densification policy. Here, the method of cross-case analysis was applied, with the main case being the municipality of Oslo. The questions related to the transformation of urban tissue were handled through a series of sub-cases (in a further text called *cases*), which were individual projects, that is interventions in the urban tissue.

The case data was composed of projects for multi-family dwellings as this has been the most frequently employed architectural programme with a particular role in the current urban development of Oslo, namely to meet the housing demand. As such, the multi-family dwellings increase the density of built-up areas significantly. Among such dwellings, those belonging to Fjordbyen have been excluded because it is was a landmark project used in the profiling of Oslo, planned and designed specifically for waterfront regeneration, and already much analysed and debated in research (see, for example, Grønning, 2011; Bjerkeset & Aspen, 2015; Røe, 2015). This study addresses the "ordinary architecture" constructed in different locations and contexts across the city. The main selection criterion was the amount of built space (the number of buildings and the number of storeys in a project). As the intention was to include the cases which affect the physical form significantly, each project contained at least two separate buildings or one large volume facing at least two street fronts, where at least one of the building was five-storeys high (ground floor and the four additional storeys). The

decision on the number of storeys was based on Lehman's study (2010) of urban density and compactness, which identified the heights between five and seven storeys as the most suitable for the concept of urban sustainability. Another criterion was the completion date of the project, that is year of the first issuance of the use permit, and the period between 2004 and 2014 was selected. Over a hundred cases of multi-family residential projects built in the aforementioned period were identified; out of them, 71 conformed to all the criteria. Some of the projects belonged to the same zoning plan but were calculated as separate cases if they were built at different phases (*felt* in Norwegian). Thus, each phase (*felt*) was counted as a separate case because such phases were often designed and developed by different teams and built at different times.

Table 1. Summary of the initial data analysis, conducted for each case project

Data	Item of analysis	Description / criteria
Address	The address of the case project	Street(s) and house numbers of all the buildings.
Timeframe	Start year	The year when construction started.
	Completion year	The year when the first use permit was issued (*brukstillatelse* in Norwegian).
Planning	Planning instruments applied in the case project	A list of plans; for example, the Municipal plan (e.g. KP 2015), Partial municipal plan (e.g. KDP-3) and Regulation plan (e.g. S-3970).
Position in urban tissue	Situation in the city	Determined relative to ring roads as the built-up areas between the ring roads vary in the density of the urban tissue.
	A map of the case and its surroundings, with a diameter of 500 m	A graphic presentation.
Quantitative	Number of buildings in the project	Minimum two buildings or one larger volume facing minimum two streets.
	Number of storeys	At least one of the buildings must have minimum five storeys.
	Property area	The area of the plot(s) that the project covers (m^2).
	Built area	The footprint area at street level (m^2).
	Total built area	The sum of all floor areas (m^2).

As there was no possibility to search for the individual projects by the year of completion using a single source, the process of collection combined different sources, from publications and databases to the author's own observations in the city, with an awareness that there may still be a number of cases not detected by the data collection. The starting point was the brochure "God boligfortetting in Oslo- eksempelsamling" ["Good Examples of Residential Intensification in Oslo"], published by the Agency for Planning and Building Services of the Oslo municipality (Oslo kommune, 2013). It contains a number of examples of residential projects that have distinct qualities according to the opinion of municipal planners.

Furthermore, sources like private registers had to be used. The most valuable one was Eiendomsverdi, a private company that registers the development and activities of real estate markets in Norway, and runs an online database (eiendomsverdi.no, with paid access) where the individual buildings can be searched for by the year of completion or the address. Another useful database was Se eiendom, a platform displaying the property data from the national database, buildings, addresses, registered owners and the rights from the cadastre by Kartverket (the Norwegian Mapping Authority). The web sites of building associations also provided information on the recently built projects. Two of these were used: OBOS (the largest Norwegian cooperative building association, owned by its members) and Selvaag bolig (one of the largest residential development companies in Norway).

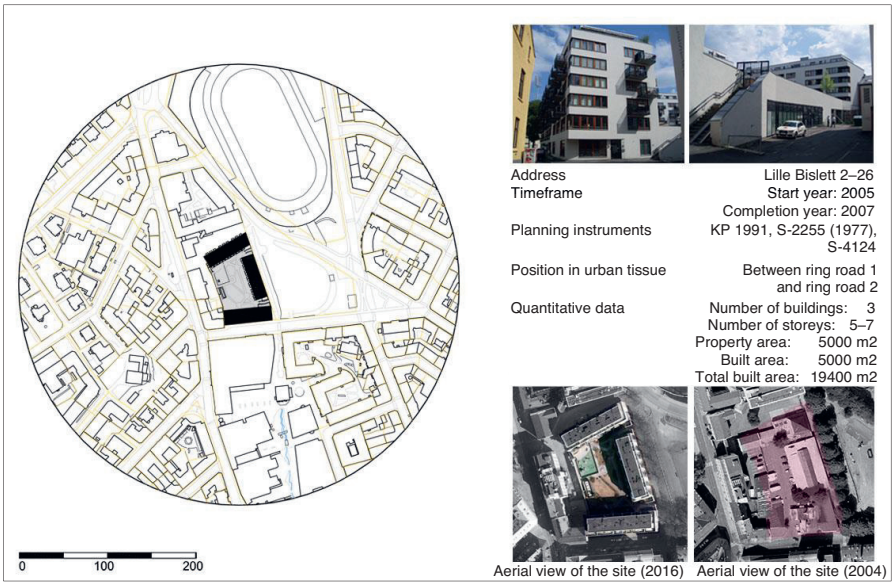

Figure 2. Example of a data sheet with an initial case description (image sources: own photos [above] and Plan- og bygningsetaten, Oslo kommune [below]).

The next step was a site visit and photo documentation of each case. This was important for a closer understanding of the spatial and functional characteristics, such as built volumes, position in the urban tissue, features of the surrounding urban tissue, access, architectural functions, and so on. Data collection continued with the creation of graphical representations for each case, consisting of the case project map together with the surroundings in a 250 m radius. These representations provide information both about the urban block where the case is situated and the surrounding urban tissue. Also, the buildings and open areas encompassed by the graphical representations are those reachable within walking distance for most inhabitants of the case projects, that is within 200–300 m (Thorén & Nyhuus, 1994, p. 23). For this purpose, digital maps were obtained from the Norgesdigitalt database, specifically FKB-data and Matrikkel-data in UTM32 Euref89. In addition to current state, historic maps (aerial photos) which show previous site conditions were used in the assessment of changes at the sites where the case projects are located. The historic maps were obtained from the online database Finn.no AS (available at kart.finn.no, produced by the Agency for Planning and Building Services of Oslo municipality [Plan- og bygningsetaten]). Lastly, a data sheet with an initial description of each case was made, comprising the information on the address, timeframe, quantitative data, planning instruments and position in urban tissue (Figure 2). An overview of the cases in the built-up area of Oslo is given in Figure 3 and 3.1 (in the Appendix).

Methods

The main research question – How has densification policy changed the urban tissue in Oslo? – was addressed through two sub-questions. These concerned various aspects of the interventions and require different data about the cases.

What kinds of urban tissues are undergoing densification in Oslo?

For the first sub-question, the central concept was *constituted tissue*, which was analysed for each case individually. In the analysis of the physical characteristics of the pre-existing urban tissue, namely the footprint (figure-ground) shapes and dispositions of buildings that constitute them relative to the street and the adjacent open spaces, the applied approach was *pattern recognition*. The reference patterns were derived from the two most common types of urban tissues from previous planning eras in Oslo (Figure 4).

a. *Traditional urban tissue*. This is a type of 19th century, pre-modernist tissue in Oslo, whereby the buildings are of a multi-family housing function, often with a non-residential ground floor level, placed along the streets and defining the street fronts, occasionally with small gaps in between, forming an urban block with open spaces in the middle, accessible from the buildings.

b. *Modernist urban tissue*. This is a type of 20th century tissue in Oslo, whereby the buildings are separate, identical and parallel volumes of a rectangular plan shape ("slabs" in morphological terminology), mono-functional (housing function), placed in the inner part of the urban block, set back from the streets. The street is reduced to an access road as the buildings do not define it as in the traditional urban blocks.

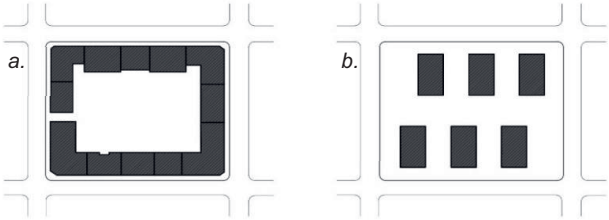

Figure 4. Two reference patterns of urban tissue: a) the traditional and b) the modernist.

For each case, pattern analysis included the streets and the urban block where the case was situated as well as the urban blocks which defined the other sides of the surrounding streets. The degree of correspondence with the reference patterns was identified, and the constituted tissues were categorised accordingly.

In addition, the site where each intervention was located was analysed based on historic maps in order to assess the change of the site itself. The previous condition was analysed for the presence of buildings and open spaces.

What types of physical results can be found at the intermediate spatial scale?

The analysis of the built form of the case projects approached the intervention in spatial terms, at the intermediate spatial scale. As densification operates within the pre-existing tissue, the new interventions interact with that tissue in different ways. Each case was analysed for its position relative to the buildings and streets in the previously existing urban block where it was situated.

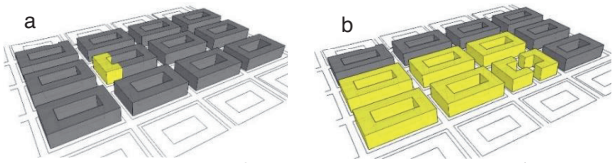

Figure 5. Presumed types of intervention in the urban tissue (presented by using the example of traditional tissue type): a) infill and b) part of the land use transformation area.

Criteria for the analysis (Figure 5) were based on the premise that the new intervention could be an infill in the pre-existing urban tissue or a part of the land use transformation area.

Results and analysis

What kinds of urban tissues are undergoing densification in Oslo?

This analysis is based on two reference patterns of urban tissue, the traditional and the modernist (Figure 4). The models represent different relationships between buildings, streets and the adjacent open spaces. In the theory of urban morphology, these three elements (together with plots) of the urban form constitute an urban block, which has become the reference element of the urban form in the analysis of constituted tissue. More specifically, the analysis of constituted tissue involves the

relations between the street and the urban block in which the case is situated, as well as the urban blocks which define the surrounding streets (see the example in Figure 2). Using the *pattern recognition* approach, these urban blocks were analysed for their correspondence to the two reference patterns. In each case, the different footprint patterns were identified and marked by different colours (see Figures 6, 6.1 and 6.2). All the patterns taken together comprised a type of constituted tissue where the particular case was situated. The mentioned degree of correspondence defined the results, which presented varieties of the two reference tissues in the case areas as well as mixed, hybrid types of constituted tissue.

These varieties and the mixed types were defined by the presence of other building patterns. First, "large volumes" occurred frequently and represented buildings of proportions significantly greater than the housing blocks, such as educational facilities, factories or warehouses. Second, in many case tissues, there was a railroad, a motorway or a river which physically and functionally divided the urban tissue and for that reason such elements were termed "linear barrier" in this analysis. Next, as housing was (and generally is) the most frequent architectural programme with many variations of building types, it was approached with a more nuanced approach. Hence, the following housing types were distinguished: "single-family houses" detached on a private plot, "multi-family housing slabs" with a simple rectangular pattern of modernist housing withdrawn from the street fronts, and "multi-family housing blocks" with more complex plan patterns and various relations to the streets.

After considering these patterns together, four main groups of constituted tissue types were identified (see Table 3 for a detailed description):

1. Varieties of the traditional urban tissue, marked as TRAD 1 and TRAD 2.
2. A variety of the modernist urban tissue, marked as MOD 1.
3. Hybrid urban tissues, comprising mixes of different building types and other objects, marked as MIXED 1 to MIXED 8.
4. Transformation urban tissue, found in the brownfield land use transformation areas, with two type variants, marked as TRANSF 1 and TRANSF 2.

It is noticeable that most interventions were performed in mixed types of constituted tissue, while considerable development occurred in parts of Oslo with traditional urban tissue. A special group of constituted tissue types was identified in the land use transformation areas. Two situations were observed there: 1) the intervention was at the edge of the defined transformation area and partly surrounded by consolidated urban tissue which was not intended for changes (TRANSF 1), and 2) the intervention took place in the former brownfield areas where old buildings were removed and the street layout was preserved, with the occasional addition of smaller access roads (TRANSF 2). Examples of analysis for each group of tissue types are presented in Figure 6, 6.1 and 6.2, with an overview of all 71 cases by the types of constituted tissue they were situated in provided in Figure 7 and 7.1 (in the Appendix).

Table 3. Types of constituted tissue their elements and the number of cases situated in each type

Main groups of constituted tissue types	Constituted tissue type	Description	No. of cases in a const. tissue type	No. of cases in group of const. tissue types
TRAD: Traditional urban tissue varieties	TRAD 1	Traditional blocks from the 19th and the early 20th century.	2	**TRAD**: 18
	TRAD 2	Traditional blocks combined with large volumes.	16	
MOD: Modernist urban tissue variety	MOD 1	Modernist multi-family blocks/slabs and large volumes, occasionally with a linear barrier.	3	**MOD**: 3
MIXED: Hybrid urban tissue – mixes	MIXED 1	A mix of traditional and modernist urban blocks, occasionally with linear barrier and/or large volumes.	7	**MIXED**: 31
	MIXED 2	Single-family houses, multi-family housing blocks/slabs and large volumes.	2	

of various urban block types, building types and other built elements	MIXED 3	Multi-family housing blocks/slabs, large volumes and a linear barrier.	2	
	MIXED 4	Single-family houses, large volumes and a linear barrier.	2	
	MIXED 5	Single-family houses and large volumes.	4	
	MIXED 6	Large volumes and a linear barrier.	3	
	MIXED 7	Single-family houses and multi-family housing blocks/slabs.	5	
	MIXED 8	Multi-family housing blocks/slabs and large volumes.	5	
TRANSF: Land use transformation areas	TRANSF 1	Tissue subject to transformation and single-family houses and/or multi-family housing.	13	**TRANSF**: 19
	TRANSF 2	Buildings removed and street layout preserved, large volumes and tissue subject to transformation.	6	
Total number of cases				**71**

Concerning the transformation of the sites, the vast majority of cases was built on land which was previously occupied by one or several low buildings of different land coverage, with only 15 out of the 71 cases having been constructed on vacant, open space. Among the 15 cases, in one case the area was entirely covered by a forest, and in two cases it was a grass lawn. However, concerning the pre-existing open spaces on all case sites, they were mostly a mix of sealed surfaces with sparse vegetation, if any. A peculiar case of densification was the housing project situated in Biskop Jens Nilssøns gate 13-19 (Figure 6.1), which was constructed above a railroad.

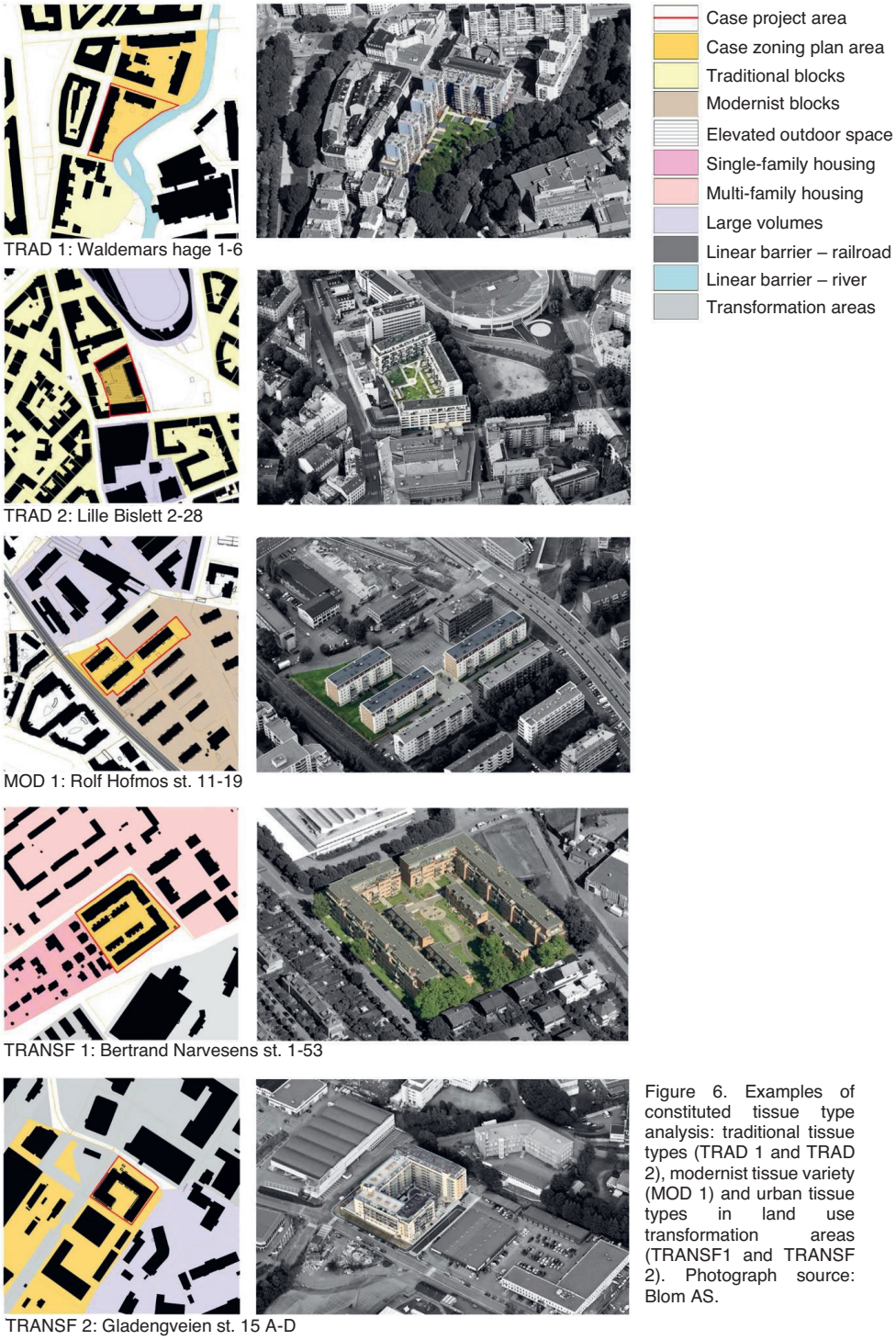

Figure 6. Examples of constituted tissue type analysis: traditional tissue types (TRAD 1 and TRAD 2), modernist tissue variety (MOD 1) and urban tissue types in land use transformation areas (TRANSF1 and TRANSF 2). Photograph source: Blom AS.

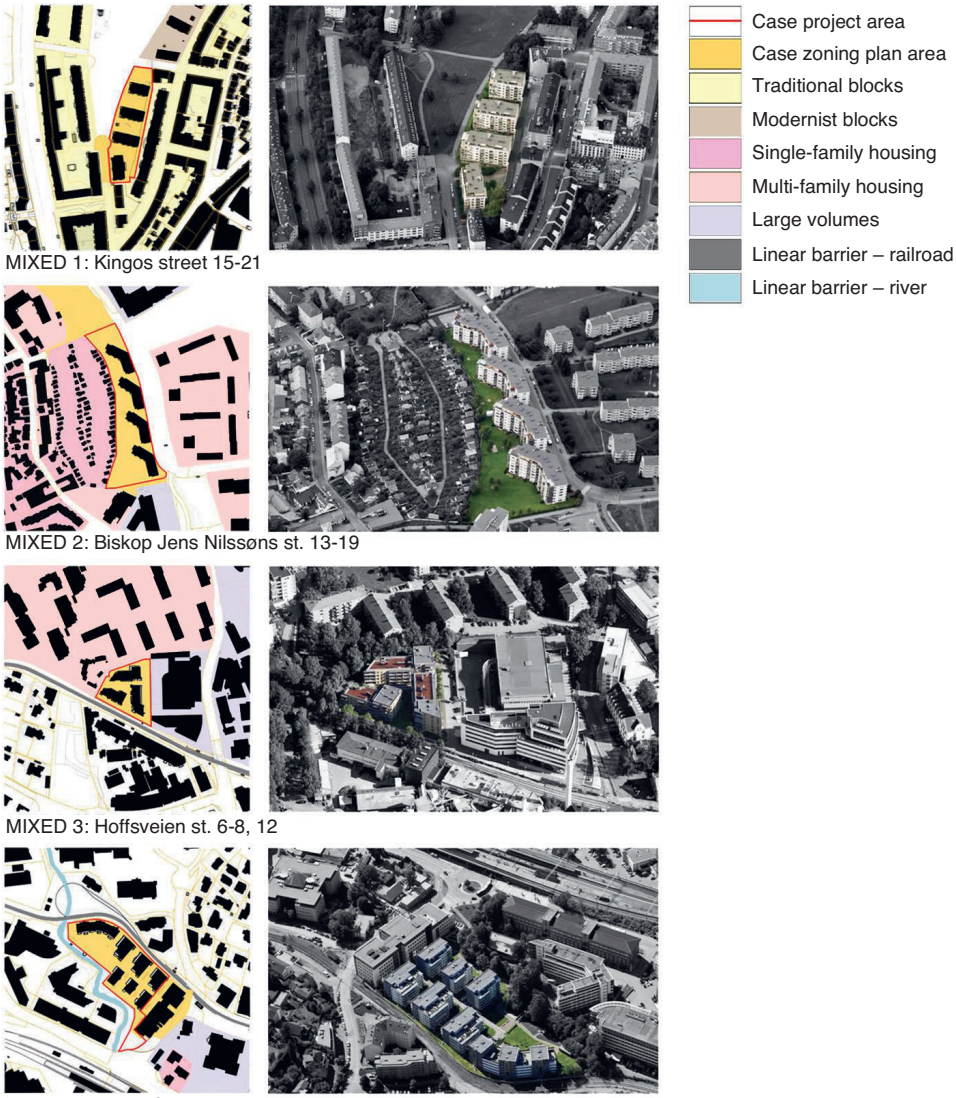

Figure 6.1. Examples of constituted tissue type analysis: mixed tissue types (MIXED 1 to MIXED 4). Photograph source: Blom AS.

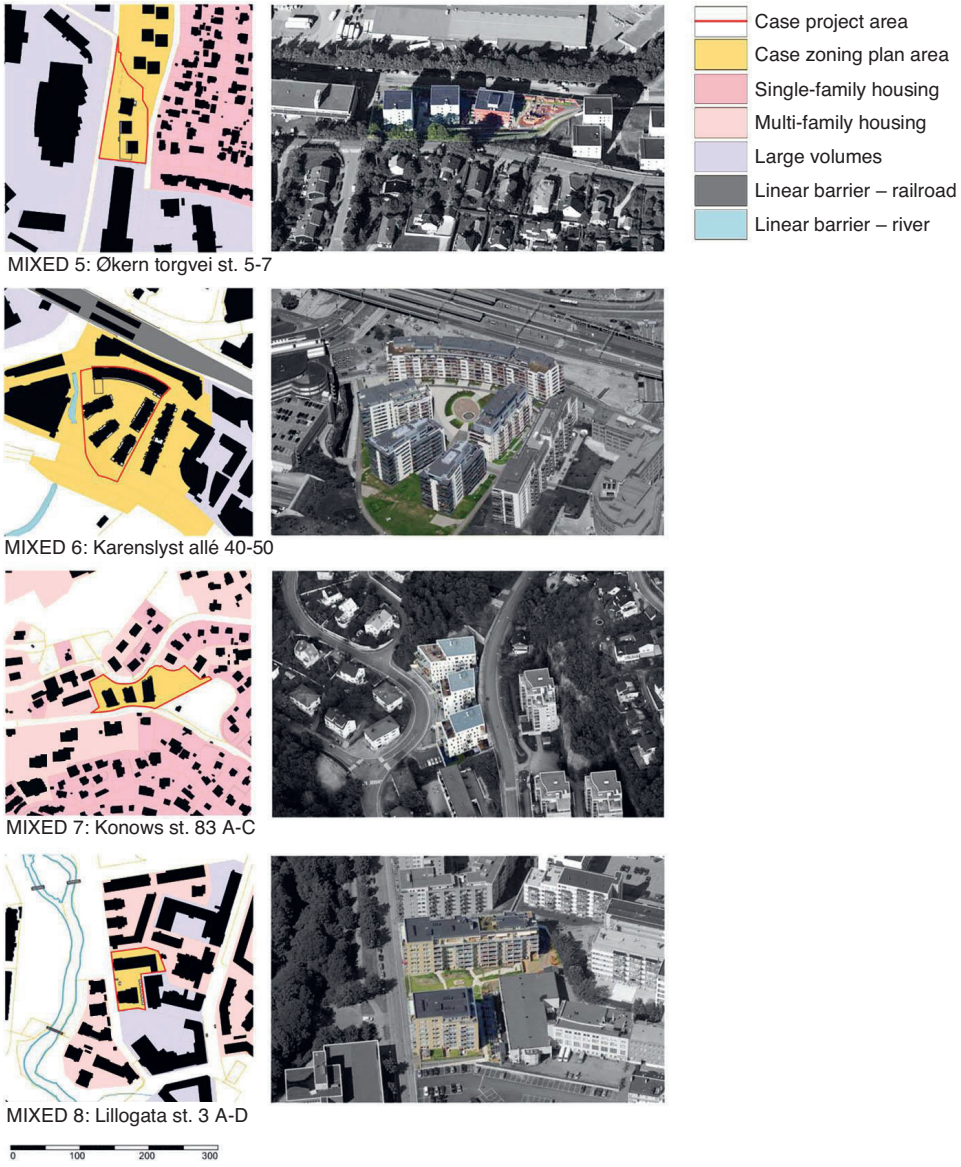

Figure 6.2.
Examples of constituted tissue types analysis: mixed tissue types (MIXED 5 to MIXED 8). Photograph source: Blom AS.

What types of physical results can be found the intermediate spatial scale?

This stage of the built form analysis explores the interventions in spatial terms, at the intermediate spatial scale. As densification operates within the pre-existing urban tissue, the new interventions interact with that tissue. The premise that the new interventions are either infills that cover a part of an urban block in pre-existing urban tissue or part of a land use transformation area was confirmed. Moreover, based on the urban block as morphological element, another type of interventions was identified: *infill as an entirely new urban block in pre-existing urban tissue*, not

related to transformation areas (see *c*. in Figure 8). However, entirely new urban blocks were also found in land use transformation areas.

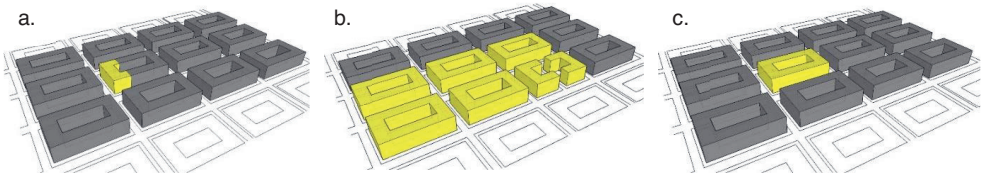

Figure 8. Identified types of intervention (presented by using the example of the traditional tissue type): a) infill as part of the urban block, b) part of the land use transformation area and c) infill as an entirely new urban block.

The graphic representation of the cases, sorted by their intervention types and the situation in the entire built-up urban area of Oslo, is provided in Figure 9 and 9.1 (in the Appendix). The dominant intervention type was infill (37 of 71 cases). It was observable in different areas of Oslo, though mainly within ring road 3, where the tissues with highest densities were. Entirely new urban blocks could be found in tissues of all densities, and their number was somewhat smaller (31 of 71 cases, of which 14 were in the transformation tissues). They were analysed and typologised for their spatial organisation of built and open spaces.

Two main types of urban blocks were identified: "boundary built" and "hybrid" urban blocks. The greatest number of new blocks was "boundary-built" (21 of 31), with buildings placed on the edges of the plot (Figure 10 and 10.1). There were the following sub-types of "boundary-built" blocks:

- the *courtyard block* (variations of the perimeter block), where built volumes enclosed the inner, open space;
- *U-shaped* blocks, which were semi-open, with built volumes on three sides (out of four);
- *L-shaped*, open blocks with buildings on two sides;
- blocks composed of a *combination of these three types*; and
- the "*slab-block*," composed of the lowest storey that covered the entire plot and parallel built volumes above.

Among the "hybrid" urban blocks, there were the following two sub-types:

- blocks consisting of boundary-built blocks and built volumes placed inside the plot; and
- the irregular block, where buildings were placed in a scheme inflected to follow the shape of the plot (Figure11).

The analysis of blocks also included the functional relations to the surrounding streets. The following features were observed:

- Most cases had access to the residential space from both the adjacent streets and the private outdoor space.
- In most cases, private outdoor spaces were placed at the street level, accessible from the streets (in the inner city, though, they were most often gated, but a view into the courtyard was possible).
- In a number of cases, private outdoor space was placed on the rooftop of the street-level storey, thus inaccessible and impossible to see from the surrounding streets, which increased its level of privacy.
- There was a number of cases where there were no entrances from the streets (or only one), which created a blind street façade.
- All cases had a common garage at the lowest storey(s), which was mostly underground and often covered the entire plot.

Figure 10. New urban blocks, the boundary-built type with courtyard.

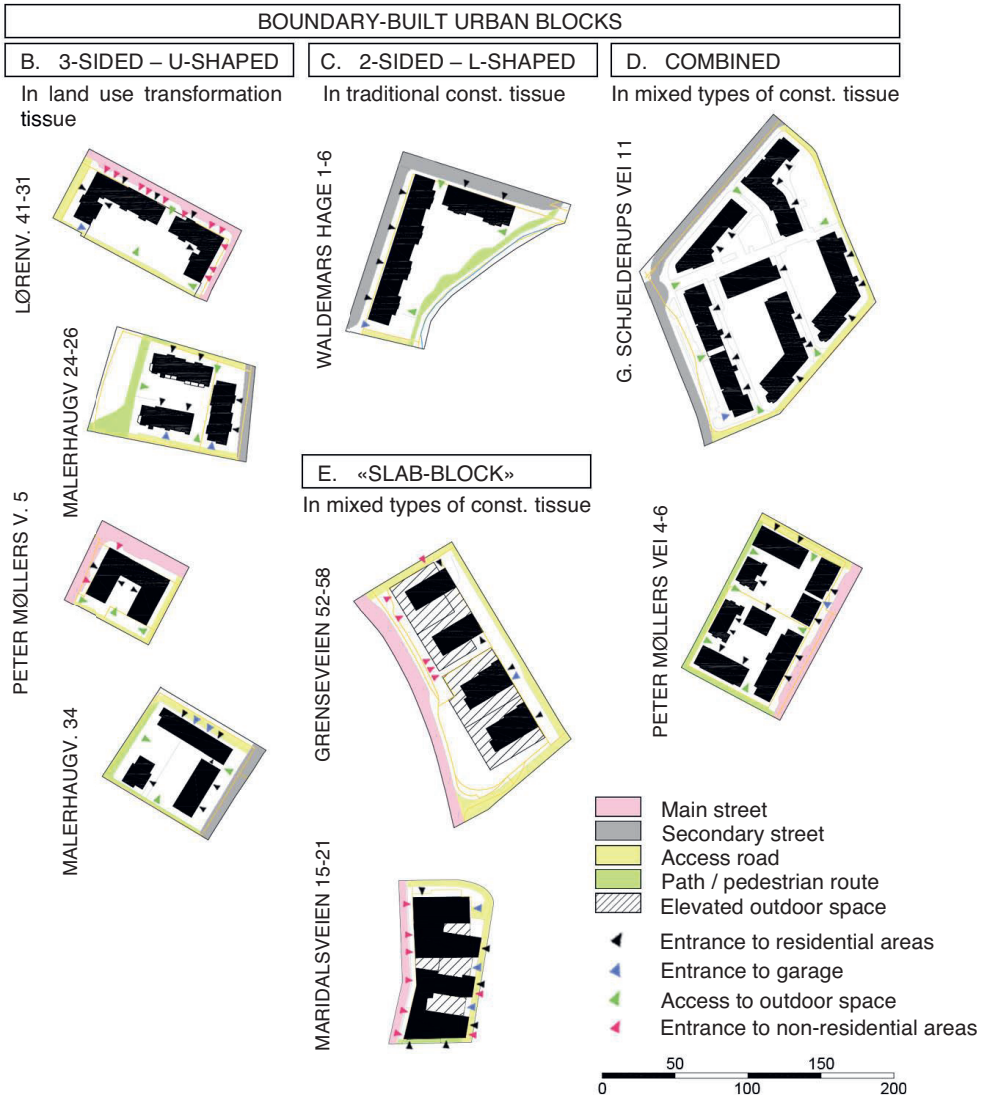

Figure 10.1. New urban blocks, boundary-built types: U-shaped, L-shaped, combined and “slab-block.”

Figure 11. New urban blocks, hybrid types.

Discussion

As the analysis covered two sub-questions, at the beginning of discussion it is worth remembering the findings from each step.

What kinds of urban tissues are undergoing densification in Oslo?

Four main types of *constituted tissue* were identified among the 71 cases: *traditional, modernist, mixed* and *land use transformation*. Each type was composed of a number of sub-types, which were nuanced varieties of the main type, distinguished by the presence of other elements.

What types of physical results are there at the intermediate spatial scale?

The spatial aspects of interventions were analysed at the intermediate spatial scale, in relation to the morphological element of the urban block. The premise that interventions occurred as infills and parts of the land use transformation was confirmed, and a third type of intervention was identified. The types can be summarised as follows:

- *infill*, where one or several buildings are inserted on a part of the pre-existing urban block (40 out of 71 cases);
- *transformation*, where buildings and entirely new urban blocks are built on a larger land use transformation area, with or without changes to the street structure (17 of 71 cases); and
- *infill as an entirely new urban block in the pre-existing urban tissue* (14 of 71 cases).

How has the densification policy changed the urban tissue in Oslo?

First, this comprehensive analysis enables a closer observation of the *growth pattern* in the entire built-up area of Oslo. It is noticeable that its character is incremental, as individual interventions add fractions of built mass in the pre-existing urban tissue, situated from ring road 1 all the way to the margins of the built-up area. This corresponds to Børrud and Syvertsen (2012), who observed that densification takes place across the entire built-up area of Oslo. Accordingly, densification is taking place in a large variety of tissue types, as was identified in the studied interventions. In turn, the built results of densification are also diverse. This is reflected in the variety of principles of intervention and the diversity of built forms among the analysed cases. As contemporary cities include a variety of tissues dating from different epochs, which also applies to Oslo, this is an expected occurrence. However, this analysis examined a particular architectural function: the multi-family residential buildings, of high densities across the built-up area of Oslo, excluding the large mixed-use "landmark" project of Oslo's waterfront transformation (Fjordbyen). To gain a more complete image of the growth pattern, it is important to bear in mind that densification has also led to numerous individual interventions with other architectural functions (non-residential) within the existing urban tissue, with similar principles of incremental addition of built volumes. Also, the mentioned "landmark" project entails high-density mixed-use assemblages of buildings as well as the revitalisation and reprogramming of previously existing industrial buildings at the coastline of Oslo. It involves the addition of larger, concentrated portions of built mass to the existing tissue, and the principles applied there resemble land use transformation and represent intense tissue transformation through particular planning procedures.

The developments addressed here, the "ordinary" housing architecture of higher density, occurred mostly within ring road 3, which is an area that encompasses the inner city where the pressure for densification is highest. On the other hand, the northeast part of Oslo, where the modernist tissue is the dominant type, and the villa area in the west, where single-family houses comprise the urban tissue, have not been affected by higher density residential projects. This is possibly due to the ownership structure (cooperative building associations and private individuals), whereby the housing owners have great decision power concerning the potential densification of the neighbourhoods. Another reason for this lies in the zoning plan for single-family housing areas (Reguleringsplan for småhusområder i Oslos ytre by [Småhusplanen], S-4220 from 1997), which defined the limits for interventions, hence no large multi-family projects can be found there. This was observed already in 1997, in the study "Boligfortetting i Oslo" (Guttu, Nyhuus, Saglie, & Thorén, 1997).

As for the interface between the pre-existing and new structures, there is a *mutual effect.* Constituted tissue provides conditions, such as structural, topographic, social and functional conditions, which affect the creation of new buildings and ensembles. On the other hand, the physical and functional features of the new structures, such as the built form, density and use, will have an effect on the pre-existing buildings, streets and the functioning of the area. Thus, the task of designing a new built structure in Oslo can be highly varied, as pre-existing tissues hold a high degree of diversity

regarding building types, block shapes and structures, uses and layouts of outdoor spaces, and the approach has to be context sensitive.

An important point here is that the more consolidated and homogeneous, traditional urban tissues found in the inner city provide a significantly different framework than other tissue types. Street fronts and building lines and heights are usually well profiled, the amount of vacant land is limited and heritage concerns are likely to exist, which is a rather solid set of references that defines the starting point for design. In the majority of analysed cases, these spatial features of pre-existing tissue were reflected in the final design solution. Traditional tissues were already densely built and populated, so many diverse interests intersected there, such as heritage concerns, planning goals defined specifically for these areas and the interests of the different stakeholders. The design of new projects that complies with the spatial organisation in these tissues is therefore the result not only of designers' skills and concepts and developers' aims but also of a range of public and private interests of concerned parties. It is possible to observe that the built results in traditional tissues do present a high degree of context-sensitivity and, as such, contribute to the further consolidation of these tissues.

This is comparable to the modernist tissues, which are also well consolidated and based on strong planning concepts. Here, the concept of pre-existing tissue is so strong that all new interventions are infills, and majority of them follow the logic of the pre-existing built forms, even if it does not coincide with the highest possible degree of site exploitation. This is possibly another indicator of planners' (both public and private) context-sensitive approach, though the final design is also affected by other aims and interests, similarly to the traditional urban tissues.

A distinctive type is the mixed urban tissue, which encompasses the greatest number of analysed cases. On the whole, mixed tissues are prevalent in contemporary cities, which could explain why densification most often occurs in mixed urban tissues. This stresses the importance of these heterogeneous tissues, and planners should be aware of the potentials and challenges they entail. In this analysis, a large variety of mixed sub-types was identified, containing a range of building types and other objects and diversely defined street fronts. In contrast to traditional and modernist tissues, mixed tissues provide varied conditions for new developments as they are often only partially consolidated in spatial terms. Consequently, there is also diversity among the built results in these tissues in terms of spatial organisation, and it is possible to find both infills and entirely new urban blocks there. This implies that mixed tissues have the flexibility to support different and possibly innovative design solutions. However, there is also a threat of creating misplaced concepts which can lead to a disordered built form. Such results could be overcome with a thorough analysis of not only the site but of the broader context as well, in morphological-structural terms (building types, scale of buildings, functions, access, street profiles and logics of open space organisation) prior to design, together with a careful proposal evaluation during the process, which would go beyond figure-ground (two-dimensional) analyses. A good example of such an approach in planning can be found in the French practice, where particular parts of the existing urban tissue are approached through a legally defined planning instrument called ZAC, Concerted Development Zone (*Zone d'Aménagement Concerté* in French). In compliance with overarching plans for urban development, spatial and architectural aspects are defined, first in volumetric terms, covering disposition of open spaces and built volumes in the entire area, and later in more detailed designs of each urban block and the individual buildings (Lucan, 2012). The heterogeneous character of the current spatial and typological conditions in cities is recognised, and the areas encompassed by a ZAC are meant to match the heterogeneity without imitation. Architectural design is an integral part of urban planning, and teams of architects are engaged in each zone (either after architectural competitions or following the agreements between the actors).The development of an entire zone is led by one chief architect, which results in a varied but coordinated design solution. Such an approach allows for a higher degree of predictability in the process regarding both the design and economic aspects of the development, and it can be applied to urban tissues of any type.

A similar, more comprehensive approach could be seen in the land use transformation areas in Oslo, where the lowest degree of spatial constraints is observed. Apart from the street layout and plot structure, which are elements of the pre-existing tissue, planning in these areas resembles expansion on open land. Here, new developments are part of planning aims for larger areas that encompass several urban blocks, though with visions that focus mainly on open spaces and have few concerns for built volumes (as defined in, for example, VPOR Ensjø, the guiding plan for open spaces

in the Ensjø area). Similar to mixed tissues, the task of designing large transformation areas is complex and can potentially result in problematic solutions.

Regarding the sites where the case projects are built, only 15 cases were built on vacant land, of which only three were built on green spaces. Among the analysed cases, most densification has been carried out by the replacement of the lower density buildings on sites where open spaces were composed of partly or entirely sealed surfaces, which is in accordance with the guidelines for densification by the Ministry for Environment (Miljøverndepartementet, 1996). This finding shows that, quantitatively speaking, the reduction of green areas was not very high, while the increase of the density of buildings was drastic. Nevertheless, this is not to say that densification has not affected green spaces, as this study is limited to 71 cases and does not cover all the developments since the introduction of the densification policy, but rather to point that ex-post studies are necessary in order to gain a more accurate picture of the effects of densification and adjust planning approaches regarding both built and open spaces.

An important finding in this research concerns the morphological element of the urban block. A considerable number of new urban blocks show that this element plays an important role in the contemporary urban development of Oslo, which is similar to the French and Dutch contexts, where the urban block has a long history and an important role in the structuring of urban tissues (as shown in Lucan, 2012 and Komossa et al., 2005). Entirely new urban blocks occur in both the pre-existing tissue and the land use transformation areas. In the transformation areas, it is noticeable that new blocks have the logics of perimeter blocks, with built volumes at the plot boundaries (on four or three sides) and a courtyard in the middle. This block type represents an interesting return to pre-modernist forms, a discontinuation with the modernist principles which were marked by the dismantling of the urban block. In visions for lively and diverse cities that are to be attained through densification in Norway, there are references to old towns due to their vibrance, the mix of uses and the structure of streets, urban blocks and squares (Hanssen et al., 2015). The emergence of courtyard blocks which resemble the blocks of traditional tissues could be understood in view of the attainment of these visions. The presence of the courtyard form may also be due to the planning norms for common outdoor spaces in residential buildings in the inner city of Oslo (Oslo kommune, 2012), which demand the provision of open spaces for residents only, as open spaces are considered highly important in the dense city. In that sense, courtyard block holds the potential to meet the requirements for density, privacy, living quality, safety for different user groups (e.g. children), mix of uses and legibility of built form, both regarding the definition of street fronts and the distinction between the street and the courtyard (in line with Selberg's observations reported in Godø, 2019).

However, there are two potentially problematic points about these blocks. Much as they represent a "re-emergence" of the pre-modernist urban form, the difference in the scale of buildings that constitute them compared to the traditional tissues is great. The re-coupling of the street and buildings, which is why the old tissues (still) possess liveliness and vitality, is a challenge for the new developments, mainly because they are situated on a single plot that allows buildings of greater scale. The street is no longer defined by a plot series, and new urban blocks (consisting of one residential project) are situated on single plots, as the transformation involves the change of land use from non-residential to residential with a single owner as the holder of the planning initiative. New property lines define individual housing units with parts of outdoor spaces allocated to flats situated at the level of the outdoor space (not necessarily at street level) as terraces for private use, constituting a new pattern of plot subdivision that does not relate to the street. Also, the city changes over time and undergoes different kinds of structural transformations. New urban blocks are built as ensembles of uniform volumes raised upon the common lowest storey used for parking, which often covers the entire plot. This is different from the logics of 19th-century blocks that are composed of rows of smaller, individual buildings, which can be changed in terms of use and structure. Thus, today's courtyard blocks do not possess the resilience of pre-modernist blocks; accordingly, larger masses of tissue formed by this type of block do not possess flexibility in terms of the replacement of their parts, should such a necessity arise at any time in the future. This stresses the responsibility of developers and the importance of creating good quality architecture and outdoor spaces. The other issue is that the understanding of the block should go beyond the provision of private open spaces for residents and the obtainment of a certain density of housing units. The urban block is a mediator between housing and public space. The block has a crucial role in the definition of streets (Kropf, 2006), reflected in the way buildings relate

to street fronts for their scale and in the openness of the street level, as well as in the way corners are shaped at the intersection of the streets. This is where architecture becomes urban, providing the street with content that shapes activities and using architectural elements to create legible and distinctive tissues. These considerations are especially relevant for the land use transformation areas because the absence of buildings in the pre-existing tissue demands careful definition of new buildings and open spaces. It is even more problematic that in these areas there are new blocks which have a blind façade towards the street that is intended to become a core of the new neighbourhood (a case in Gladengveien, Figure 10), which has a negative effect, missing the opportunity to create liveliness in the new, transformed street.

Among the cases analysed in this study, variations of the perimeter block were observed. They are shaped with one or more disruptions in a large, continuous built mass and are invariably inflected to correspond to plot shape. In many cases, the courtyard is slightly more open as it is shaped by separate buildings placed along the plot boundaries. Some blocks are even composed of different architectural types of residential buildings, where terraced houses are combined with multi-storey buildings. This creates conditions for a diversity of user groups, along with architectural diversity. Terraced houses are lower in height, which allows for the addition of housing units while maintaining sunlight and other environmental conditions demanded in planning norms. The combination of different building types and their positioning relative to the boundaries of the block creates different relations to the pre-existing context. Terraced housing is used to create a softer transition towards the pre-existing housing of lower density, as is the case in the Sigurd Hoels street, or to consolidate the street front (at the same time as the private outdoor space), as in the case of Årvollveien (see Figure 10).

The analysed transformation of the physical form of Oslo stems from an intersection of a range of factors, such as design approaches, actors' aims and interests and policy-related goals. These factors will be the subject of further research, with the aim to deepen the understanding of the current densification of Oslo by addressing the links between design and urban planning.

Conclusion

This study examined densification through multi-family residential buildings, which significantly increase density, both of built masses and of population. This kind of densification occurs in a large variety of urban tissues, across the built-up area of Oslo: from the inner city all the way to the outskirts and border to the forest belt (*markagrense* in Norwegian). This indicates that the tasks of the design of these projects can be very diverse, as different pre-existing tissues present different kinds of conditions and challenges. The more consolidated tissues, such as the traditional and the modernist, provide well-defined frameworks for new developments. Therefore, the results have a higher degree of predictability in terms of physical structures that they introduce, and they contribute to the further consolidation of these tissues. On the other hand, mixed tissues present a higher degree of flexibility in sustaining concepts that may have substantially different spatial organisation, which requires caution as it may result in undesirable built forms, but it also provides an opportunity for innovation. A particular type of tissues is found in the land use transformation areas, for their development resembles expansion. This poses a range of challenges, such as the design of open and built spaces in larger areas, the definition of public and private use, green spaces, issues related to coordination of actors, and so on. An interesting finding is that in these areas, the urban block is used as a "module" for spatial organisation, and in the majority of cases it is a variation of the perimeter block, here termed "courtyard block." Entirely new blocks are also found in other types of tissues, having different spatial principles, which further stresses the relevance of the urban block in contemporary urban development. For planners, it is important to be aware that a successful design of urban blocks lies in the relations of buildings and the surrounding streets (both in terms of function and form), where architectural design plays a crucial role in the creation of legible and distinctive urban tissues.

A high degree of context sensitivity is observed in the majority of cases. Their final design is the outcome of different factors, and further research should delve into the effects of these factors in the planning processes.

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Appendix

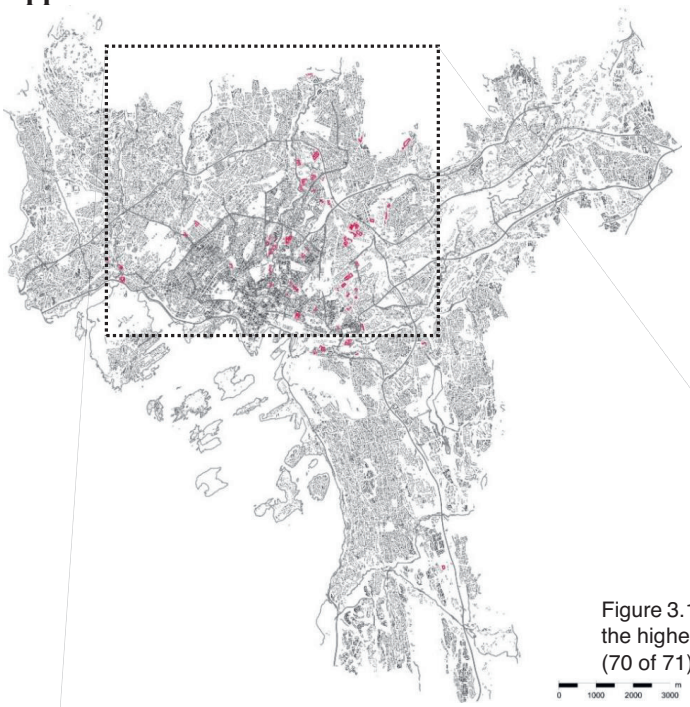
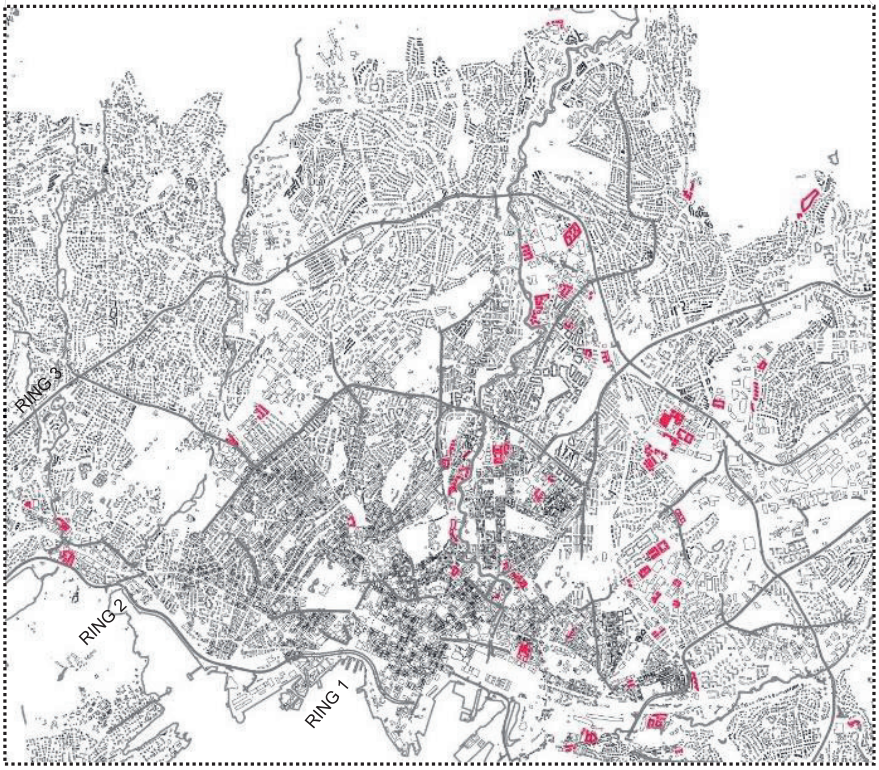


Figure 3. Map of the built-up area of Oslo with the 71 cases marked in red.
RING1 – ring road 1, which encircles the densest, most central part of the urban tissue.
RING2 – ring road 2, which encircles the dense, central part of the urban tissue, of lower density than that within ring road 1.
RING3 – ring road 3, which encircles a part of the urban tissue less dense than that within ring road 2; outside ring road 3, the urban tissue is of lowest density.

Figure 3.1. Section of the map with the highest concentration of cases (70 of 71).



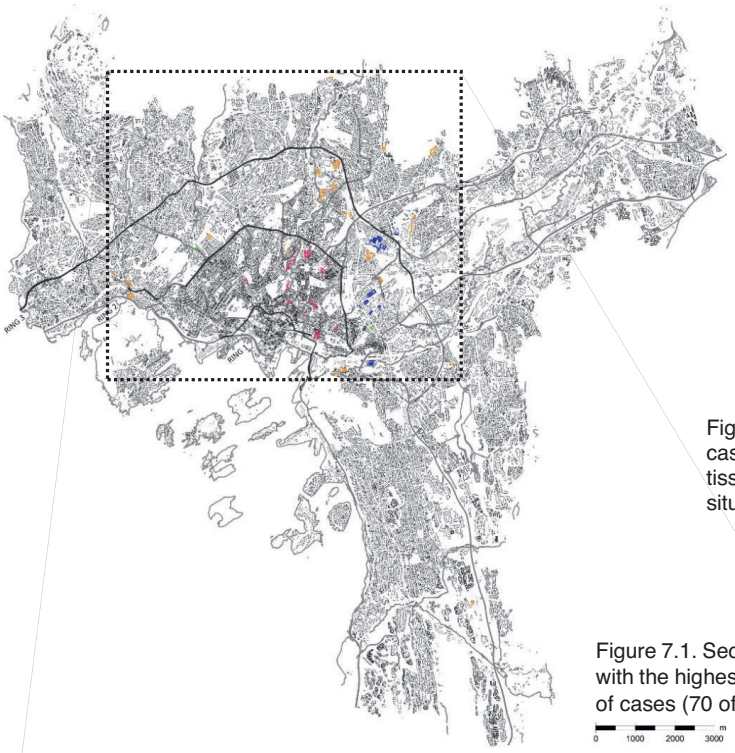
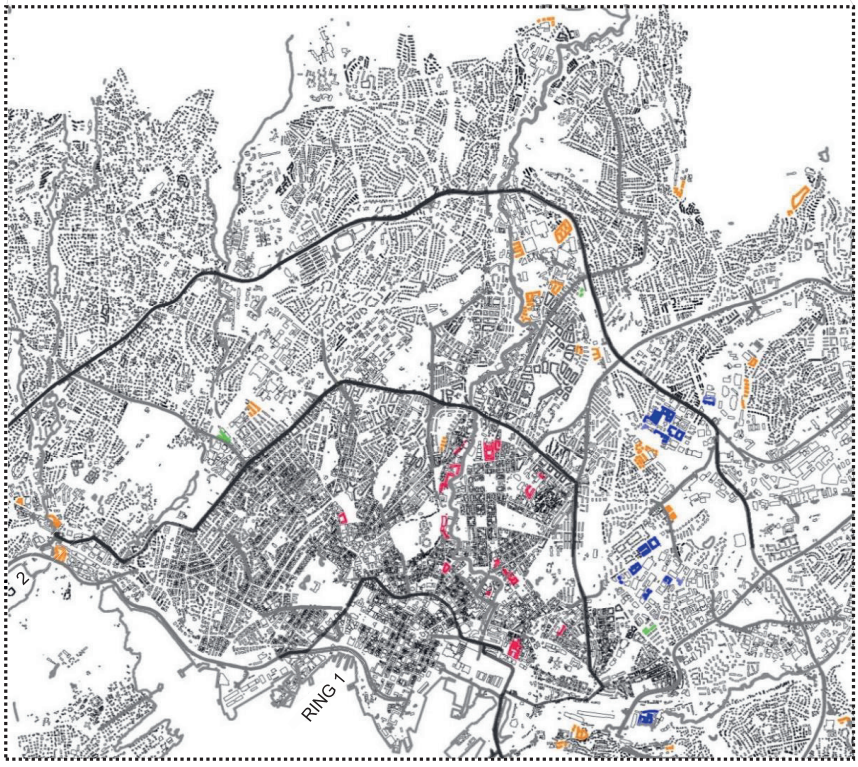
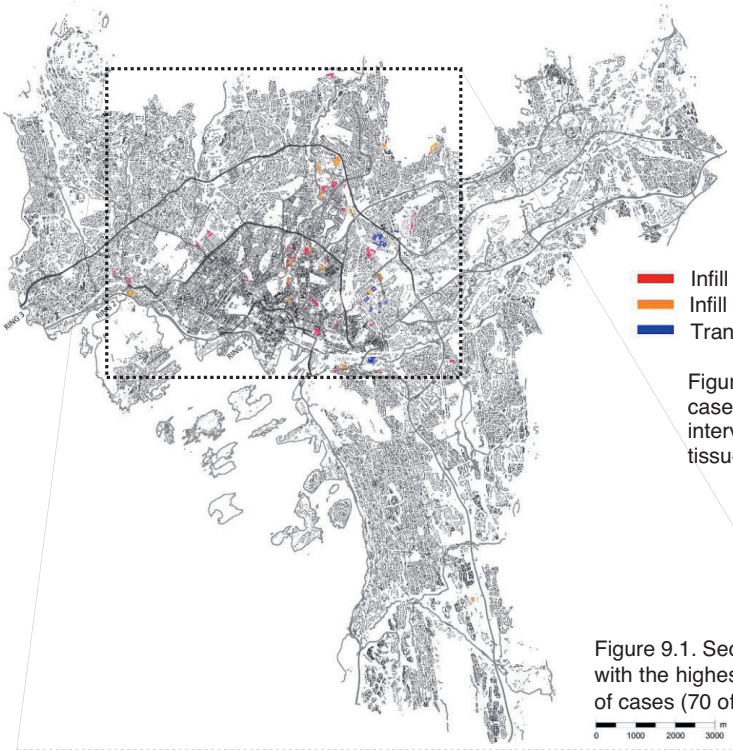


Figure 7. Overview of the 71 cases by types of constituted tissue in which they are situated.

Figure 7.1. Section of the map with the highest concentration of cases (70 of 71).



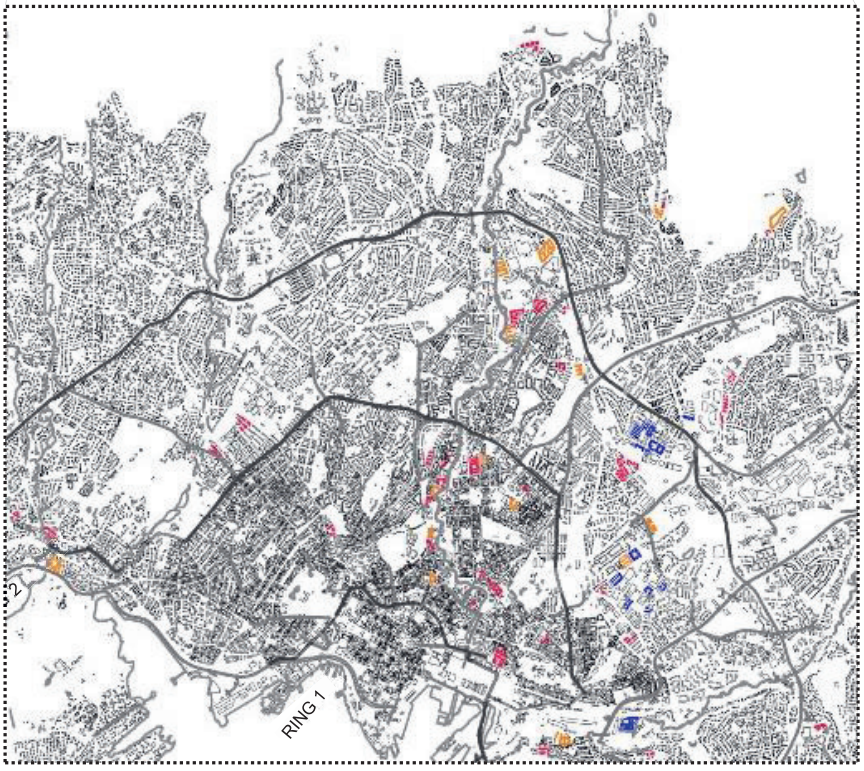


No. of cases

Infill	37/71
Infill – new urban block	17/71
Transformation	17/71

Figure 9. Overview of the 71 cases by the types of intervention in the urban tissue.

Figure 9.1. Section of the map with the highest concentration of cases (70 of 71).



Appendix C : Paper III

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Title: Design performance in planning for densification – the case of Oslo

Abstract

This paper addresses design performance in transformation of urban tissue under densification policy. It is a cross-case study of built-up area of Oslo, where planning processes for three cases of multi-family residential projects have been selected. The focus is on the zoning stage, where strategies are translated into built form. Through interviews with public planners who were in charge of this planning stage and analysis of planning documents, the paper examines the aspects of planning strategies for built form, design of built and open spaces in different kinds of pre-existing tissue, and actors' involvement. The main findings are that there is no strategy for built form at the spatial scale of such individual projects (intermediate scale) except in land-use transformation areas, and that built results are greatly conditioned by the plot and the pre-existing tissue, beside architects' and public planners' skills and goals. Certain propositions are given for improvement of planning approaches through a closer connection between planning and architecture.

Keywords: *densification, design performance, urban tissue transformation, urban architecture, Oslo*

1. Introduction

Urban planning is a complex activity, which involves a variety of aspects ranging from political, economic and anthropological to ecological, spatial and technological. In the past few decades, planning theory has sought a position within social sciences, abandoning its original roots with architecture and engineering, which created a void between planning and design (urban and architectural) to the detriment of both fields. (Palermo & Ponzini, 2010) This positioning coincided with another two occurrences. The goals of planning have been directed towards sustainability in numerous countries in Europe and the world (OECD, 2012) since the Brundtland report "Our Common Future" was published in 1987. This direction involves cities for the most part and entails a different treatment of resources through coordination of transport and land use, higher densities of built structures, population and functions, and often a strict limitation of expansion of urban built-up areas. Soon after the report, in 1990s, the approach of 'strategic spatial planning' became prevalent in European context, considered to be the most apt to respond to the contemporary challenges (Albrechts, 2004; Palermo & Ponzini, 2010).

In this milieu of separation of planning from design on one side, and strategic orientation towards sustainability on the other, production of physical outputs is nevertheless taking place in urban spaces. Planning is "*insolubly linked to establishing form*" (Westrik, 2002) through design processes, which is where translation of planning goals into tangible physical results happens. Now that planning is tightly woven into social science, the question of current planning in connection with approaches to design of urban architecture and open spaces comes to the fore as important for connecting and improving these fields, and strengthening the practice and quality of new built environments. Urban design attempts to bridge this gap (Çalişkan & Marshall, 2011) by addressing sizeable parts of urban districts or neighbourhoods, though a major criticism directed toward it concerns its lack of socio-spatial perspective beyond the market logic (ibidem). On the other hand, the interdisciplinary field of urban morphology offers stances that cover this issue more comprehensively (Çalişkan & Marshall, 2011) by integrating spatial and socio-economic perspectives.

This paper is part of a broader study which focuses on current planning context in Norway, where the mentioned gap can be observed as well. Already in early 1990s, Norway adopted a policy of 'densification with quality' as an orientation toward sustainable development (Miljøverndepartementet, 1992), which posed demands for a more effective use of the existing built-up urban areas with limitation of their expansion. This entails formation of new structures in already existing urban tissue. At the same time, dominant planning approach is characterised by a strong emphasis on strategic goals and planning processes. Hence, the ways in which policy goals are

'translated' into physical results have been given insufficient attention. Using Oslo as the case and employing urban morphological approach, this paper looks into performance of actors in planning processes concerning design of physical outputs and performance of new structures in pre-existing tissues regarding qualities of the resulting built form. This is done at a sample of three cases of single projects for multi-family residential buildings.

In over 25 years of implementation, densification has produced numerous physical results and gave rise to plentiful discussions, both in professional circles and the public, covering a myriad of topics: from qualities of planning processes, actors' roles and positions, issues related to specific large-scale projects, to market conditions and qualities of new buildings and open spaces. In research, design-related issues that occurred in densification in Norway have been addressed to an extent. Soon after the policy introduction, attainment of spatial qualities gained importance. Physical implications of densification were covered with the purpose to assess its possible effects in different types of settlements (Miljøverndepartementet, 1996) and provide guidelines for handling the design and planning processes. By applying urban morphological thinking and analysing a selection of a small number of urban tissue fragments of different types within three municipalities (Guttu, Nyhuus, Saglie & Thorén, 1997a; Guttu, Nyhuus, Saglie & Thorén, 1997b), these early studies provided a critical evaluation of effects densification has on physical space and the complexities densification entails. Continuing with morphological thinking, subsequent studies investigated application of planning norms in design processes (Thorén, Pløger, & Guttu, 2000) as well as planning processes and physical results from the perspective of housing and living qualities (Schmidt, 2007; Guttu & Schmidt, 2008). In 2005, Børrud elaborates on questions of production of physical results in densification, covering non-residential projects and actors' interactions, underlining the high potential of urban morphology to provide the necessary understanding of the complex conditions and possibilities for design which is in line with Çalişkan and Marshall's (2011) perspectives. In another study, Børrud and Knutsen (2018) address strategies for spatial development expressed in municipal plans for Oslo in past three decades, finding that concepts and principles for implementation of main densification strategy vary greatly.

In general, the links between design and planning have been differently addressed in different contexts, presumably due to differences in traditions in these fields. Lately, there are increasingly more studies which bring the relevance of design in connection with urban planning back on stage. The stances that such studies take can be prescriptive, which is often the case with urban design field but also found in urban morphology (Moudon, 1997), analytical-critical towards the actual practices, or both. Urban design is often addressed in the Anglophone realm, not only in research but also in planning practice, where guidelines for design of particular segments of urban built-up areas are a commonly devised, though not obligatory, tool for municipal planning level (see for example Beunderman, Hall & Vrolijks, 2009). "Dealing with Incremental Change: An Application of Urban Morphology to Design Control" by A.C. Hall (1997) is another example with prescriptive stance and it proposes concepts for improvement of design policies and design control in view of surpassing the limitations of land-use map, applying urban morphological perspectives. The analytical-critical studies can involve different aspects, from particular urban design approaches and their relevance for the qualities of new development (see for example Racine, 2016), the role of urban design in policy making (see Batuman & Erkip, 2017), to current performances in planning and design in particular contexts (see Lucan, 2012 and Salama & Wiedmann, 2016). The virtuous and comprehensive study by Jacques Lucan, which deals with urban planning in France, presents an important reference for this study of Norwegian planning context. Relying on urban morphological thinking, Lucan provides an integrative analysis of current performances in urban planning and design, synthesising the aspects of planning system (zoning instruments), development processes (which are standardised in terms of spatial scale and organisation of actors) and the resulting architecture in defined segments of urban tissue.

This paper addresses the links between design and planning in Norwegian context, covering recent developments in a systematic way. It is preceded by a study of physical results of urban tissue transformation at the spatial level of urban block (*Ref. author's article in revision), using a larger number of case projects in Oslo. The line of inquiry continues here with a detailed study of planning processes, focusing on design. Production of physical results takes place in the framework of planning system and here it is understood as a synthesis of planning goals and strategies, actors' interests and involvement in the process, and design concepts which determine spatial articulation of built form and

architectural functions (Figure 1). In order to examine design performance in planning for densification, the main research question posed in this paper is:

What characterises design performance in planning processes for densification regarding design of new structures in pre-existing urban tissue?

2. Theoretical perspective and main analytical concepts

In this study, the understanding of *design performance in planning* comprises the performance of actors in the design process (including underlying planning strategies and design concepts applied) and the performance of resulting physical structures in the previously existing tissue.

Figure 1. Aspects that determine the production of physical form

Theoretical field that provides necessary stances for such an integrative analysis is urban morphology. In a morphological study, defining the spatial scale is the starting point in analysis of physical structures. The dominant growth pattern in urban tissue of Oslo is incremental (*Ref. author's article in revision) with single projects being inserted into the pre-existing tissue. This analysis therefore addresses the scale where these projects take place, which is the scale between a building (or a group of buildings) and the urban block where they are situated (Figure 2), and it is termed intermediate spatial scale.

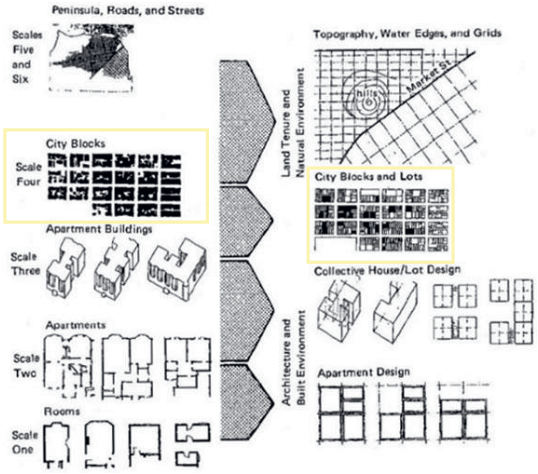


Figure 2. Modularity in the built landscape (Moudon, 2007 [1994]); presents the different spatial scales and the ways a building fits into the urban tissue. The intermediate scale between the urban block and a single building is marked yellow.

Planning aspect

In addressing the planning aspect, certain stances from planning theory are combined with urban morphological approach. Production of physical results takes place in a framework of planning system, where planning goals and strategies are expressed and employed through municipal plans and other instruments that regulate economic and social relations. Faludi (1989) explains that there are two types of plans: *strategic* and *project plans*, and states the differences between them:

"Project plans are the blueprints where implementation is unproblematic and outcomes are expected to conform to intentions. Strategic plans are momentary agreement records of various projects considered at different points in time by the participants. The future remains open. Decision makers who use them must *perform*. Analysis of their performance requires case studies."

In Norwegian planning context we can identify both types (Figure 3), yet regarding *strategic plans* it would be more accurate to say that they are predominantly strategic as they might contain some particularities on physical issues. The current incremental development is put into effect through individual projects and it is in this stage of planning that *project plans* occur. The first such plan is the zoning plan (in Norwegian: 'reguleringsplan') which is the stage in between the strategic goals and the actual physical form, where the synthesis of these goals happens and a physical form is shaped through a particular planning and design process, in a specific context of a particular part of urban tissue. The spatial scale of zoning plans is the aforementioned intermediate scale (Figure 2). The solution adopted at the end of zoning stage provides legally obligatory framework for the second, final step in the development (in Norwegian: 'byggesak') - building permit application, where design is elaborated in detail and the building(s) constructed accordingly. This study focuses on the zoning stage as the first step in design of physical outputs and enquires the ways they come about.

Planning aspect is addressed through a sub-question:
1. Are there strategic goals in municipal plans concerning the physical form at the intermediate scale (among selected cases) and if so, what are they?

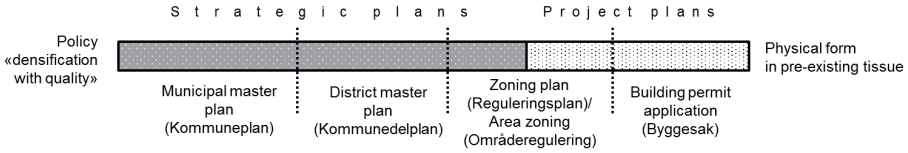


Figure 3. Outline of municipal plans for their character, following Faludi's (1989) types of plans

Design aspect

In the analysis of design, the basic concept is *constituted tissue* which denotes pre-existing physical context around newly designed structures. It is linked to morphological concept of *urban tissue*, understood as the *"ensemble of aggregated buildings, spaces and access routes"* in a city (Larkham & Jones, 1991 p.80). Other morphological concepts employed here are:

- building *("A house or stationary structure with walls and a roof"* (Larkham & Jones, 1991, p. 23)),
- street *("A town or village road that has more or less closed building development along its length"* (Larkham & Jones, 1991, p. 74)) and
- urban block (*"entity consisted of one or more adjacent plots, surrounded by planned and unplanned paths, roads and streets on all sides, with buildings located on the plot(s)"* (Krier, 2007 [1984])).

In the book "Ways to study and research urban, architectural and technical design" (2002), John Westrik exposes a variety of urban design approaches and links them to urban architecture. As the most important aspects he states *function* and *form* as well as their articulation on the site, continuing with acknowledgment of existing characteristics of the area and specific design problems. This understanding of approaches to design in urban setting is used as the basis in this analysis of Oslo, and design of new structures in pre-existing urban tissue is examined through the aspects of:

- articulation of physical *form* and architectural *function* of buildings and open spaces at the intermediate spatial scale – disposition of new built volumes on the site and their relations to the constituted tissue: buildings, streets and urban blocks. Relations of new built volumes with the pre-existing tissue provide an insight into morphological qualities of resulting physical forms, as a perspective that links to the policy goals of qualities in densification, and
- *connections* of new open spaces to other open spaces in the vicinity (including streets).

Design aspect is addressed through a sub-question:
2. How are built forms and architectural functions of new structures spatially articulated on the site and in relation to the surrounding urban tissue?

Actors

The interests and involvement of different actors in the production of physical results include the effects of their inputs on design as well as possible considerations for the broader context - neighbourhood and the entire city. As Oliveira states (2016), a critique that is often directed toward the public planners is an excessive focus on particular projects and the lack of concern for the entire city or larger parts of the city. This relates to Fainstein's (2005) claim about the spatial context being insufficiently considered in planning theory (and consequently also practice) as well as the observed gap between architecture and current urban planning. This study, however, does not delve deep into the planning system and investors' role, as these topics have been the subject of numerous studies so far (see for example Børrud, 2005; Røsnes, 2005; Nordahl, 2015; or Hanssen & Hofstad, 2015)

The aspect of actors is addressed through a sub-question:
3. What actors affect the physical results in different types of pre-existing urban tissue and in what aspects?

Drawing upon these stances and concepts, the purpose of this article is to look closely into performance of actors, planning strategies for physical form and employed design concepts in urban tissue transformation in Oslo. This is investigated through planning processes for development of new physical structures in three individual projects for multi-family residential buildings.

3. Methods and data

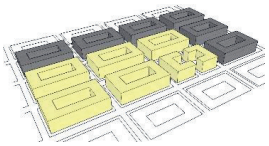
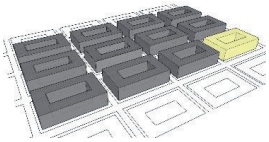
Case study approach and selection of cases

As this study addresses the planning context in Norway through its capital, Oslo, it is inherently a case study. The focus is on design performance in planning processes relative to physical results, which requires a detailed analysis. For that purpose, three cases of recent residential developments have been selected. This determines its methodology as a cross-case study, where the main case is the built-up area of the city of Oslo, within which three sub-cases of recently built multi-family residential projects have been addressed (in further text referred to as "cases").

Case selection is based on a broader study, of which this paper is a part, which comprises 71 multi-family residential projects constructed between 2004 and 2014. Each case was analysed for the resulting physical form (*Ref. author's article in revision) and applied planning instruments, which provided references for selection of three cases. In that stage, four constituted tissue types (varieties of traditional and modernist, mixed type, and land-use transformation type) and three types of intervention (infill, infill as entirely new urban block and transformation) (ibidem) have been identified among the 71 cases, together with three types of planning instrument sets. Three cases have been selected in the way to include all these types (Table 1.), except for constituted tissue criterion where three most common types have been covered: traditional, transformation and mixed. Additionally, the cases have been selected to cover different positions in the urban tissue (Appendix A). For each case, basic data are provided (see Appendices B, C and D). Plan drawings were based on digital maps, obtained from Norgesdigitalt database - FKB-data and Matrikkel-data in UTM32 Euref89 (accessed in February 2014). The cases were also visited on site and photo-documented.

Table 1. Summary of cases according to the selection criteria

Cases	***Case 1***	***Case 2***	***Case 3***
Selection criteria	***Christian Krohgs gate*** *37, 39A-H, 41*	***Gladengveien*** *4 A-J, 6 A-F*	***Årvollveien*** *52A-X, 54A-X, 56A-X, 58A-V, 60A-L, 62A-E* ***(Årvollskogen)***
Type of planning instrument set	P1 Municipal master plan (Kommuneplan), District master plan (Kommunedelplan), Zoning plan (Reguleringsplan) and Building permit application (Byggesak)	P2 Municipal master plan (Kommuneplan), District master plan (Kommunedelplan), Planning-programme for Ensjø (Planleggingsprogram), VPOR, VPOV, Zoning plan (Reguleringsplan) and Building permit application (Byggesak)	P3 Municipal master plan (Kommuneplan), Zoning plan (Reguleringsplan) and Building permit application (Byggesak)

Constituted tissue type	TRAD2 traditional urban blocks combined with large volumes	TRANSF2 Land use transformation area where buildings were removed, street layout preserved	MIXED7 single-family houses; multi-family housing blocks/slabs
Intervention type*	**Infill**, part of pre-existing urban block 	**Transformation**, where entirely new urban blocks are built in a larger land use transformation area 	**Infill as entirely new urban block** in pre-existing urban tissue 
Position in urban fabric	Between Ring1 and Ring2	Between Ring2 and Ring3	Outside Ring3
* the schemes are given at the example of pre-modernist urban tissue type			

To address the aspect of planning goals and involvement of actors, two methods are applied: analysis of case planning documents and semi-structured interviews with public planners who were in charge of the processes. Public planners act as mediators between the private and public interests and actions (Oliveira, 2016), which provides them with a rather complete overview of the planning processes and makes them a solid source for investigation of such processes. Case documentation is available at Planinnsyn, the publicly accessible online database of the Agency for Planning and Building Services of Oslo Municipality (PBE). Documents from the zoning stage (in Norwegian: reguleringssak) and the building permit application (in Norwegian: byggesak) have been analysed. The inputs from the interviews provided additional information which could not be obtained from the documents, regarding steps in the process, communication between actors, public planners' work in the processes and general inputs on the functioning of the planning system.

A common feature of all cases concerns the actors involved, who can be classified into three main groups: municipal planners, who belong to public sector and represent public interests, initiators of the planning proposal, who are private parties and comprise the property owner (developer) and the architect, and other stakeholders, who can be either from public sector (municipal or higher level authorities) or general public. Their involvement in all analysed processes follows the sequence of steps prescribed by Planning and Building Act from 1985. (see Appendix F)

Methods by research questions

The main research question, ***What characterises design performance in planning processes for densification regarding design of new structures in pre-existing urban tissue?*** is addressed through three sub-questions.

Sub-question 1. ***Are there strategic goals in municipal plans concerning the physical form (among selected cases) and if so, what are they?***
The first step is analysis of municipal plans, regardless of their legal status, which were applied at the time of zoning of the three cases in search of strategies for physical form, focusing on the intermediate spatial scale. Another data source are interviews with municipal planners, who explained the application of municipal plans in the case processes.

Sub-question 2. ***How are built forms and architectural functions of new structures spatially articulated on the site and in relation to the surrounding urban tissue?***
The main concept of *articulation* of built structures is understood as the spatial distribution of physical form and architectural functions in the composition, at the intermediate spatial scale. Hence at this scale, the analysis of articulation includes the interaction between the new built structures and the constituted tissue, based on:

d) *building-street relations*: spatial disposition of new buildings in relation adjacent to street fronts,
e) *heights:* of new buildings compared to the buildings in surrounding urban blocks, and
f) *organisation of open spaces:* whether it is comparable to open spaces in the surrounding urban blocks in terms of size, connections to surrounding streets and accessibility.

Following these criteria, categories that can occur are:

4. *Integrated* - refers to cases where the new built volumes follow the spatial logic of the surrounding tissue
5. *Segregated* - refers to cases where the new built volumes introduce a different spatial logic compared to the surroundings, by the previously mentioned criteria; also, if only one criterion for "integrated" is fulfilled, the built structure is considered segregated.
6. *Semi-integrated* - refers to cases where two out of three criteria for "integrated" are present.

As for the articulation of functions, cases are analysed for the presence of non-residential use and their spatial placement within the new built structure, including the position relative to streets.

Sub-question 3. ***What actors affect the physical results in different types of pre-existing urban tissue and in what aspects?***
Sources for this sub-question are planning documents at the zoning stage and interviews with public planners who were in charge of the cases. All actors are identified and characterised for the sector they belong to. Next, the topics of their inputs are analysed and actors who were concerned with physical results at the intermediate spatial scale are specified. Finally, the actors whose inputs were accepted (and thus affected the physical form at the intermediate spatial scale) and the particular subjects of their inputs have been identified and analysed in relation to constituted tissue types.

4. Analysis and results

Sub-question 1. ***Are there strategic goals in municipal plans concerning the physical form (among selected cases) and if so, what are they?***

Among municipal plans applied in the cases (Table 2), only a few provided guidelines for physical form of new buildings and open spaces. The most distinctive are planning instruments used in case 2, located in Ensjø land use transformation area, which provided strategy for shaping of the built and open spaces at the intermediate scale: Planning programme and VPOR (they were adopted locally and not defined in Planning and Building Act.). This was a solid framework for design of particular projects in that area. It is interesting that for the centrally located case (no.1) there was a district master plan (KDP-13) which provided rather detailed principles for physical shaping of new structures at the intermediate spatial scale in the inner city, using morphological thinking. Its application was later discontinued, though it was never politically adopted. In case 3, situated in less dense, peripheral, mixed urban tissue, there were no guidelines for design at the intermediate scale and the only plan applied was Municipal master plan. In both such plans (from 2000 and 2004) found in cases, the goals for physical form were to increase density in areas close to transportation nodes which refers to the spatial scale greater than the intermediate scale, i.e. to the entire built-up area of Oslo. Beside the municipal plans, other planning instruments were applied, such as policy guidelines (in Norwegian: rikspolitiske retningslinjer) which cover certain topics, and norms, e.g. parking norms or norms for outdoor spaces ('Utearealnormer').

Table 2. Overview of applied planning instruments and their relations to physical form at intermediate spatial scale

Case	Planning instruments applied	Reference to physical form of buildings and open spaces
1. Christian Krohgs st.	Municipal master plan (KP 2004)	None
	District master plan KDP-13 (KDP for indre Oslo nr.13 from 1997)	Provides guidelines for physical shaping of new buildings in the inner city
	District master plan KDP Akerselva Miljøpark	None

	District master plan KDP Trafikkplan for indre by (Plan for traffic in the inner city)	None
	Reguleringsplan S-2255 (from 1977)	Defines building density for the area
2. Gladengveien st.	Municipal master plan (KP 2004)	None
	District master plan KDP for lokalisering av varehandel og andre servicefunksjoner (for locating retail trade and other service functions)	Concerns localisation and size of a shopping centre in the new area; no inputs relevant for the case
	Planning programme for Ensjø (adopted on 17, March 2004)	Provides principles for placement of functions, building density and heights as well as functioning and layout of Gladengveien street
	VPOR Ensjø (Guiding plan for public spaces)	Defines concept for the network of open spaces (to contain water and green elements), street widths, building heights and densities as well as functions in open spaces
	VPOV (Guiding plan for stormwater)	Gives principles for aesthetic, functional and environmentally-friendly use of stormwater
3. Årvollveien st.	Municipal master plan (KP 2000)	None

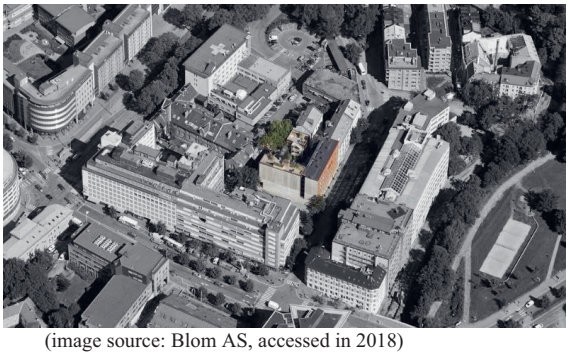
Sub-question 2. ***How are built forms and architectural functions of new structures spatially articulated on the site and in relation to the surrounding urban tissue?***

Case 1 – Christian Krohgs street: *Integrated*

By the criteria of analysis (stated in chapter 3), the features of this case are:

a) *building-street relations:* New buildings are aligned with the existing street front.
b) *heights:* Heights of built volumes are approximately the same as the other previously existing buildings in the street.
c) *organisation of open spaces:* Open space is organised in the similar logic to that of other buildings in the urban block – private (only for residents), inside the urban block, accessible only through the buildings.

As the new volumes follow the spatial logic of the constituted tissue, which is a variety of traditional tissue, this case is integrated.



(image source: Blom AS, accessed in 2018)

Figure 4. Case 1 - Plan and bird's eye view

Regarding *architectural functions*, it is a mixed-use development, where functions are distributed vertically. Street level is designated for non-residential uses, while the upper storeys are residential. There are also two underground storeys which accommodate parking garage and a car passage towards the hospital located in the same urban block. The new open space is placed on the rooftop of the street-

level storey and it is aimed entirely for residential use. It is connected to the courtyard of the pre-existing neighbouring building and it is open also for its residents.

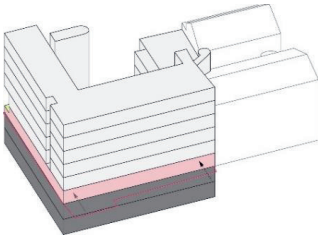


Figure 4.1. Case 1 - View from Christian Krohgs street

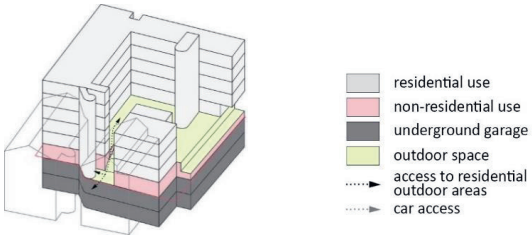


Figure 4.2. Case 1 - View of the courtyard and the neighbouring buildings

Case 2 – Gladengveien street: *Integrated*

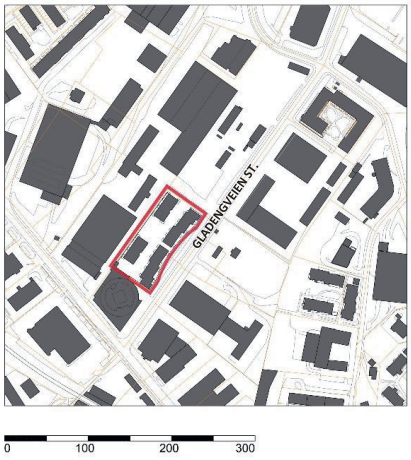
The assessment of interaction in this case differs from the other two, as it is a brownfield transformation project where previous buildings have been removed in a larger area. Therefore, the sole reference of the pre-existing urban tissue is the plot where it is situated, beside other newly planned buildings and urban blocks in the area encompassed by the same zoning plan. It is considered integrated into this new planned area.

By the criteria of analysis, the features of this case are:

a) building-street relations: Built volumes of Gladengveien 4-6 are aligned with the street front of the neighbouring building, at the same time shaping a new square.

b) *heights:* Building heights are approximately the same as the other planned buildings on both sides of the street.

c) *organisation of open spaces:* Open space is organised in a similar logic to that of other buildings in the street – it is semi-private, providing links between the main street (Gladengveien), the street and urban block to the north-west, as well as the new park axis to the north-east.



(source: Google Germany, accessed in 2018)

Figure 5. Case 2 - Plan and bird's eye view

Concerning *architectural functions*, it is a mixed-use development, with vertical distribution of functions. The street-level storey facing Gladengveien hosts non-residential uses, as part of this new, redesigned central street. Upper storeys are for residential purpose.

Figure 5.1. Isometric view of Ensjøbyen - location of case 2; source: https://www.oslo.kommune.no/politikk-og-administrasjon/slik-bygger-vi-oslo/ensjobyen/ (accessed in 2018)

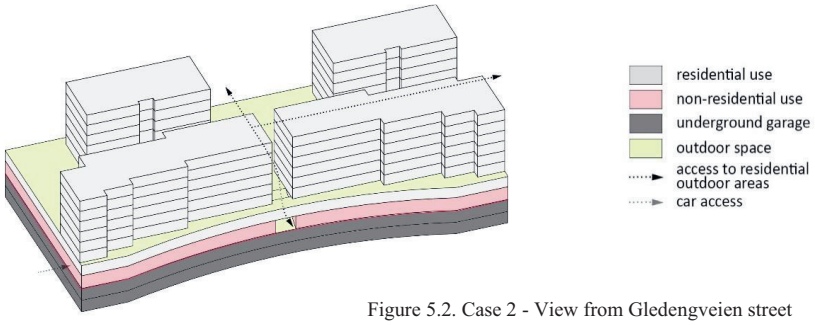


Figure 5.2. Case 2 - View from Gledengveien street

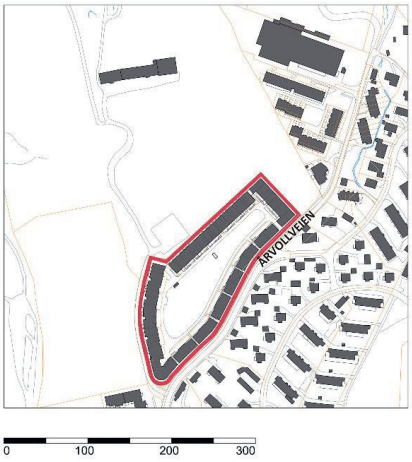
Case 3 – Årvollveien street: *Segregated*

This case is situated in constituted tissue of mixed type, at the very margin of Oslo's built-up area. By the criteria of analysis, the features of this case are:

a) *building-street relations:* New buildings are aligned with the existing street as terraced housing type. This differs from the pre-existing buildings which are semi-detached houses, parallel repeated volumes at an angle of cca. 60 degrees toward the street axis.

b) *heights:* Building heights vary. Terraced houses along the street, Årvollveien, are of approximately the same height as the pre-existing buildings on the other side of the street, and amount to total of 3 storeys. Built volumes inside the new block are considerably higher, 6 storeys total.

c) *organisation of open spaces:* Open space of the new development is organised in a dissimilar logic compared to pre-existing tissue – it is semi-private, courtyard type and it hosts a mix of uses – residential and kindergarten. Its proportions (single, large space) and size are noticeably different from the surrounding urban blocks.



(source: Blom AS, accessed in 2018)

Figure 6. Case 3 - Plan and bird's eye view

Distribution of *architectural functions* is predominantly horizontal, as a kindergarten occupies the lowest storey of a part of the built volumes and uses a part of the common outdoor space in a split regime with the residents, while several storeys in another building are designated to offices.

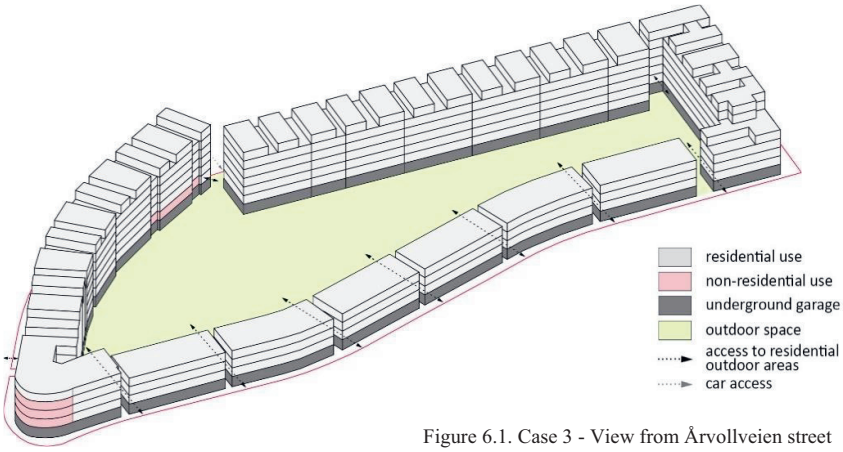


Figure 6.1. Case 3 - View from Årvollveien street

Sub-question 3. ***What actors affect the physical results in different types of pre-existing urban tissue and in what aspects?***

In every planning process for individual interventions there are three main groups of actors involved: public (municipal) planners, initiators of the planning proposal (developer and architect) and other stakeholders (public or private). Public planners cooperate with architects in the design process, ensuring compliance of the design proposal with overarching planning goals. In the interviews, public planners stated that their focus in the zoning process is not architectural design and details, but a higher spatial scale (here termed as intermediate scale). Thus their attention is on volumes (building heights, size, position and shapes of outdoor spaces, density, position of new buildings relative to the surrounding buildings, streets and urban block) and functional layout (use of street-level storey, access, connections and use of outdoor space, access for cars, pedestrians and the disabled). Apart from the case in land use transformation area, the project initiators handed in design proposals with elaborated

concepts to public planners and it can be said that the processes entailed small adjustments of the design according to municipal plans and inputs of other stakeholders.

While architects balance between public planners' demands and developers' aims and preferences, other stakeholders provide their inputs through mechanisms of public participation, i.e. in certain steps during the planning process. Most actors provide inputs which concern the physical results in a direct or indirect way, and a number of those relate to the intermediate spatial scale. Of these inputs, a few are accepted and included in the proposal, either entirely or in part, thus affecting the final physical results to a certain extent. Figures 7 and 8 present spatially-related issues discussed in each case and actors who were concerned with them. Remarks on these issues came from both public and private stakeholders and often different stakeholders were concerned with the same topic, though from slightly different perspectives. For instance, building heights could be a concern of Cultural heritage management office, Borough council, Public health authority, County governor and neighbours. In cases 1 and 3, the issue of building heights attracted the most interest, followed by the qualities of outdoor spaces, such as sunlight, noise and accessibility. Case 2 is yet again somewhat different, and the most debated topics were related to open spaces – parking, dimensions of adjacent streets and open spaces, balconies, as well as the use of buildings.

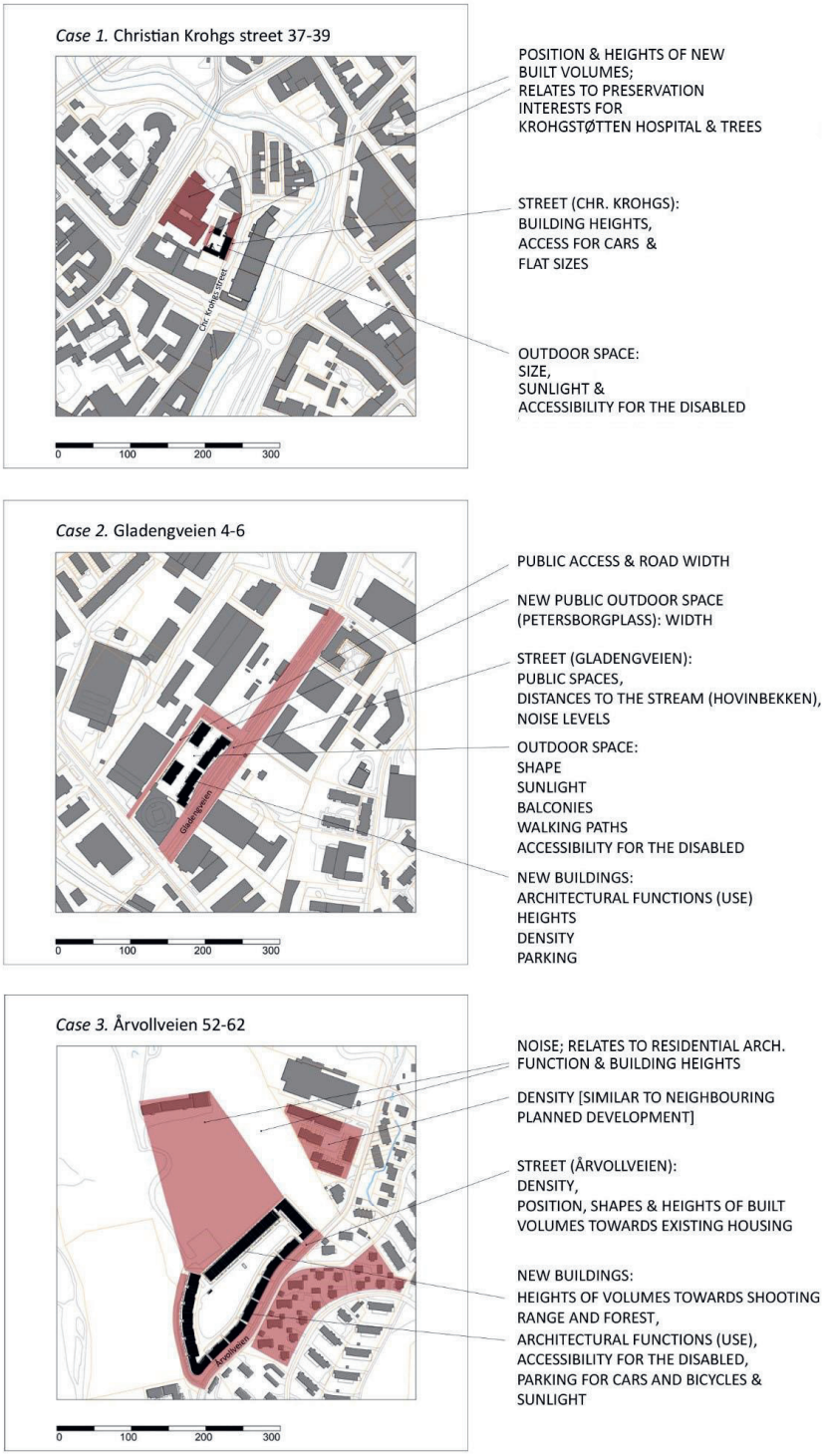


Figure 7. Overview of spatially-related topics discussed in zoning processes

Another interesting result is the degree in which the proposal was actually affected by the actors' inputs. (Figure 8. and Appendix E) In all cases, the strong initial concepts underwent slight changes. In case 1, which is centrally located, Cultural Heritage Management Office affected the building heights and positions on the plot. In case 3, where the initial proposal came as a result of previously organised architectural competition, the greatest change was introduction of passages through the terraced houses placed along the street, and this change was demanded by municipal planning authorities. Concerning case 2, since it is part of a larger transformation area that was designed as an ensemble, a larger number of inputs affected the physical results. The changes covered the functions of the buildings (reduction of the areas for non-residential use), dimensions of adjacent open/green space (Petersborgplassen) and adjustments of building heights (to enable the use of prefabricated constructions and prevent views into the flats on the first floor).

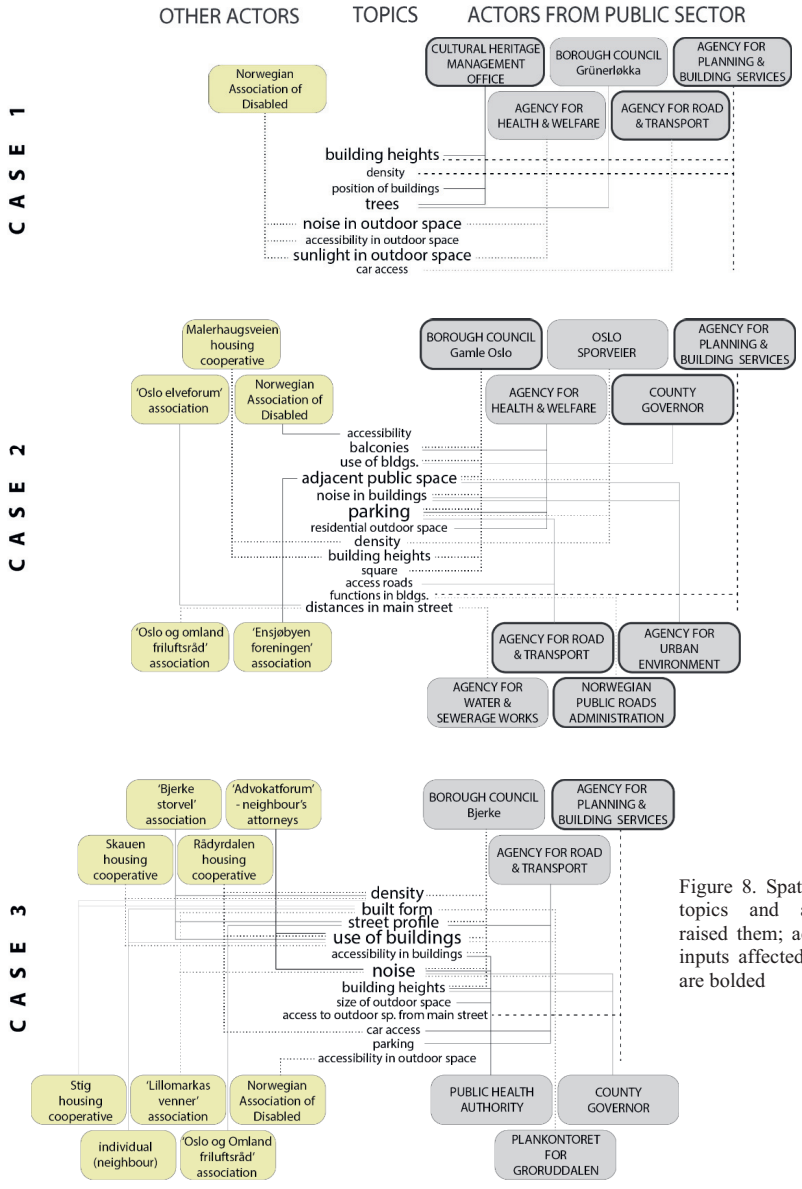


Figure 8. Spatially-related topics and actors that raised them; actors whose inputs affected the results are bolded

5. Discussion

As the main question is addressed through three aspects of production of built form, the discussion follows these aspects.

Planning – strategy for physical form
The cases have been selected in the way to cover different planning instruments and situations in urban tissue. Hence, the presence and types of inputs or strategies for built form found in those instruments varies considerably among the cases, but also due to the situation in urban built-up area and the time these instruments date from.

Among the plans defined in the law, District master plan for inner city (KDP-13, from 1997) applied in case 1 was a unique example, as it provided guidelines for design of new structures in the urban tissue and ambience of the inner city, employing morphological thinking. Case 2, located in Ensjø transformation area, is distinct for the presence of spatially-related inputs that resemble expansion of urban tissue. Yet, in case 3, situated in less dense, peripheral urban tissue, there were no guidelines for design at the intermediate spatial scale. The design in this case resulted in a completely dissimilar physical structure (segregated) compared to the pre-existing tissue, which was of mixed type. This can be explained both by the flexibility of mixed tissues to sustain different designs and the absence of strategy for built form in that area. The influence of the constituted tissue and strategy on the final output can be more clearly observed in case 1, which resulted in an integrated design due to consolidated pre-existing tissue and defined design principles for that particular area in the city.

Design – spatial articulation of built forms and architectural functions
Articulation of built form is closely connected to spatial conditions of pre-existing tissue. There is a difference between the treatment of the three constituted tissue types, mainly in terms of building heights, volume sizes and connectivity of open spaces, while the size and physical form in all cases was greatly conditioned by the size and shape of the plots. Street dimensioning and shaping of outdoor space were of great importance in each case and influenced the form and disposition of buildings to a high extent. It was in early 2000's that norms for outdoor spaces (in Norwegian: Utearealnormer) were developed and case project 1 was used in their development (according to interviewed planners). Subsequently, these norms became essential in design of new residential projects, despite the fact that they were never legally adopted.

In the most centrally located case (no. 1), the fairly consolidated constituted tissue provided a solid framework for new buildings. Therefore, the new design is well integrated and contributes to further consolidation of the pre-existing tissue, enhancing its existing morphological qualities. On the other hand, in case 3, situated in mixed tissue in the peripheral part of Oslo's built-up area, the new development introduces an entirely new spatial organisation, despite the fact that the constituted tissue contained sizeable, well defined spatial units. As their density is low, which contrasts the aims of today's urban development, a compromise between the new (dense) and the pre-existing (far less dense) was reflected in a mix of architectural types – terraced houses with lower heights were introduced in the main street Årvollveien. Yet, while these built volumes match the heights of pre-existing buildings, they are placed continually along the street which is completely different from the surrounding blocks. Here, the context is primarily addressed in the design of the main street, adjusting the building heights, distances and front gardens to fit with the spatial features of pre-existing, surrounding urban blocks. In case 2, which is part of Ensjø brownfield transformation area, the situation is specific as the pre-existing buildings had been removed beforehand. Consequently, interaction with the constituted tissue is different than in the other two cases and instead of interplay with pre-existing buildings, this project was aimed to be integrated in the new design of the neighbourhood, supporting the visions for the greater spatial ensemble. This is comparable to the urban design method that Westrik terms "urban image" (2002), as the layout and coherence of a large spatial unit determine the particular projects.

As for *architectural functions*, there are common, fixed functional demands in residential projects. One is placement of the parking lot, which is defined in the planning norms ('Parkeringsnormer for Oslo') and occupies the lowest storey(s). In cases 1 (centrally located) and 2 (in brownfield transformation area), non-residential functions were included in the proposal from the beginning and placed at the street-level (vertical distribution of functions). This reflects considerations for the immediate urban context expressed in the intentions of architects (case 1) and public planners (case 2) for creating a lively street front, as a desirable urban quality. The last case (no.3), located in the peripheral area, is also a mixed-use development but with horizontal distribution of functions. There, the articulation differs significantly from the central and transformation areas, as the street level is almost entirely residential. This functional distribution was affected by the mixed type of constituted tissue and the position in the broader context (on the outskirts of Oslo's built-up area).

Further, it is possible to observe that all cases revolve around strong concepts for residential outdoor areas, with variable accessibility and connections to the surrounding open spaces in different constituted tissues. In the most central case (no.1), outdoor area is private, intended for use only by residents, situated above the street-level (on the rooftop of the street-level storey), with limited access from the main street (Figures 3.1 and 3.2). In case 2, the outdoor space is semi-public, accessible on three sides from the surrounding public areas (Figure 4.1). In case 3, it is a large, park-like semi-private area, intended mainly for residents but providing physical access from the surrounding streets and blocks (Figure 5.1). These differences, again, depict a diversity of mutual effects between new projects and the constituted tissue, as well as a diversity of spatial qualities that new projects introduce in the urban built structure. They also indicate that planning aims for the larger area around the project site have a great influence on the final design.

Functional character of outdoor spaces is also different among the cases. In the centrally located case, it is separated from the street and intended for the exclusive use by residents. Case 3, again, differs as its outdoor space is accessible from the surrounding streets and partly shared with a non-residential function (kindergarten). This could be due to the plot size and the design concept that recognised the potentials of the site, as this open space covers a large area and the shared use poses no threat to the living qualities of the entire outdoor space. The case in land-use transformation area is an "in-between", as its outdoor space is placed above the main street level, but without barriers (gates) so it is accessible. It is also open on two other sides and linked to the surrounding public open spaces (where the terrain is sloped and higher than the main street), which makes it semi-public and subjugated to the concept for open spaces for the entire area (as defined in VPOR for Ensjø).

Actors – impact on design

Evidently, architects (private planners) who represent developers have a crucial role in the design and in cooperation with public planners compliance of the new development with public interests is ensured. Other actors (from both public and private sector) provide inputs regarding design through legally defined mechanism in the process. In all cases, these inputs had a possibility to affect the physical result regardless of the type of stakeholder behind them, i.e. regardless of whether they have a legally obligatory status or not. From the analysis it is possible to observe that different stakeholders tackled a variety of spatially-related issues, where building heights and open spaces were topics that attracted most attention (Figure 8). Some inputs, such as remarks on universal design posed by Norges handikapsforbund, occur in any case. Demands of public authorities have an obligatory character, e.g. by County governor (Fylkesmann), and while municipal plans may have provided scarce guidance for physical form at the intermediate spatial scale, the inputs of other municipal (and county) sectors addressed this scale, being based on other legal and technical regulations (for instance, heritage preservation interests or traffic regulations).

Regarding *considerations for a wider spatial context* such as the urban block, neighbourhood and the entire city, and the critique of public planners for the lack of it (Oliveira, 2016; Fainstein, 2005), these considerations can be traced indirectly in the process through the role of public planners. Their task covers the assessment of design proposals based on the intentions expressed in overarching municipal plans and the inputs from other stakeholders that hold different levels of obligation. A concern of

public planners in Oslo is also the effect of new buildings on the townscape viewed from the distance (in Norwegian: fjernvirkning, found in case 3), which involves the broader neighbourhood and even the entire built-up area of the city. Another observed factor is tacit knowledge, as public planners in all three cases have educational background in architecture. This indicates that public planners in Oslo possess the awareness of both the wider context and the particular site with its surroundings, and they ensure that the incremental transformation of urban tissue complies with the general goals for urban development.

Bearing upon these findings, the main question, ***What characterises design performance in planning processes for densification regarding design of new structures in pre-existing urban tissue?*** can be answered through the following points:

- Strategies for built form at intermediate spatial scale are partial
- Design approach is highly context-sensitive, though commonly covering just the immediate surroundings
- Public planners' performance is a learning process, thus process structure and applied tools change
- Skills of public planners and architects, together with project initiators' aims are crucial for design outcomes
- Public planners' performance is predominantly reactive to design proposals.

Firstly, strategies for design of new built structures at the intermediate spatial scale are partial and refer to certain, few areas in urban tissue of Oslo, which is in line with findings of Børrud and Knutsen (2018). In central parts, there are no longer guidelines for built form, as the use of District master plan for inner city (KDP-13) was discontinued since planning became dominantly strategic. Transformation areas are somewhat different, for they cover larger parts of urban tissue. Defining a design strategy for particular areas in urban tissue can have several benefits: it can provide better guidance to planners, lead to more coherent larger areas, increase predictability of outcomes and shorten the processes.

Secondly, design approach in new multi-family residential projects is highly context-sensitive, though rather limited to the site and its immediate surroundings. This is in line with Børrud (2005), who reached the same conclusion through an analysis of projects of other architectural functions. Design is greatly conditioned by the pre-existing tissue, which further stresses the importance of developing spatial strategies for particular types of urban tissue, especially mixed types. It is also greatly dependent on the plot size and shape, and concerning multi-family residential buildings, densification occurs in an incremental, fragmentary and property-oriented way. Physical form of buildings is mainly moulded by adjacent outdoor spaces, especially those for private use of residents, as well as technical requirements for traffic and a number of planning norms.

Actors who affect the design have various roles and levels of obligation, and participate in processes in different ways. The analysed cases were processed between 2000 and 2007 and at that time, according to the interviewees, there was no precisely defined and accepted sequence of steps in the zoning process. Private and public planners had very little guidance and strategic goals regarding the morphology of new developments in structural terms. The possibilities for physical form were open and proposers could come up with virtually any idea on any site, which was later discussed and adjusted in cooperation with public planners. There was also a strong sectorial division, with an evident impact of Agency for Road and Transport in terms of technical regulations and Cultural Heritage Management Office, who appear to have structural morphological approach in assessment of heritage interests for buildings and open spaces in Oslo. Due to this division, processes could be characterised as irregular and uncertain. Eventually, the process structure has been consolidated and today there is a higher degree of predictability. Another change concerns planning instruments. Since 2015, site analysis (in Norwegian: stedsanalyse) has been introduced by municipal planners as an obligatory step at the beginning of design processes. Likely, this will lead to improved solutions regarding considerations for the broader context and urban qualities of new developments. Another instrument,

defined in Planning and Building Act 2008, which aims to better address the context and improve design outcomes is area zoning plan (in Norwegian: områderegulering). This indicates that densification is an evolving process, where planners learn from experience and adjust their approaches to meet the demands occurring in policy implementation. Hence their need for instruments that address physical development in a more concrete and comprehensive manner (not only strategic). Still, this does not mean that before these tools were introduced there were no good design proposals. According to an interviewed planner, there were skilled architects then and the quality of new architecture depended greatly on them. Besides, the analysis shows that the proposals were not significantly changed in the process, which implies the architects' skills and thorough knowledge of regulations; yet, as Børrud (2005) exposed, this may also be due to investors' important role in the development, coupled with public planners' unpreparedness for proposals.

In any case, professional knowledge of both private and public planners is highly important and reliance on norms is not sufficient, which is in line with findings of Thorén et al. (2000). This will remain true, whereas it could be beneficial to strengthen densification approaches in Norway with a set of morphological guidelines both for treatment of particular parts of existing urban tissue and brownfield redevelopment areas. It could present possibilities for development, or alternatively restrictions to it (e.g. building height limits or possible street profiles), aid to connect the new and the pre-existing more closely, and lead to more coherent physical forms. As mentioned earlier, tendencies to cover larger areas have occurred, with the attention on both open spaces and built volumes, and the experiences from French context could be of use there. In the French system, regeneration of a particular segment of urban tissue is addressed through a legally defined instrument, ZAC (Zone d'Aménagement Concerté - Concerted Development Zone) (Lucan, 2012). A general concept that prescribes the interplay between built volumes and voids, with considerations to the surrounding tissue, is laid out and a chief architect is appointed for it. Fragments of the area are elaborated by other architects under the supervision of the chief architect, who cooperates with public planners and ensures compliance of design with the general concept of articulation. Occasionally, the elaboration of fragments follows the steps across spatial scales, from the entire area, across urban blocks within it, to particular plots within the blocks (as in Masséna quartier), where each scale is designed by another team, embedded in the concept at the larger scale above it. The appointment of architects can either be a matter of agreement between actors (as in ZAC Bercy) or conducted through architectural competitions (as in Masséna development). (ibidem) The hierarchical organisation of actors provides a more structured and more predictable process, while the entire area is functionally and spatially coordinated, having a diversity of architectural designs. The resulting space is coherent and legible, with numerous opportunities for innovation. This approach integrates architectural design and planning to a great extent. In Norwegian context, such involvement of architects could yield an experience that would contribute to establishing a closer link between design and planning, and a more consolidated knowledge base for design for urban architecture. Still, land ownership structure could represent a hindrance to such changes in approaches in Oslo, and additional practical examination would be necessary prior to modifications.

Another issue in Oslo is that projects can propose a different use of the site than that intended by public planners (for instance, from public institution to residential as in case 1, or from light industry to residential as in case 3), which can affect the entire surrounding area in unanticipated ways. This finding is in line with the results of Børrud (2005). The influence of private initiators is great, while public planners have a reactive role in handling their proposals. Nevertheless, new planning instruments represent a step toward a more holistic, proactive approach, which has a potential of bridging the gap between planning and design to the benefit of new urban tissues and their future users. They reflect an increasing awareness among public planners of the importance of addressing the actual physical structure of the city, which is also noticeable in more precise mapping of areas intended for densification in municipal plans (see current Municipal Master Plan – Kommuneplan 2015 or proposal for new Municipal Master Plan – Kommuneplan for Oslo 2018), despite the predominantly strategic and process-oriented character of planning. This is an important tendency, for it places a stronger emphasis on physical developments of larger areas that give spatial framework for attainment of goals for the dense city, and indicates that there will potentially be less reasons for criticism of planning

practice for lack of concern for wider spatial context in future (as exposed by Oliveira (2016) and Fainstein (2005)).

6. Conclusion

Considering planning strategies, design and actors as the basis for production of physical results (Figure 1) in densification of urban tissue in Oslo, it can be said that the planning aspect is the "soft spot" in the design performance. While design is context-based and actors' professional skills play an important role, a strategy for physical form of new single projects and their interactions with pre-existing tissue is partial, based primarily on goals for (semi-)private outdoor spaces stated in norms devised by municipal planners. Implementation of densification policy in Oslo is a learning process in which public planners perceived the need for addressing spatial issues more closely. A way to improve design and planning approaches together with the resulting physical forms could be to strengthen the aspect of spatial strategies for particular segments of urban tissue, at a standardised spatial scale. The considerable experience that public planners have gained in the implementation of densification policy and the knowledge about aims and interests of different actors, especially project initiators and developers, could serve as a basis for developing an integrative strategy for design of physical form which would balance public and other actors' interests to the benefit of both.

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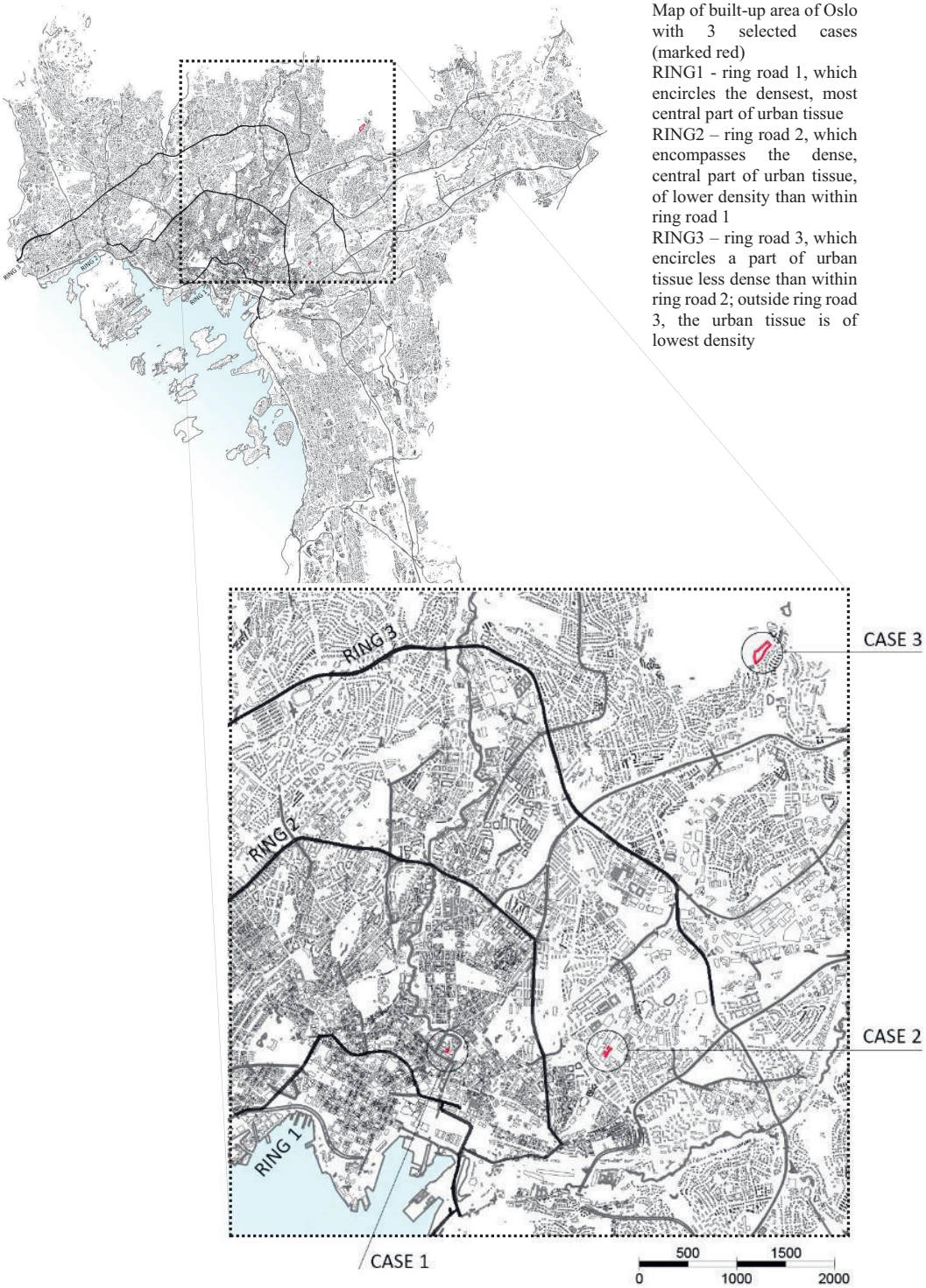
Appendix A



Map of built-up area of Oslo with 3 selected cases (marked red)
RING1 - ring road 1, which encircles the densest, most central part of urban tissue
RING2 – ring road 2, which encompasses the dense, central part of urban tissue, of lower density than within ring road 1
RING3 – ring road 3, which encircles a part of urban tissue less dense than within ring road 2; outside ring road 3, the urban tissue is of lowest density

Appendix B
Data sheet for CASE 1 - Christian Krohgs gate 37, 39A-H, 41

Timeframe	**Start of planning**	2003
	Adoption of zoning plan	2007
	End of building	2011
Constituted tissue	**Typology of surrounding urban blocks**	TRAD2
	Patterns of surrounding buildings	19th c. urban blocks combined with large volumes
	Functions of surrounding buildings	mixed-use, business and administration, housing
	Proximity of new development to public green areas and open spaces	100m
	Proximity of new development to public transport nodes	220m
Type of intervention	**Infill**	Infill in a part of urban block (<50% urban block coverage)
Planning	**Set of planning instruments**	Type P1; Municipal master plan (KP 2004); District master plans: KDP-13 (KDP for indre Oslo nr.13), KDP Akerselva Miljøpark, KDP Trafikkplan for indre by; Reguleringsplan S-2255; Zoning plan S-4347 – covers just the project
	Plot description relative to corresponding urban block	A plot in an urban block
Design	**Situation**	Between Ring 1 and Ring 2, in central urban area
	Built structure	3 built volumes above underground garage; street-level storey covers entire plot
	Functions/use	Mixed use; ground floor: shops; upper floors: housing

Built area (above street level): 1100m2
Total built area (above street level): 4000m2
No. of storeys: 5-6
No. of housing units: 33
Plot area: 1170 m2

Case project
Area encompassed in zoning plan

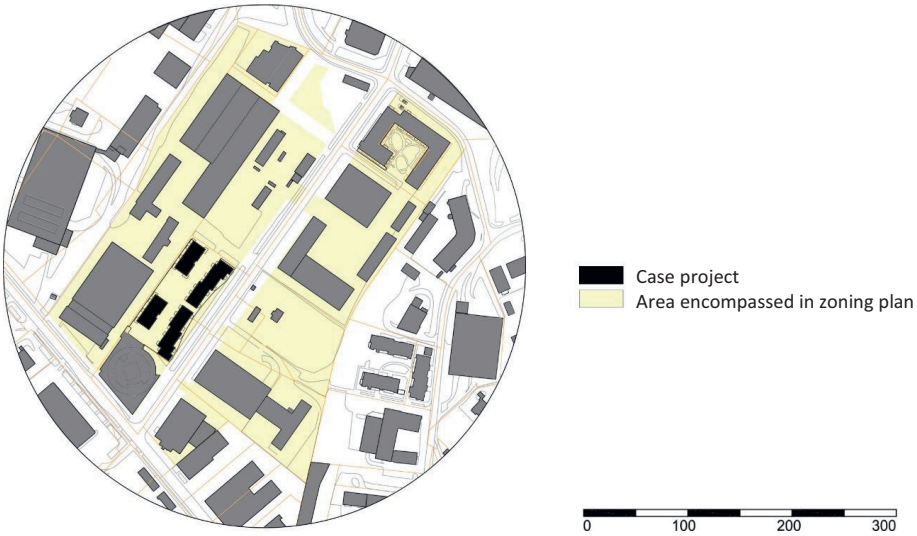
0 100 200 300

Appendix C
Data sheet for CASE 2 - Gladengveien 4 A-J, 6 A-F

Time	**Start of planning**	2002
	Adoption of zoning plan	2007
	End of building	2011
Constituted tissue	**Typology of surrounding urban blocks**	TRANSF2
	Patterns of surrounding buildings	buildings were removed, street layout preserved
	Functions of surrounding buildings	/
	Proximity of new development to public green areas and open spaces	350m (*condition from 2014; upcoming open spaces will be next to it)
	Proximity of new development to public transport nodes	300m
Type of intervention	**Transformation**	New development on a cleared brownfield site
Planning	**Set of planning instruments**	Type P2; Municipal plan (KP 2004); District master plan KDP for lokalisering av varehandel og andre servicefunksjoner (for locating retail trade and other service functions); Planning programme for Ensjø (adopted on 17, March 2004), VPOR Ensjø (Guiding plan for public spaces), VPOV (Guiding plan for stormwater)
	Plot description relative to corresponding urban block	A plot which defined part of a new urban block in a large transformation area (former brownfield)
Design	**Situation**	Between Ring 2 and Ring 3, in Ensjø transformation area
	Built structure	4 built volumes above underground garage; street-level storey covers entire plot
	Functions/use	Mixed use; ground floor: shops; upper floors: housing

Built area (above street level): 5400m2
Total built area (above street level): 20000m2
No. of storeys: 6-7
No. of housing units: 152
Plot area: 6660 m2

Image source: Spor Arkitekter web site

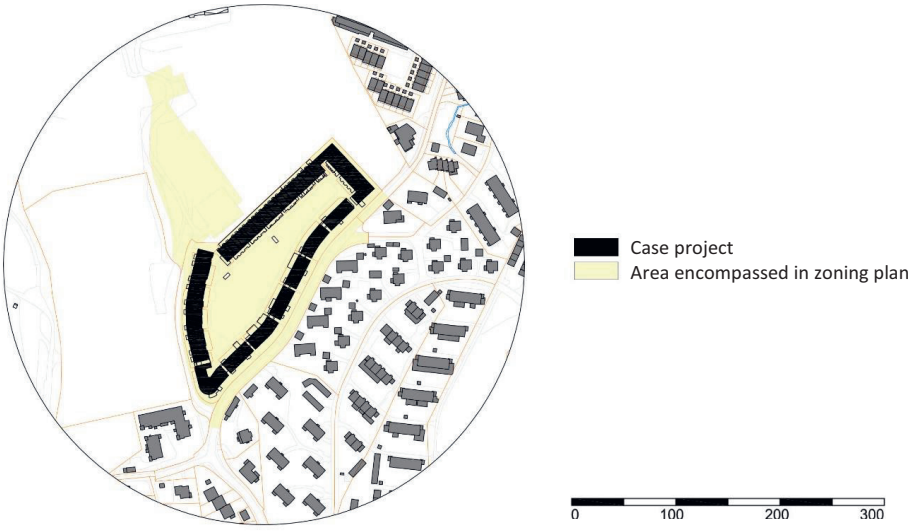


Appendix D
Data sheet for CASE 3 - Årvollveien 52A-X, 54A-X, 56A-X, 58A-V, 60A-L, 62A-E (Årvollskogen)

Time	**Start of planning**	2000
	Adoption of zoning plan	2002
	End of building	2006
Constituted tissue	**Typology of surrounding urban blocks**	MIXED7
	Patterns of surrounding buildings	Separate repetitive volumes (slabs)
	Functionss of surrounding buildings	housing (single-family and multi-family)
	Proximity of new development to public green areas and open spaces	0m
	Proximity of new development to public transport nodes	>2000m
Type of intervention	**Infill as entirely new urban block**	New development is inserted into pre-existing urban tissue
Planning	**Set of planning instruments** Type P3; Municipal plan (KP 2000), Zoning plan S-3936 – covers just the intervention project area	
	Plot description relative to corresponding urban block	A plot which defined new urban block in low density peripheral area
Design	**Situation**	Outside Ring 3, at the border to 'marka' (forest belt)
	Built structure	9 built volumes around a large semi-private outdoor area
	Functions/use	Mixed-use: housing combined with offices and a kindergarten in one of the volumes

Built area (above street level): 7380 m2
Total built area: 28300 m2
No. of storeys: 3-6
No. of housing units: 320
Plot area: 21100 m2

Image source: Jensen & Skodvin Architects web site



Appendix E

Analysis of types of actors in the planning processes and their inputs on physical results. Actors (other than planners and project initiators) who gave inputs on physical characteristics of the project are written in italics; actors whose inputs affected the final results are marked yellow.

CASE	ACTORS IN PLANNING PROCESSES					
			Other stakeholders			
			Public		Private	
	Public/ municipal planners	Private/ Initiators of the planning proposal	Other municipal agencies / political authorities	Authorities above municipal level	Stakelholders from the neighbourhood	Other stakeholders
1. Chr. Krohgs gate 39-41	**Agency for Planning and Building Services of Oslo Municipality** (in Norwegian: Plan- og Bygningsetaten or PBE)	**Property owner and developer** (Christian Krohgs gate 39-41-43 AS)	*Cultural Heritage Management Office (Byantikvaren)*	*County Governor of Oslo and Akershus (Fylkesmannen)*		*Norwegian Association of Disabled (Norges handikapsforbund)*
		Architect (FuthArk Arkitekter)	Agency for Water and Sewerage Works (Vann- og avløpsetaten)			Hafslund nett
			Agency for Health and Welfare (Helse- og velferdsetaten)			Viken fjernvarme 2006
			Agency for Road and Transport (Samferdselsetaten)			
			Grünerløkka borough council (Bydel) *			
			Municipal Undertaking for Educational Buildings and Property (Undervisningsbygg)			
2. Gladeng -veien 4-6	**Agency for Planning and Building Services of Oslo Municipality** (in Norwegian: Plan- og Bygningsetaten or PBE)	**Property owner and developer** (Gladengveien 10 m.fl. v/Bjørn Thorkildsen c/o Wilhelm Jordan AS)	Agency for Water and Sewerage Works (VAV)	*County Governor of Oslo and Akershus (Fylkesmannen)*	*Foreningen Ensjøbyen*	*Oslo og Omland Friluftsråd*
			Agency for Health and Welfare (Helse- og velferdsetaten)	*Statens vegvesen – SV*	*Malerhaugsveien Boligsameie*	*Norwegian Association of Disabled (Norges handikapsforbund)*
		Architect (Torstein Ramberg AS Sivilarkitekt MNAL)	Cultural Heritage Management Office (Byantikvaren)			*Oslo Elveforum*
			Agency for Road and Transport (Samferdselsetaten)			Viken fjernvarme
			Oslo Sporveier AS			Ferd eiendom
			*Borough council Helsfyr-Sinsen (Bydel)**			
			*Borough Council Gamle Oslo (Bydel)**			
			Friluftsetaten			
			Trafikk etaten			
			Renovasjonsetaten			
			Eiendoms- og byfornyelsesetaten			
			Undervisningsbygg			
			Utdanningsetaten			
			Biblioteksentralen			
3. Årvoll-veien 52-62	**Agency for Planning and Building Services of**	**Property owner and developer** (Årvollskogen Boligselskap AS)	*Bjerke borough council (Bydelsutvalg)**	*County Governor of Oslo and Akershus (Fylkesmannen)*	*Advokatforum for Olso Østre Skytterlag*	*Norges handikapsforbund*

	Oslo Municipality (in Norwegian: Plan- og Bygningsetaten or PBE)	**Architect** Jensen & Skodvin Arkitektkontor AS	*Agency for Public Health (Helsevernetaten)*	Statens vegvesen-Oslo Vegkontor	*Rådyrdalen borettslag*	*Oslo og Omland Friluftsrad*
			Agency for Water and Sewerage Works (VAV)	Viken energinett	*Bjerke Storvel*	Veidekke bolig AS
			Agency for Road and Transport (Samferdselsetaten)		*Lillomarkas venner*	Skiforeningen
			Cultural Heritage Management Office (Byantikvaren)		*Stig borettslag*	
			Plankontoret for Groruddalen		*Skauen borettslag*	
			Bolig og eiendomsetaten		*Strand, Årvollveien 65*	
			Skoleetaten			
			Friluftsetaten			
			Oslo Sporveier AS			

Appendix F

Sequence of identified steps in 3 case processes, showing where other stakeholders participated. Actors (other than planners and project initiators) who affected the physical result through the process are written in italics.

IDENTIFIED STEPS IN THE PROCESS

CASE 1 **Chr. Krohgs gate 39-41**		**CASE 2** **Gladengveien 4-6**		**CASE3** **Årvollveien 52-62**	
Kunngjøring - Notice about the start of planning activities					
30.01.2003		22.11.2002/ 11.07.2003		17.01. 2000	
Kunngjøringsinnspill - Comments on the notice					
11.03.2003	-*Cultural heritage management office (Byantikvaren)*		* inputs are listed, referred, commented and attached together with preliminary statements		*no information available
				Architectural competition	
				Spring 2000	The winning team leads the project to realisation
Mottat plan initiative/forslag - Received planning initiative/proposal					
24.10.2003		11.07.2003		07.11. 2000	
		Planforum			
		13.04.2005			
				Notice about extension of planning area	
				08.11. 2000	
Kommunalt samråd - Municipal consultation and statements					
04.11.2003	-*Cultural heritage management office (Byantikvaren)* -Agency for Health and Welfare (Helse- og velferdsetaten)				
Oppstartsmøte - Initial meeting					
18.11.2003			*no information on date available		*no information on date available
Forhåndsuttalser - Preliminary statements					
2003-2006	-*Cultural heritage management office (Byantikvaren)* -Grünerløkka borough council - Agency for Water and Sewerage Works (VAV) -Norges handikapsforbund -*Agency for Road and Transport (Samferselsetaten)*	2003-2005	-Agency for Water and Sewerage Works (VAV) -Oslo Sporveier AS *-Agency for Health and Welfare (Helse- og velferdsetaten)* -Cultural Heritage Management Office (Byantikvaren) -Borough council Helsfyr-Sinsen *-Agency for Road and Transport (Samferdselsetaten)*	2001	-Bjerke borough council (Bydelsutvalg) -Agency for Public Health (Helsevernetaten) - Agency for Water and Sewerage Works (VAV) - Agency for Road and Transport (Samferdselsetaten) -Cultural Heritage Management Office (Byantikvaren) - Norges handikapsforbund - Advokatforum for Oslo Østre Skytterlag -Rådyrdalen borettslag -Bjerke Storvel -Lillomarkas venner -Stig borettslag -Oslo og Omland Friluftsråd -Veidekke bolig AS
Mottatt komplett planforslag - Complete revised planning proposal received by PBE					
27.10.2006		30.03.2006			*no information available
Offentlig ettersyn - Public inspection					
20.11. - 20.12. 2006.	-*Cultural heritage management office (Byantikvaren)* -Agency for Health and Welfare -Grünerløkka borough council -VAV -Agency for Road and Transport	03.04. - 10.05. 2006	*-Borough Council Gamle Oslo* -Oslo Sporveier AS *-Agency for Health and Welfare (Helse- og velferdsetaten)* *-Friluftsetaten* *-Agency for Road and Transport (Samferdselsetaten)*	12.11. - 12.12. 2001	-Bjerke borough council (Bydelsutvalg) -Agency for Public Health (Helsevernetaten) - Agency for Water and Sewerage Works (VAV) - Norges handikapsforbund - Advokatforum for Oslo Østre Skytterlag -Rådyrdalen borettslag -Bjerke Storvel

		- County Governor of Oslo and Akershus		-Agency for Water and Sewerage Works (VAV) -Fylkesmannen i Oslo og Akershus -Statens vegvesen -Norges handikapforbund -Foreningen Ensjøbyen -Oslo og omland friluftsråd -Oslo Elveforum -Malerhaugsveien Boligsameie		-Lillomarkas venner -Skauen borettslag -Plankontoret for Groruddalen -Strand, Årvollveien 65
	Revisions of the proposal					
		*no information available	09.-12.2006			*no information available
	Oppdatert planforslag mottatt - Updated planning proposal received					
	03. 2007		12.2006		27.06. 2002	
	Politisk behandling og vedtakelse - Political processing and adoption of the zoning plan					
	26.04.-05.12. 2007		21.12.2006-20.06.2007		08.07.-06.11. 2002	

List of figures and tables

Appendix D : Additional analysis I

Building type characteristic for densification

This step of the analysis of 71 cases focuses on the spatial scale of a single project. As exposed in previous analytical steps (covered in papers I and II), a single project can be built as infill in an urban block or introduce an entirely new urban block. The entirely new urban blocks occur either as infills in pre-existing tissue or as part of land-use transformation areas. This part of study builds into the historical knowledge on housing development in Norway, similarly to the study by Johan-Ditlef Martens (2000) who covered housing in the 20th century, however with different analytical perspectives and a focus on structural characteristics of the developments in this particular period of time.

Research question posed at this stage of analysis is:
Is there a particular building type produced among multi-family residential projects in densification of Oslo?

Theoretical approach and methodology

In order to address this question, the approach of urban morphology is employed. The understanding of building type in this analysis follows the perspectives of Pierre Gauthier (2005). His stances build upon the notions of *type* and *typological process* established by Italian morphologist Muratori, and further defined by Caniggia and Maffei. According to Gauthier, "type encompasses both the form and the knowledge pertaining to the fabrication and usage of the concrete objects that correspond to the said form" (Gauthier, 2005, p. 88). He elaborates on the non-formal aspects of type and argues that the forces affecting the course of typological process involve various kinds of knowledge and cultural models that guide the actions of different agents. These actions are exerted through practices, which can be studied by *praxeology*, so Gauthier proposes that the approach to studying a type should integrate the morphological study of (built) form (or typo-morphological if addressing a building type) and the study of practices that lead to its emergence (Figure D1..).

Figure D1. Gauthier's diagramme (2005, p. 91) of the 'mirror-theories' of the built environment in the making

This study of Oslo is based on the analysis of the physical form of 71 cases. A typo-morphological analysis of the cases is conducted in order to identify their structural characteristics and deepen the understanding of the ways these new multi-family residential projects organise built and open spaces, along with relations these spaces create to the surrounding streets. The analysis of the common spatial characteristics of the cases enables to identify a characteristic building type. Next, the analysis is to cover underlying practices of actors, however, with certain limitations. Exploring the practices is a complex task, addressed by a discipline within social sciences (praxeology), but also due to the complexity of the planning system and a diversity of actors, as observed in this study thus far. For that reason, this part of analysis encompasses the most influential underlying forces that can be observed from the available data, building upon the previous steps of the entire PhD study, mainly the results and knowledge produced in paper III. The mentioned paper covered the zoning processes in which new buildings were planned and designed, at the intermediate spatial scale,

focusing on the influence that public planners and current planning goals have had on the new developments.

Typo-morphological analysis of the cases includes both built and open spaces, aiming to understand the spatial layers within these cases in morphological terms. Theoretical stances employed here are based on Kropf's (2014) comprehensive understanding of the urban form as a composition of different spatial elements and voids, from building materials to streets, including both occupation space and the movement space. He proposes this approach for different spatial scales, for example, in studying the morphological element of street (Figure D2a.) or in studying a multi-storey residential building (Figure D2b.). His approach is applied in this analysis, focusing on the spatial scales between "materials" and "plot", as the subject is a type of multi-family residential buildings (Figure D2b). The position of the built volumes on the plot, and their relations to the street and the corresponding urban block are also covered.

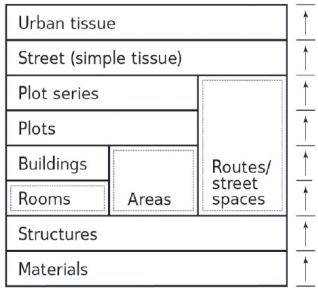


Figure D2a. Multi-level diagram showing the position of the route or street space and its relationship to plot series to form the street. (Kropf, 2014, p. 50)

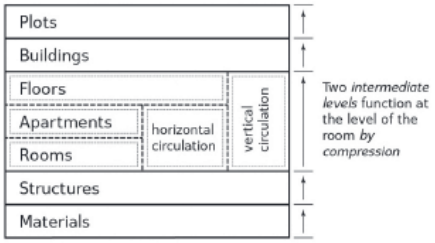


Figure D2b. Multi-level diagram of the multistorey apartment house. (Kropf, 2014, p. 52)

Results and analysis

In compliance with the criteria of selection (explained in Section 3.1.2), there are two main varieties of developments among the 71 cases:

1. single volume facing at least two streets, created as infill in pre-existing urban tissue (5 of 71 cases)
2. assemblage of buildings, here termed "*building complex*". Such a complex is designed either as part of the pre-existing urban block or as an entirely new urban block (this links to the findings presented in paper II). The size of a building complex varies, and it can comprise anything from two to 20 buildings or more (66 of 71 cases).

Regarding the organisation of built space, the most common feature among the analysed cases is the lowest storey connecting all built volumes and hosting parking lots for the residents. Outdoor space for the residents is almost invariably on the rooftop of this storey. Such built structure resembles what is known as *podium type* in North America and Asia (see

for example Department of Planning & Development, 2017; Newall, 2008; Walsh, 2013), though at a significantly smaller scale.

Figure D3 displays the spatial organisation of the identified type, using multi-level diagramme as a basis. Among the analysed cases, 66 cases have been structured in this way – with the "podium" storey.

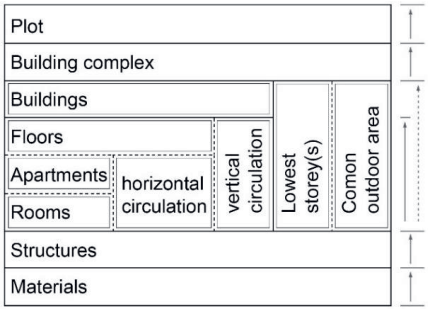


Figure D3. Multi-level diagram of multi-family residential buildings in compact city of Oslo, following Kropf's diagram (2014). The dotted arrow (on the right side) indicates the spatial level at which several buildings are joined by the lowest storey (and common outdoor area on its top) to form a "building complex".

Position of the lowest storey relative to the surrounding streets varies among different case projects, defining variants of the podium type (see Figure D4).

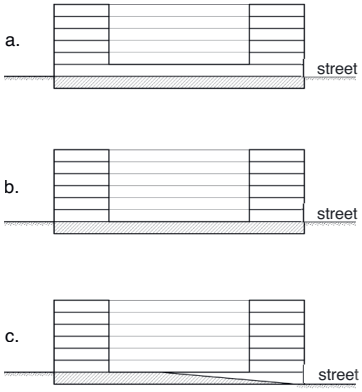


Figure D4. Illustration of the possible varieties of the podium type, determined by the positions of the lowest storey relative to the terrain; a. lowest storey above street level – podium type; b. lowest storey entirely under the ground – variation of podium type; c. lowest storey partly under the ground/above street level – variation of podium type.

The variant marked a. in Figure D4 is the main podium type and of 66 cases, 11 belong to this group (see examples in Figure D5). A case representing this group is presented Figures D6 and D7. This is a clear example of podium type created in Oslo, as the street-level storey streches across the entire plot. On its rooftop, there is common outdoor space for residents. Built volumes above the open space have access both from the streets and the outdoor area. Streets and outdoor space are connected via a number of staircases, and in most cases the access is restricted for the public. Thus, the character of ourdoor space is private.

Figure D5. Examples of the main podium type (with the lowest storey above the street-level); location of cases: Grenseveien 50–58 (left) and Helga Vaneks vei 1–3 (right); image sources: author's own photos

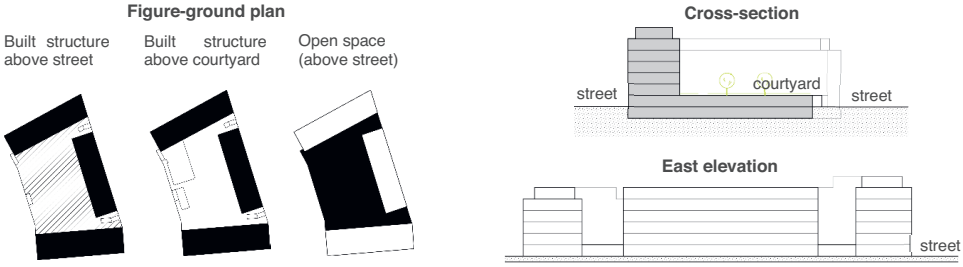


Figure D6. Example of podium type – plan drawings (within zoning plan limits), sections showing built and outdoor spaces relative to the surrounding streets, and east elevation; case located in Lille Bislett 2–26

Figure D7. Views of the case in Lille Bislett 2–26 from the street level; source: author's own photos

Variant of the podium type with the lowest storey placed under the ground is presented in Figures D8 and D9. Its spatial organisation corresponds to variant b. in Figure D4, and of 66 cases, 26 belong to this group. In this variant, outdoor space is semi-private, accessible from the streets, and open on all sides.

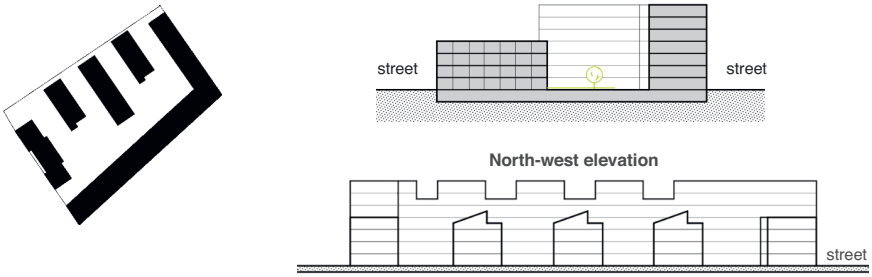


Figure D8. Example of variation of podium type with the lowest storey entirely under the ground – plan drawing (within zoning plan limits), section showing built and outdoor spaces relative to the surrounding streets, and north-west elevation; case located in Sigurd Hoels vei 42–110

Figure D9. Views of the case in Sigurd Hoels street 44–110; source: author's own photos

An example corresponding to variant c. in Figure D4, where the surrounding terrain is sloped, is presented in Figures D10 and 11. Out of 66 cases, 26 belong to this type. In this variant, outdoor space is accessible from the street at one, higher point, and it is of semi-private character.

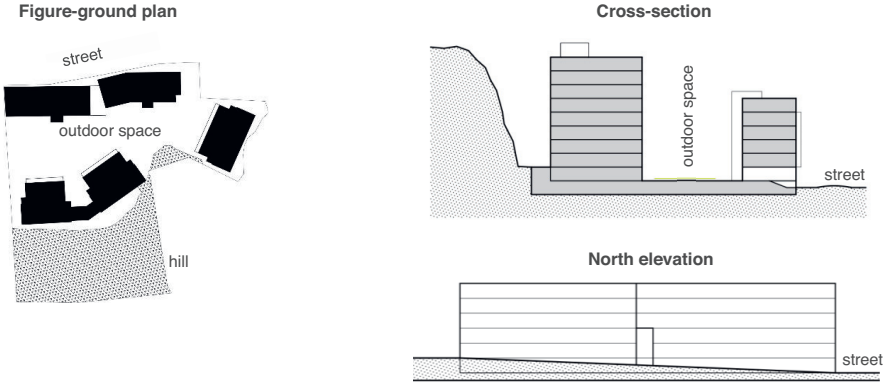


Figure D10. Example of variation of podium type with the lowest storey partly under the ground/above street level – plan drawings (within zoning plan limits), section showing built and outdoor spaces relative to the surrounding street, and north elevation – view from the street; located in Ekebergveien street 5 A–E

Figure D11. Views of the case in Ekebergveien 5 A–E; source: author's own photos

Another three cases (out of 66) are "combined" as a part of their podium storey is placed above the ground level and the other part is placed below the ground level.

Discussion

Since the greatest number of analysed cases corresponds to the podium type, it can be said that densification in Oslo produces a recognisable type of multi-family residential architecture that has become a symbol of densification policy in architectural terms. This architectural type is the physical outcome of individual intervention projects. Such interventions transform Oslo's urban built-up area at the intermediate spatial scale, being added to pre-existing urban tissue in different locations. One of the aims of densification is more efficient use of available space, and this is also reflected in spatial organisation of these cases. Parking garages are placed at the lowest storeys, often on two floors, and entirely or partly under the ground (as shown in this analysis). Built volumes with housing units are positioned above the level of garages, and rooftops of the highest storeys are occasionally also used as common outdoor spaces. This architectural type has a compact structure, comprising both built and open spaces, and as such, it can be considered a "fractal" of the compact urban form.

Regarding the underlying forces contributing to creation of this type, planning norms applied in design processes are a crucial factor that led to such spatial organisation; principally, parking norms and norms for outdoor areas in residential projects in inner Oslo (in Norwegian, *utearealnormer*) (Oslo kommune, 2012), both provided by the local planning authorities. These norms represent main inputs for design of multi-family residential buildings, having an effect on organisation of both built and open spaces simultaneously.

Parking norms have the greatest influence on the new building type, as they prescribe the placement of garages at the lowest storey(s), integrating the function of car parking in the multi-family housing building. At the same time, planning norms for outdoor spaces are another relevant factor that influence the spatial organisation of this type. These norms set rather strict requirements for provision and qualities of adjacent outdoor spaces in new residential developments. Built volumes are designed accordingly, thus being subordinated to outdoor spaces to a certain extent. Due to the placement of parking at the lowest storey(s) and relatively small plots, in a vast majority of developments the outdoor space has been placed on the rooftop of the lowest storey.

Another important condition that influences the new building complexes is topography, mainly regarding the street-level storey. This storey functions as a link between the buildings and the street(s), shaping the life of the street as public space. Another aspect

related to topography concerns the access to open spaces within the complexes from the surrounding streets. The effects of topography vary among the cases. This is a context-sensitive question, dependent on the location of the building complex in the urban built-up area, but also on the design and technical solutions applied in construction. In a number of cases, street facades are blind due to the sloping terrain of the site, as, for example, in the case located in Gladengveien 15, in Ensjø land-use transformation area. Blind facades are problematic as they have negative effects on the street dynamics, which has been observed also in earlier studies of the physical outcomes of densification (see, for example, Guttu & Schmidt, 2008).

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Appendix E : Additional analysis II

Planning instruments and urban tissue

This part of analysis addresses the link between planning and design in procedural terms, by investigating the applied planning instruments in 71 case projects. The objective is to reveal whether planning instruments target particular areas, addressing the features of pre-existing urban tissue and of new physical forms inserted in it. The focus is on the intermediate spatial scale. This step of analysis is connected to the findings exposed in Paper II, regarding the analyses of constituted tissue types and types of intervention. Methods applied here are presented in Section 3.2.2.

Research question posed in this analytical step is:
What planning instruments are applied in the planning processes for individual interventions and how do they relate to urban tissue?

Results and analysis
The analysis of planning instruments follows these steps:

1. Outline of municipal plans and planning instruments which can be applied in intervention projects as prescribed by the law (PBL1985 and PBL2008); based on literature: *Lovsamling for Miljøforvaltning* (*Law Collection for Environmental Management*) (Lovdata, 1990) and *Lov om planlegging og byggesaksbehandling* (*Planning and Building Act*) (Kommunal- og moderniseringsdepartementet 2008).
2. Outline of municipal plans and planning instruments applied in each case; based on planning documents for each case project.
3. Comparison of contents (municipal plans and other planning instruments) of each case to the cases prescribed by law, and noting the correspondence and potential differences.
4. Typologisation of instruments applied in cases, based on the contents; approach of pattern recognition.

Firstly, the applied planning instruments have been listed for each case. Both the instruments found in the zoning plan documentation and the plans added afterwards have been included (the document database was accessed in 2017). It was revealed that in each case a *set of planning instruments* applied in the zoning process. Out of 71 cases, 70 are planned according to the previous legislation, PBL1985, and only one was planned following the current law, PBL2008. It has been noticed that not all the planning instruments prescribed in the legislation were applied in each case. These differences have been registered and four main types of planning instrument sets have been identified. Table E1 displays these types: P1, P2, P3 (which follow PBL1985) and P4 (which follows PBL2008).

Table E1. Types of planning instrument sets by the two Planning and Building Acts: PBL1985 and PBL2008 at the municipal planning level. Original Norwegian terms are provided in brackets.

	PBL 1985								PBL 2008
Set	**P1**	**P1.1**	**P1.2**	**P2**	**P2.1**	**P2.2**	**P2.3**	**P3**	**P4**
Planning instruments found in case projects									Municipal planning strategy (Kommunal planstrategi)
		*Planning programme * (Planprogram)*							
	Municipal master plan (Kommunep lan)	Municipal master plan (Kommunep lan)	Municipal master plan (Kommunep lan)	Municipal master plan (Kommunep lan)	Municipal master plan (Kommunep lan)	Municipal master plan (Kommunep lan)	Municipal master plan (Kommunep lan)	Municipal master plan (Kommunep lan)	Municipal master plan (Kommunep lan)
	District master plan (Kommuned elplan)	District master plan (Kommuned elplan)	District master plan (Kommuned elplan)	District master plan (Kommuned elplan)		District master plan (Kommuned elplan)			District master plan (Kommuned elplan)
				Planning programme for Ensjø*** (Planlegging sprogram)	Planning programme for Ensjø*** (Planlegging sprogram)	Planning programme for Ensjø*** (Planlegging sprogram)	Planning programme for Ensjø*** (Planlegging sprogram)		
			*VPOR** (Veiledende plan for offentlige rom)*	VPOR for Ensjø*** (Veiledende plan for offentlige rom)	VPOR for Ensjø*** (Veiledende plan for offentlige rom)	*VPOR for Ensjø** (Veiledende plan for offentlige rom)*	*VPOR for Ensjø** (Veiledende plan for offentlige rom)*		
				VPOV*** (Veiledende prinsipplan for overvann)					
							Zoning plan for parts of Oslo's outer zone (S-2864)		
	Zoning plan (Regulerings plan)	Zoning plan (Regulerings plan)	Zoning plan (Regulerings plan)	Zoning plan (Regulerings plan)	Zoning plan (Regulerings plan)	Zoning plan (Regulerings plan)	Zoning plan (Regulerings plan)	Zoning plan (Regulerings plan)	Zoning plan**** (Regulerings plan)
									Detailed zoning plan (Detaljregul ering)
	Building permit application (Byggesak)	Building permit application (Byggesak)	Building permit application (Byggesak)	Building permit application (Byggesak)	Building permit application (Byggesak)	Building permit application (Byggesak)	Building permit application (Byggesak)	Building permit application (Byggesak)	Building permit application (Byggesak)
No.of cases	41	2	9	2	4	2	1	9	1
	52			**9**				**9**	**1**

* this instrument was introduced after the analysed cases were built and it included the cases in plans for future development. 'Planprogram' is a legally defined tool that provides the steps for implementation of a plan. This translation is adopted from the officials (Regjeringen.no, 2010), but it is misleading as there is another tool called 'planleggingsprogram' – planning programme (contained in P2 sets). A more suitable translation would be plan-programme.
** this instrument was introduced after the analysed cases were built and it included the cases in plans for future development; it is not prescribed by the law, but it was created and adopted locally in the planning system in Oslo
*** this instrument is not prescribed by the law, but it was created and adopted locally in the planning system in Oslo and applied in the analysed cases
**** this instrument was prescribed by PBL 1985, but it was identified in a case that was planned following PBL 2008

The first set of planning instruments, P1 consists of municipal master plan (in Norwegian, *kommuneplan* [KP]), district master plan (in Norwegian, *kommunedelplan* [KDP]), zoning plan (in Norwegian *reguleringsplan*), and building permit application (in Norwegian, *byggesak*) for an individual project. In a number of cases, it is noted that certain planning instruments were introduced after the projects were constructed, including them for future developments in the case area. These instruments are: planning programme (in Norweigan, *planprogram*; defining sub-type P1.1), which is an instrument legally defined in PBL2008, i.e. after the development of case projects, and guiding plan for public spaces (in Norwegian, *veiledende plan for offentlige rom* [VPOR]; defining sub-type P1.2), which is not part of the Norwegian Planning and Building Act but an instrument developed by the municipality of Oslo. However, these case projects had P1 set applied at the time of their development, so P1.1 and P1.2 are essentially equivalent to P1 type. (Table 4.) In one case, there is a reference to an old zoning plan, S-2255 (from 1977) which followed the planning legislation from 1965, later to be substituted by a "District master plan for the city centre" (KDP-13 in 1998). The zoning process of this case began at about the same time as the adoption of this plan (KDP-13), which included the case project, so this case has been classified into P1 type. This case illustrates the changes in the system, where one municipal plan builds up on its precedent.

In a number of cases, found in set P1, certain locally adopted and informal planning instruments have also been applied: "Report on housing development in areas close to transportation nods" (in Norwegian, "*Rapport om boligutvikling i stasjonsnære områder i Oslo*"), a "Municipal strategy – planning programme (1999)" (in Norwegian, "*Kommunale strategi – planprogram Drammensveien 154 (1999)*") and a "Plan for sustainable urban area development in Løren" (in Norwegian, "*Miljøby Løren. Rammer for en bymessig og miljøvennlig områdeutvikling*"; this plan was developed by Agency for Planning and Building Services of Oslo Municipality – PBE, but no details on the type of this plan were given in the documents). These instruments had a role in the later development of municipal master plans, district master plans and VPOR for Løren. The presence of these instruments among the analysed cases depicts the evolution of locally devised planning instruments in Oslo. In one case, *Green Poster* (in Norwegian, "*Grønn plakat*") was applied, which was a municipal instrument for handling the urban green structure and its values in the process of densification.

The second set of planning instruments, P2 consists of municipal master plan (KP), district master plan (KDP), Planning programme for Ensjø (in Norwegian, *Planleggingsprogram for Ensjø*), guiding plan for public spaces (VPOR), guiding principles for handling of storm water (in Norwegian, *veiledende prinsipplan for overvann* [VPOV]), zoning plan (in Norwegian, *reguleringsplan*), and building permit application (in Norwegian, *byggesak*) for an individual project. The sub-types of P2 are defined by the absence of one or two of the stated instruments, while each variant contains Planning programme for Ensjø and VPOR for Ensjø (introduced either at the time or after the zoning of cases). These two instruments make this set distinctive (see Table 1).

The third set of planning instruments, P3 comprises municipal master plan (KP), zoning plan (in Norwegian, *reguleringsplan*), and building permit application (in Norwegian, *byggesak*) for an individual project. Set P3 contains the lowest number of planning instruments identified in a set.

The fourth set of planning instruments, P4 is following the new law, PBL 2008, and consists of municipal planning strategy (in Norwegian, *kommunal planstrategi*), municipal master plan (KP), district master plan (KDP), detailed zoning plan (in Norwegian, *detaljregulering*), and building permit application (in Norwegian, *byggesak*) for an individual project. Set P4 was applied in only one case project. In this project, also a zoning plan was applied (*reguleringsplan*), even though this planning instrument was defined by the old law, PBL 1985.

Three types of sets, P1, P2 and P3, indicate differences in handling the case projects, primarily regarding the inputs for treating the different types of urban tissue through the design of new developments. In order to understand how planning instruments relate to the location in the urban built-up area of Oslo, a graphic presentation of the cases sorted by the procedural types has been made (Figures E1 and E1.1). Type P1 and its variations are unquestionably dominant, and at this stage it is possible to observe that the cases planned following this set of instruments are located in different areas of Oslo. In other words, this type has been applied in most interventions in Oslo, in different urban tissues and densities, not targeting any particular type of pre-existing urban tissue.

Discussion

In order to answer the posed question *What planning instruments are applied in the planning processes for individual interventions and do they address certain urban tissues?* the results from this part have been discussed relative to the results from paper II.

Upon integrating the results of the two analytical steps, it has become evident that the most prevalent set of planning instruments P1 (comprising KP, KDP, zoning plan and building permit application) and its varieties (P1.1. and P1.2) are employed in all types of constituted tissue and for all types of interventions (see Figure E1 and Table E2). Hence, this set is unspecific in relation to types of constituted tissue and the intervention types.

Planning instrument set P2 (comprising KP, KDP, Planning-programme for Ensjø, VPOR, VPOV, zoning plan and building permit application) covers mainly the constituted tissue of land-use transformation type and the transformation intervention type. This is expected, as it is a set that contains instruments specifically intended for the brownfield transformation area in Ensjø. This set contains types of instruments that are not part of PBL: Planning-programme for Ensjø, VPOR and VPOV.

Set P3 (including municipal master plan, zoning plan and building permit application) includes six cases, all of which are situated in mixed types of constituted tissue on the margins of Oslo's built-up area. All these cases represent infill types of intervention.

Set type P4 applies in only one case project, which is found insufficient for valid conclusions on the application of planning instruments belonging to PBL 2008.

The noticeable patterns are that the three planning instrument set types (P1, P2 and P3) are applied in different types of constituted tissue and in different intervention types at the

intermediate spatial scale (Table 2). Hence, the analysis shows that neither set of instruments presents sensitivity towards particular physical conditions of interventions (pre-existing urban tissue) nor is it specific towards the spatial results of interventions.

Nevertheless, the set type P2 can be considered an exception to a certain extent. A number of instruments contained in P2 were specifically created for intervening in a large segment of urban tissue undergoing land use transformation (Ensjø), even though these instruments also encompassed and provided guidelines for a number of infills in the Ensjø area. The set P2 thus presents a higher degree of consideration for the physical outputs compared to other planning instrument sets identified in this analysis. This could be partly explained by the planning instruments it contains, and the difference in the way P2 handles the physical outputs most probably lies in VPOR, which is an instrument that provides guidelines for physical planning of an area (mainly public open spaces). Another, possibly stronger reason for the higher presence of spatially related considerations in P2, could be that the interventions covered by this instrument set mostly deal with substitution of the pre-existing urban tissue, where streets and plot structures are largely preserved. In operative terms, this process resembles that of urban expansion, as planning is laid out on previously cleared sites and the urban tissue is treated to a much higher degree than it is in infills.

Along with the mentioned planning instruments, certain planning norms are also used in planning for densification. For instance, norms for outdoor areas in residential projects (in Norwegian, *utearealnormer*) (Oslo kommune, 2012) refer to the intermediate spatial scale and deal with the interface between built and open spaces in individual multi-family residential projects. These norms were also devised and used in Oslo informally (M. Boysen, personal communication, September 26, 2016) as they have not been legally adopted by the municipal authorities. Even though these norms are a useful tool for ensuring certain quantities and qualities, "norms for external areas do not contribute, for instance, to a successful localisation or acceptable development/content." (Thorén, Pløger, and Guttu, 2000 p.16) This observation indicates that planning instruments and norms alone are not sufficient in the task of planning, and that actors' expertise plays an important role in planning processes. Another finding that indicates the relevance of actors is the fact that one set of planning instruments can be applied in different types of constituted tissue (spatial contexts) and used in the processes that result in different spatial outputs (types of intervention).

In addition to relations between planning instruments and spatial results, this analysis depicts the evolution of the planning instruments in Oslo, both the formal and the informal ones. It reveals certain changes in the ways spatial aspects have been treated in the planning instruments. These changes are also observable in the new legislation, which introduced the instrument called "area zoning" (in Norwegian, *områderegulering*). It is a place-making device intended to address the transformation of a larger area and to cover the coordination of property and architectural functions, in order to achieve a coherent development in that area. Over the past several years, it has been combined with an instrument called "place analysis" (in Norwegian, *stedsanalyse*) which is used at the beginning of the zoning stage, prior to development of design proposal. However, this approach is not oriented toward particular constituted tissue and it does not have a standardised framework in terms of spatial scale it addresses. The application of area zoning, place analysis, VPOR and planning programme (in Norwegian, *planprogram*) comprise the "Oslo model", as public planners named it (Nyrnes, 2016), which makes Oslo a specific planning context within Norway.

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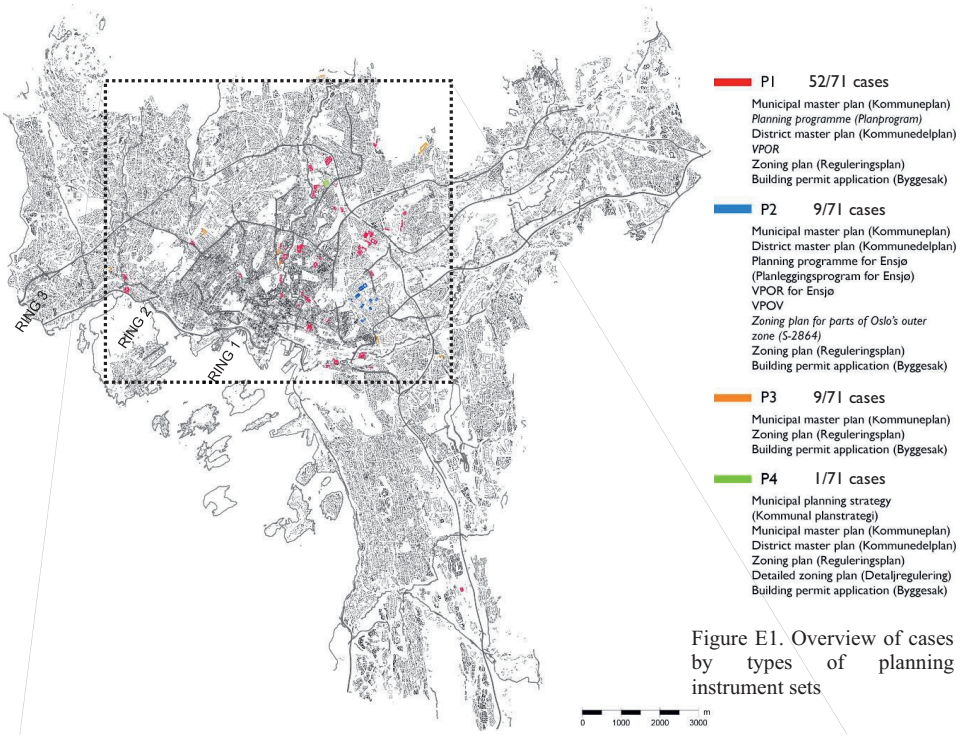


Figure E1. Overview of cases by types of planning instrument sets

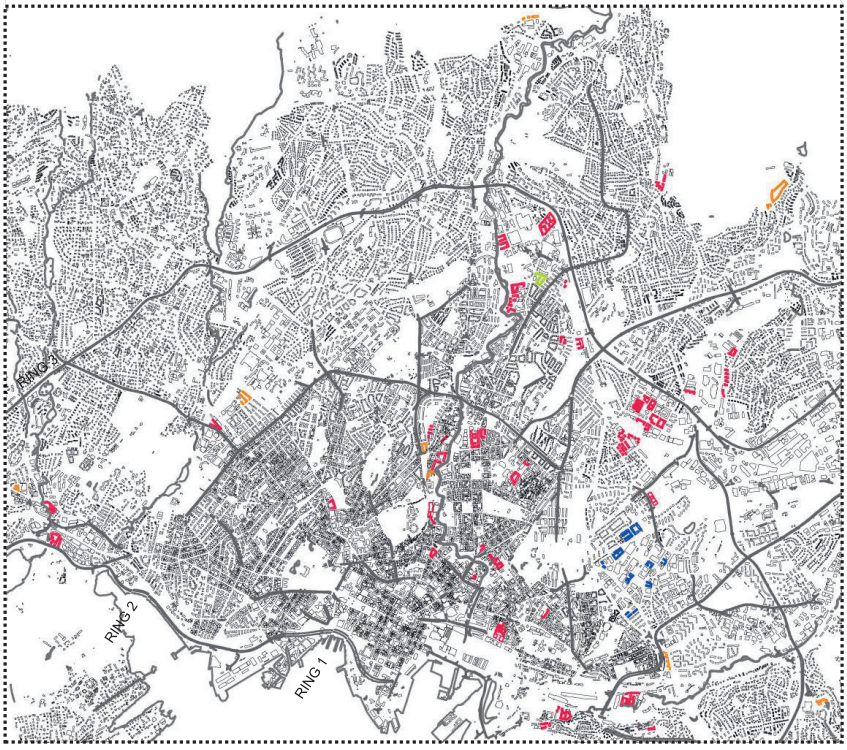


Figure E1.1. Section of the map with the highest concentration of cases (70/71)

Table E2. Sets of planning instruments identified in case projects presented relative to constituted tissue types and types of interventions

	CASE - address	PL. INSTR. SET Type	CONSTITUTED TISSUE Type	INTERVENTION Type
1	Alnagata 14-22	P1	MIXED 1	Infill & Infill-new urban block
2	Ekebergveien 5A-E	P1	MIXED 1	Infill
3	Hans Nielsen Hauges gate 29 A-D	P1	MIXED 1	Infill
4	Kingos gate 15-21	P1	MIXED 1	Infill
5	Grenseveien 50-58	P1	MIXED 2	Infill-new urban block
6	Økern Torgvei 5-7	P1	MIXED 5	Infill
7	Økern Torgvei 9A-K	P1	MIXED 5	Infill
8	Økernveien 196-218	P1	MIXED 5	Infill
9	Helga Vaneks vei 1-3	P1	MIXED 6	Infill-new urban block
10	Nydalen Allé 1-29	P1	MIXED 6	Infill-new urban block
11	Grefsenkollveien 14A-F	P1	MIXED 7	Infill-new urban block
12	Grefsenkollveien 16A-C	P1	MIXED 7	Infill
13	Konows gate 83A-C	P1	MIXED 7	Infill
14	Gunnar Schjelderups vei 11A-S	P1	MIXED 8	Infill-new urban block
15	Gunnar Schjelderups vei 13A-C,E	P1	MIXED 8	Infill-new urban block
16	Hans Nielsen Hauges gate 37 A-G	P1	MIXED 8	Infill-new urban block
17	Lillogata 2-18	P1	MIXED 8	Infill-new urban block
18	Lillogata 3A-D	P1	MIXED 8	Infill
19	Lillogata 5 A-S	P1	MIXED 8	Infill
20	Hans Nordahls gate 96-98	P1	MOD 1	Infill
21	Sørkedalsveien 7-11	P1	MOD 1	Infill
22	Waldemar Thranes gate 75-77	P1	TRAD 1	Infill
23	Waldemars hage 1-6 (building phase 1)	P1	TRAD 1	Infill-new urban block
24	Christian Krohgs gate 37-41	P1	TRAD 2	Infill
25	Eiriks gate 8-18	P1	TRAD 2	Infill
26	Gøteborggata 10-20	P1	TRAD 2	Infill-new urban block
27	Heimdalsgata 4-10	P1	TRAD 2	Infill
28	Herslebs gate 17-25	P1	TRAD 2	Infill
29	Lille Bislett 2-28	P1	TRAD 2	Infill
30	Maridalsveien 13A-T	P1	TRAD 2	Infill
31	Maridalsveien 15-21	P1	TRAD 2	Infill
32	Marstrandgata 1-7	P1	TRAD 2	Infill
33	Møllergata 44-58	P1	TRAD 2	Infill-new urban block
34	Rubina Ranas gate 1-9, 6-12	P1	TRAD 2	Infill
35	Sagveien 1-15, 19	P1	TRAD 2	Infill
36	Toftes gate 11-23	P1	TRAD 2	Infill
37	Toftes gate 2-12	P1	TRAD 2	Infill
38	Trondheimsveien 2D-G	P1	TRAD 2	Infill
39	Turbinveien 1-5	P1	TRANSF 1	Transformation
40	Turbinveien 4B-24	P1	TRANSF 1	Transformation
41	Turbinveien 7-13	P1	TRANSF 1	Transformation
42	Nedre Skøyen vei 4-16	P1.1	MIXED 4	Infill
43	Karenslyst Allé 40-50	P1.1	MIXED 6	Infill-new urban block
44	Frydenbergveien 50-60	P1.2	MIXED 4	Infill
45	Kanonhallveien 10-64	P1.2	TRANSF 1	Transformation
46	Kruttveien 1-15	P1.2	TRANSF 1	Transformation
47	Kruttveien 2-12	P1.2	TRANSF 1	Transformation
48	Spireaveien 12A-C	P1.2	TRANSF 1	Transformation
49	Leyrins gate 3-7	P1.2	TRANSF 2	Transformation
50	Lørenveien 41-43	P1.2	TRANSF 2	Transformation
51	Lørenveien 44A-C	P1.2	TRANSF 2	Transformation
52	Peter Møllers vei 5A-B	P1.2	TRANSF 2	Transformation
53	Gladengveien 15A-D	P2	TRANSF 2	Transformation
54	Gladengveien 4-6	P2	TRANSF 2	Transformation
55	Bertrand Narvesens vei 2-4	P2.1	TRANSF 1	Transformation
56	Ensjøveien 6A-B	P2.1	TRANSF 1	Infill
57	Malerhaugveien 34A-F	P2.1	TRANSF 1	Transformation
58	Sigurd Hoels vei 42-108	P2.1	TRANSF 1	Transformation
59	Rolf Hofmos gate 11-19	P2.2	MOD 1	Infill
60	Bertrand Narvesens vei 1-53	P2.2	TRANSF 1	Infill
61	Malerhaugveien 24-26	P2.3	TRANSF 1	Transformation
62	Gydas vei 16-34	P3	MIXED 1	Infill
63	Kingos gate 6-10	P3	MIXED 1	Infill
64	Biskop Jens Nilssøns gate 13-19	P3	MIXED 2	Infill
65	Østensjøveien 81A-G	P3	MIXED 2	Infill
66	Hoffsveien 6-12	P3	MIXED 3	Infill
67	Brekkeveien 10-16	P3	MIXED 5	Infill
68	Årvollveien 52-62	P3	MIXED 7	Infill-new urban block
69	Østreheimsveien 34-38	P3	MIXED 7	Infill
70	Maridalsveien 33G-M	P3	TRAD 2	Infill
71	Birch-Reichenwalds gate 2 A-F	P4	MIXED 1	Infill

Appendix F : List of questions used in the interviews

Questions for the interview about a particular case

Prior conditions of site

1. What was the use of the site before the development?
2. What public plans applied to the location at the time?

*About start meeting (*in Norwegian, *oppstartsmøte) and inputs by PBE*

3. What were the inputs about the built form that developer received from PBE in the beginning? (For example: building lines along the streets; heights of buildings; shape of roof/uppermost storey; BRA; number of dwellings; outdoor space(s) – shape, position, area/quantity; sunlight; parking; existing qualities (heritage); vegetation.)
4. Could any inputs concerning the physical form be found in the valid KDP(s) or former public plans?
5. Were those inputs followed until the final solution? If yes, how was it ensured?

Organisation of the project

6. What was the planned land use before the development? Was that use kept or changed?
7. Was it necessary to rearrange the property, plots (cadastral modification)?
8. Who were the actors (developers and architects)? Did the actors change during the process?

Project proposal – negotiations on built form

9. What built form was proposed initially? Was it approved or did you require modifications of the built form?
10. Why was a modification required, with what reasons and arguments? Did the requirements for change rely on KP or KDP or were they supported by goals of densification (and desired qualities)?
11. Regarding the built form proposals, what were developer's aims and arguments? Did architects have some other, different suggestions?
12. For the case in Ensjø land use transformation area: How was planning programme (in Norwegian, *planleggingsprogram*) used in the negotiations on built form? Could PBE use it as a way to make developers follow the general idea, e.g. to follow certain building lines? Or was it used in some other way?
13. What regulations and norms (both legally binding and professional) regarding the built forms were used?
14. Was outdoor space discussed and how? (In terms of: a) its connections to other open and green spaces; b) functions of areas, BRA, distances, heights/shades of buildings)
15. How did the parking solution come about? When was it decided?
16. Was "place analysis" (in Norwegian, *stedsanalyse*) required for this project?

Other questions about the case

17. How and when was local political level involved in the process?
18. Do you think this case is typical compared to others that you know? If not, what is different about it?

Planning approach for the case and its surroundings

19. Did you want the developer and designers to simply follow the rules and regulations concerning the site or did you tell the designers "we need you to design the buildings like this, because we have a vision/demands for the whole neighbourhood"?
20. What visions did you, the architects and the developer have concerning the future of the area that was being densified and the role of the new design proposal in the final idea of "compact city"/dense city? Did their proposal rely solely on the existing layout of the city?

Generally on planning

21. According to your experience, have the ways of negotiating in the zoning processes changed over time? Has public planners' room of action changed over time related to design of new physical forms, and if so, how and why?
22. Is "place analysis" (in Norwegian, *stedsanalyse*) obligatory now? How do you think it influences the zoning process and design?
23. Are there any questions regarding physical form that you find important that I have not included in this list?

Appendix G : Presentation of cases

71 cases are presented graphically, including basic description (as explained in Section 3.1.2.). The quantitative data of property areas, built areas and total built areas are approximated values.

The sources of images presented in each case presentation are as follows:

- upper right corner – author's own photographs
- lower right corner – © 2019 Oslo commune, Plan- og bygningsetaten, as found at kart.finn.no; rendered with permission of copyright owner.

Data sheets presenting case projects

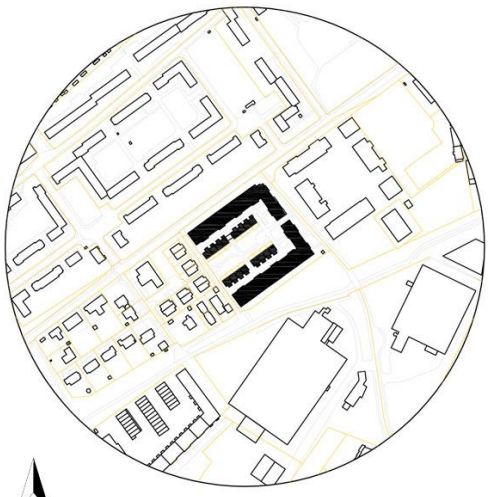
Case 1 Alnagata 14-18, Inges gate (2A-S, 4A-U, 6A-R, 8A-Q), Konows gate (22A-Q, 24A-J, 26A-T,28A-F, 30A-M), Alnagata (20A-V, 22A-U) (Baglerlunden Borettslag)

Timeframe	Start year: 2002 Completion year: 2006
Planning instruments	KP 2000, KDP 13, 4003 (2003)
Planning instrument set	P1
Position in urban tissue Constituted tissue type	Between ring roads 1 and 2 MIXED 1
Quantitative data	Number of buildings: 11 Number of storeys: 4–8 Property area: 15000 m2 Built area: 4450 m2 Total built area: 20925 m2

Aerial view of the site (2019)

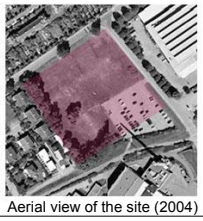
Aerial view of the site (2001)

Case 2: Bertrand Narvesens vei 1-53



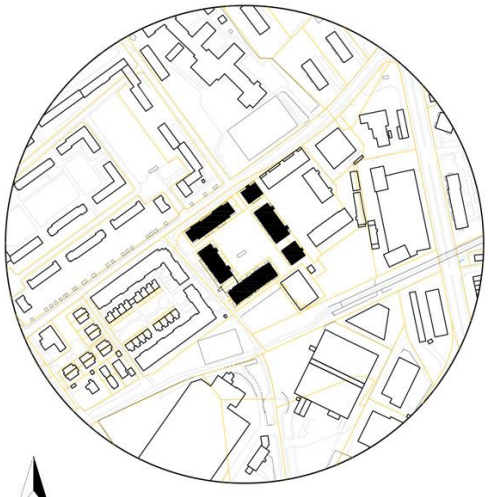
Timeframe	Start year: 2005 Completion year: 2008
Planning instruments	KP 2000, KDP 13, Planleggingsprogram for Ensjø, S-4157 (2005)
Planning instrument set	P2
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 5 Number of storeys: 2–5 Property area: 11800 m2 Built area: 4570 m2 Total built area: 19350 m2

Aerial view of the site (2019)



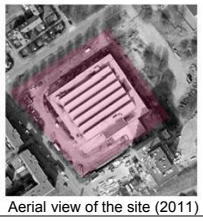
Aerial view of the site (2004)

Case 3: Bertrand Narvesens vei (2A-B, 4A-C), Hovinveien 37A-D



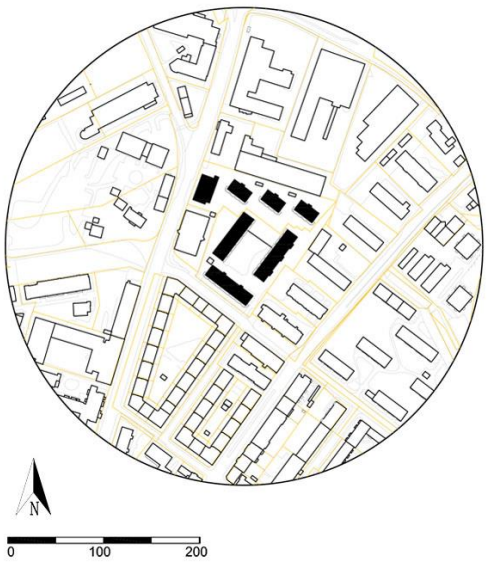
Timeframe	Start year: 2010 Completion year: 2013
Planning instruments	KP 2000, KDP 13, Planleggingsprogram for Ensjø, S-4411 (2008)
Planning instrument set	P2
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 6 Number of storeys: 5 Property area: 9700 m2 Built area: 3560 m2 Total built area: 17800 m2

Aerial view of the site (2019)



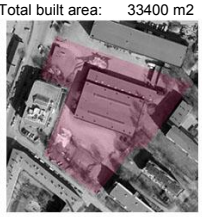
Aerial view of the site (2011)

Case 4: Birch-Reichenwalds gate 2 A-F, Sandakerveien 101A-F (Lillohagen)



Timeframe	Start year: 2010 Completion year: 2012
Planning instruments	KP 2008, KDP 17, S-4524 (2010)
Planning instrument set	P4
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	MIXED 1
Quantitative data	Number of buildings: 7 Number of storeys: 6–8 Property area: 14000 m2 Built area: 3600 m2 Total built area: 33400 m2

Aerial view of the site (2019)

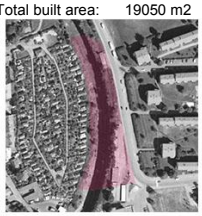


Aerial view of the site (2010)

Case 5: Biskop Jens Nilssøns gate 13A-B, 15A-B, 17A-B, 19A-B (Vålen borettslag)

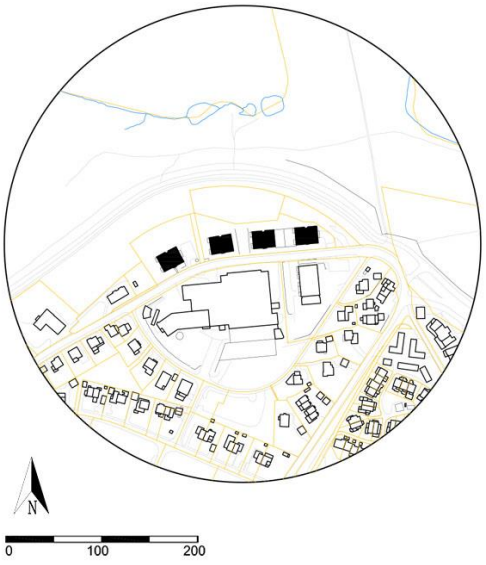
Timeframe	Start year: 2001 Completion year: 2004
Planning instruments	KP 1984, S-3160 (1990)
Planning instrument set	P3
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 2
Quantitative data	Number of buildings: 7 Number of storeys: 6–7 Property area: 11065 m2 Built area: 2930 m2 Total built area: 19050 m2

Aerial view of the site (2019)



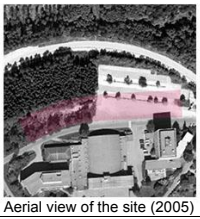
Aerial view of the site (2001)

Case 6: Brekkeveien 10-16 (Brekkedammen)



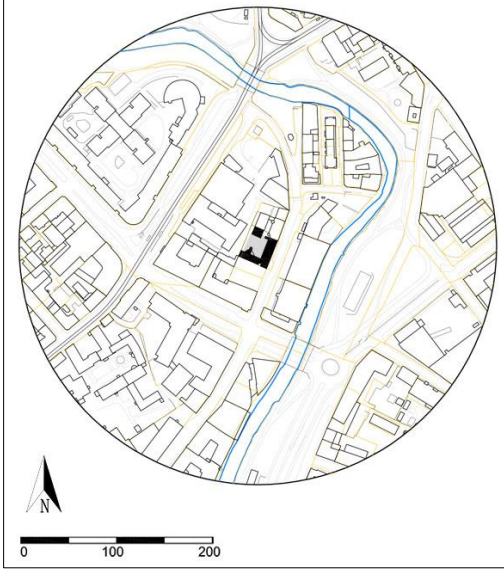
Timeframe	Start year: 2007 Completion year: 2011
Planning instruments	KP 2004, S-4282 (2006)
Planning instrument set	P3
Position in urban tissue	Outside ring road 3
Constituted tissue type	MIXED 5
Quantitative data	Number of buildings: 4 Number of storeys: 4–6 Property area: 8000 m2 Built area: 1650 m2 Total built area: 8650 m2

Aerial view of the site (2019)



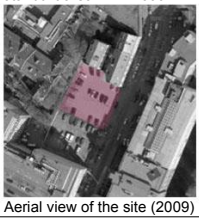
Aerial view of the site (2005)

Case 7: Christian Krohgs gate 37, 39A-H, 41



Timeframe	Start year: 2008 Completion year: 2011
Planning instruments	KP 2004, KDP 13, KDP Akerselva Miljøpark, KDP Trafikkplan for indre by, S-4347 (2007)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 2 Number of storeys: 5–6 Property area: 1170 m2 Built area: 1100 m2 Total built area: 4000 m2

Aerial view of the site (2019)

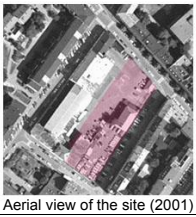


Aerial view of the site (2009)

Case 8: Eiriks gate 8-18

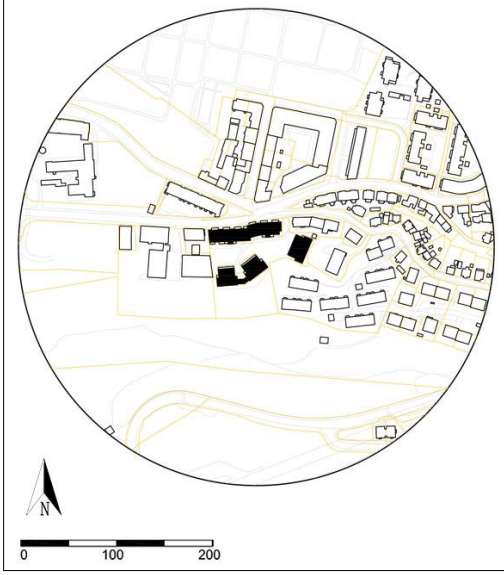
Timeframe	Start year: 2002 Completion year: 2004
Planning instruments	KP 2000, KDP for indre Oslo (1998), S-3873 (2001)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 1 Number of storeys: 6 Property area: 3400 m2 Built area: 1700 m2 Total built area: 10000 m2

Aerial view of the site (2019)



Aerial view of the site (2001)

Case 9: Ekebergveien 5A-E, Konowsgate 9

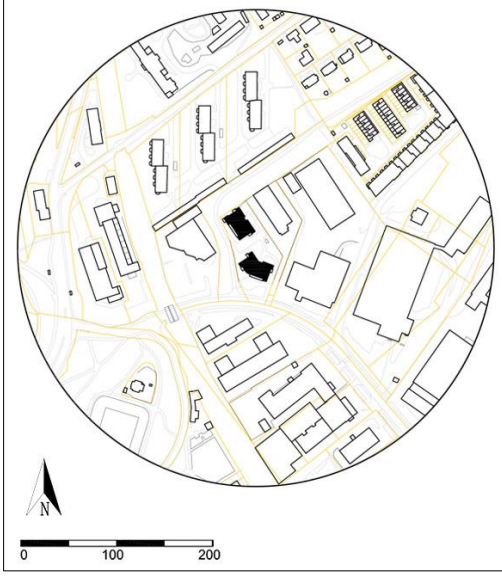


Timeframe	Start year: 2007 Completion year: 2008
Planning instruments	KP 2000, KDP for indre Oslo (1998), S-4114 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	MIXED 1
Quantitative data	Number of buildings: 4 Number of storeys: 5–9 Property area: 7750 m2 Built area: 2220 m2 Total built area: 17500 m2

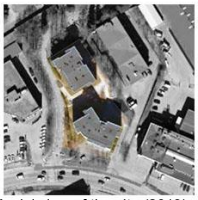
Aerial view of the site (2019)

Aerial view of the site (2004)

Case 10: Ensjøveien 6A & 6B



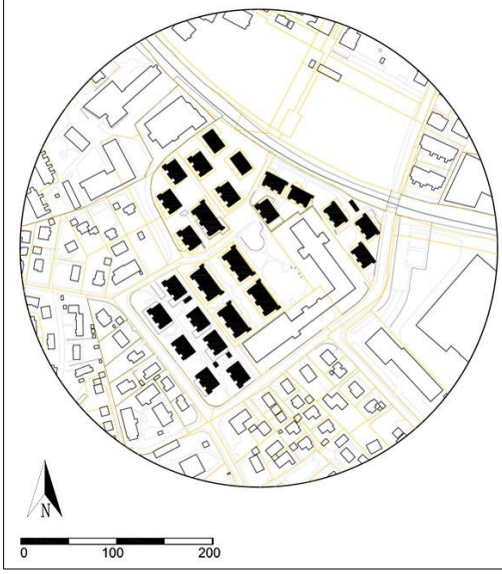
Timeframe	Start year: 2006 Completion year: 2008
Planning instruments	KP 2000, Planleggingsprogram for Ensjø, S-4224 (2006)
Planning instrument set	P2
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 2 Number of storeys: 5–7 Property area: 4000 m2 Built area: 1040 m2 Total built area: 6300 m2



Aerial view of the site (2019)

Aerial view of the site (2004)

Case 11: Frydenbergveien 50-60, Seljeveien 1-37

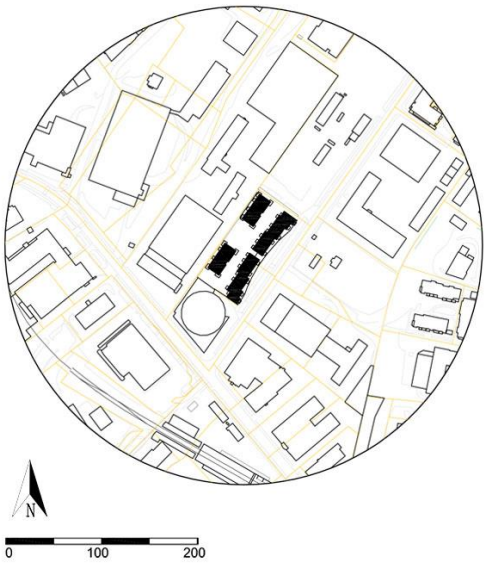


Timeframe	Start year: 2006 Completion year: 2008
Planning instruments	KP 2000, KDP 13 (1998), S-4084 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 4
Quantitative data	Number of buildings: 25 Number of storeys: 4–7 Property area: 37000 m2 Built area: 9400 m2 Total built area: 51000 m2

Aerial view of the site (2019)

Aerial view of the site (2004)

Case 12: Gladengveien 4 A-J, 6 A-F

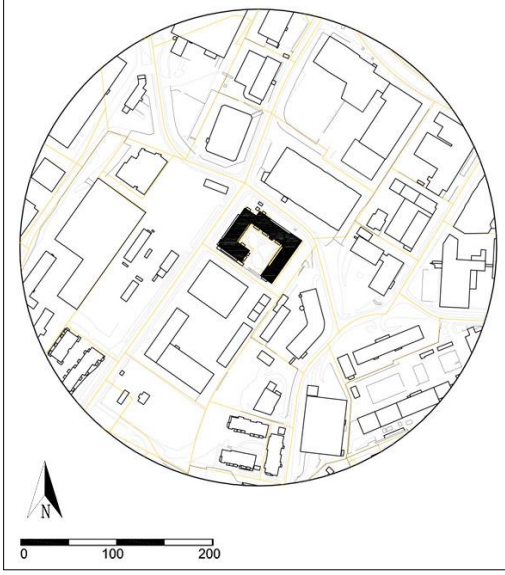


Timeframe	Start year: 2010
	Completion year: 2012
Planning instruments	KP 2004, VPOR Ensjø, VPOV Planleggingsprogram for Ensjø, KDP for lokalisering av varehandel og andre servicefunksjoner, S-4317 (2007)
Planning instrument set	P2
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 2
Quantitative data	Number of buildings: 2
	Number of storeys: 6–7
	Property area: 6660 m2
	Built area: 5460 m2
	Total built area: 20000 m2


Aerial view of the site (2019)

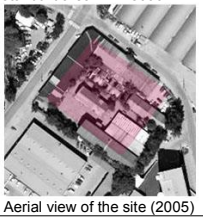

Aerial view of the site (2008)

Case 13: Gladengveien 15A-D



Timeframe	Start year: 2007
	Completion year: 2012
Planning instruments	KP 2004, VPOR Ensjø, VPOV Planleggingsprogram for Ensjø, KDP for lokalisering av varehandel og andre servicefunksjoner, S-4317 (2007)
Planning instrument set	P2
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 2
Quantitative data	Number of buildings: 1
	Number of storeys: 6–7
	Property area: 7450 m2
	Built area: 3700 m2
	Total built area: 18000 m2


Aerial view of the site (2019)


Aerial view of the site (2005)

Case 14: Gøteborggata 10A-D, 12A-H, 14A-J,16-20, Malmøgata 2-4, Stockholmgata 5-7 (Konfektfabrikken)

Timeframe	Start year: 2011 Completion year: 2012
Planning instruments	KP 2004, KDP for indre Oslo (1998), S-4482 (2009)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 2 Number of storeys: 5 Property area: 9100 m2 Built area: 4800 m2 Total built area: 24000 m2

Aerial view of the site (2019)

Aerial view of the site (2010)

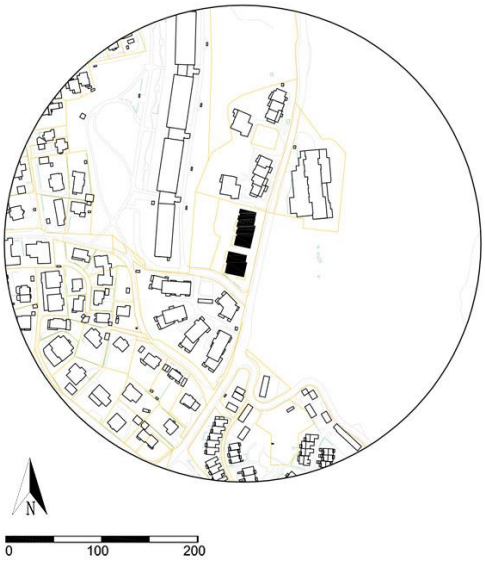
Case 15: Grefsenkollveien 14A-F

Timeframe	Start year: 2007 Completion year: 2010
Planning instruments	KP 2004, KDP for grøntstrukturen, S-4282 (2006)
Planning instrument set	P1
Position in urban tissue	Outside ring road 3
Constituted tissue type	MIXED 7
Quantitative data	Number of buildings: 5 Number of storeys: 3–7 Property area: 8800 m2 Built area: 2320 m2 Total built area: 9040 m2

Aerial view of the site (2019)

Aerial view of the site (2004)

Case 16: Grefsenkollveien 16A-C

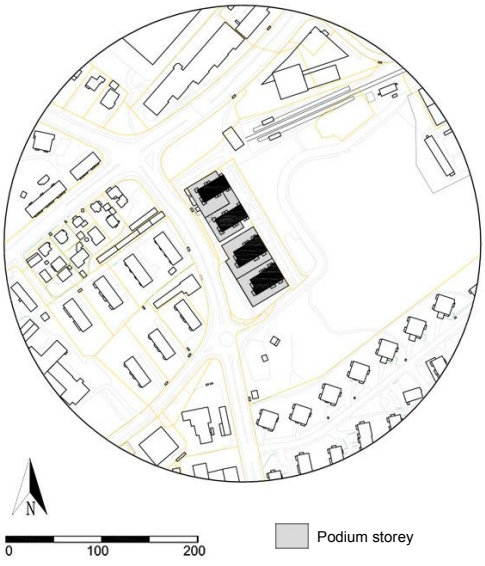


Timeframe	Start year: 2008 Completion year: 2011
Planning instruments	KP 2000, KDP for grøntstrukturen, S-4182 (2005)
Planning instrument set	P1
Position in urban tissue	Outside ring road 3
Constituted tissue type	MIXED 7
Quantitative data	Number of buildings: 2 Number of storeys: 6–7 Property area: 3600 m2 Built area: 1100 m2 Total built area: 7150 m2

Aerial view of the site (2019)

Aerial view of the site (2009)

Case 17: Grenseveien 50-58



Timeframe	Start year: 2004 Completion year: 2006
Planning instruments	KP 2000, KDP 13, S-4065 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 2
Quantitative data	Number of buildings: 4 Number of storeys: 7–9 Property area: 7900 m2 Built area: 5550 m2 Total built area: 26100 m2

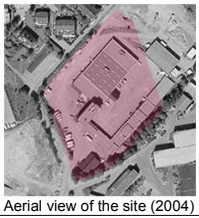
Aerial view of the site (2019)

Aerial view of the site (2003)

Case 18: Gunnar Schjelderups vei 11A-S

Timeframe	Start year: 2004 Completion year: 2006
Planning instruments	KP 2000, KDP 3, S-4053 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 8
Quantitative data	Number of buildings: 6 Number of storeys: 6–7 Property area: 18900 m2 Built area: 5260 m2 Total built area: 35000 m2


Aerial view of the site (2019)


Aerial view of the site (2004)

Case 19: Gunnar Schjelderups vei 13A-C, E

Timeframe	Start year: 2004 Completion year: 2006
Planning instruments	KP 2000, KDP 3, S-4053 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 8
Quantitative data	Number of buildings: 2 Number of storeys: 6–9 Property area: 9430 m2 Built area: 3800 m2 Total built area: 28500 m2

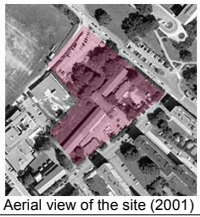

Aerial view of the site (2019)


Aerial view of the site (2004)

Case 20: Gydas vei 16-34, Suhms gate 24-34 (Marienlyst park)

Timeframe	Start year: 2001 Completion year: 2004
Planning instruments	KP 1996, S-3802 (1999)
Planning instrument set	P3
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 1
Quantitative data	Number of buildings: 5 Number of storeys: 7 Property area: 13600 m2 Built area: 3900 m2 Total built area: 27300 m2

Aerial view of the site (2019)



Aerial view of the site (2001)

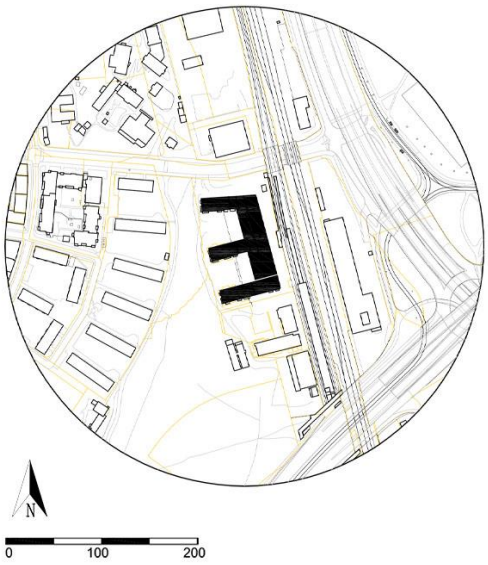
Case 21: Hans Nielsen Hauges gate 29 A-D, Kyrre Grepps gate 19 A-B, Roveruds gate 12

Timeframe	Start year: 2003 Completion year: 2005
Planning instruments	KP 2000, KDP for indre Oslo (1998), S-3970 (2003)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 1
Quantitative data	Number of buildings: 2 Number of storeys: 5–7 Property area: 5900 m2 Built area: 3500 m2 Total built area: 10440 m2

Aerial view of the site (2019)

Aerial view of the site (2001)

Case 22: Hans Nielsen Hauges gate 37 A-G (Sinsen Torg/Torshovdalen)

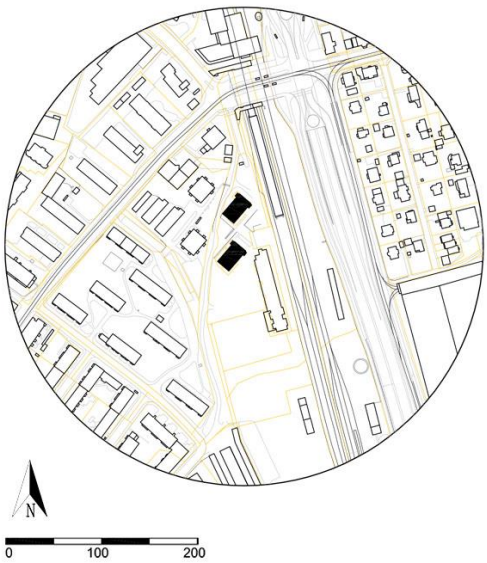


Timeframe	Start year: 2010 Completion year: 2011
Planning instruments	KP 2004, KDP for byutvikling og bevaring i indre Oslo 2005–2020, S-4491 (2010)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 8
Quantitative data	Number of buildings: 4 Number of storeys: 3–9 Property area: 10500 m2 Built area: 3600 m2 Total built area: 20700 m2

Aerial view of the site (2019)

Aerial view of the site (2010)

Case 23: Hans Nordahls gate 96A-B, 98A-B

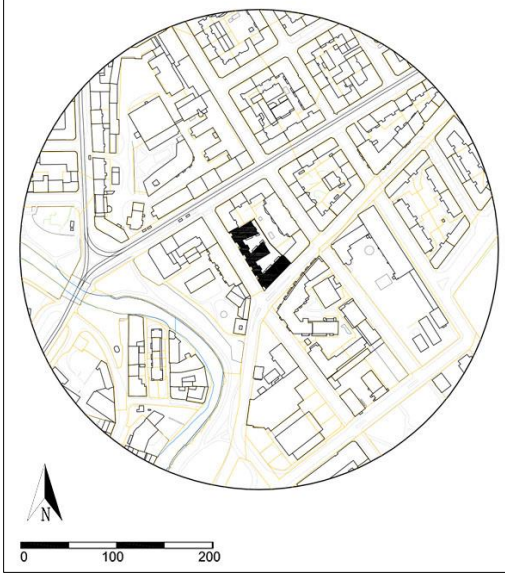


Timeframe	Start year: 2010 Completion year: 2013
Planning instruments	KP 2004, KDP for indre Oslo (1998), S-4360 (2008)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MOD 1
Quantitative data	Number of buildings: 2 Number of storeys: 12 Property area: 6900 m2 Built area: 880 m2 Total built area: 10560 m2

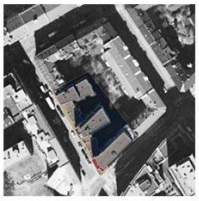
Aerial view of the site (2019)

Aerial view of the site (2011)

Case 24: Heimdalsgata 4-10A-B

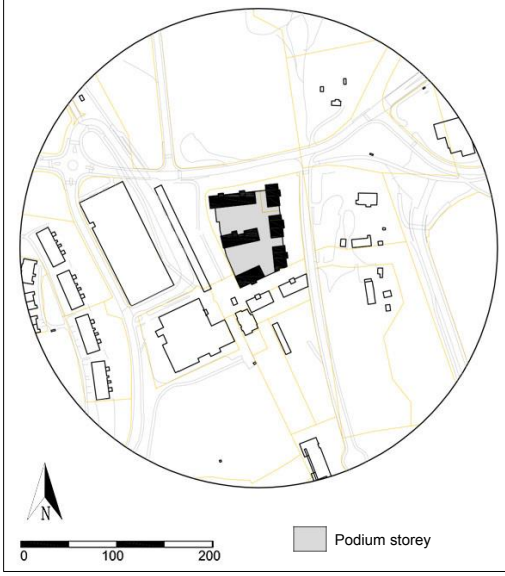


Timeframe	Start year: 2004 Completion year: 2006
Planning instruments	KP 2000, KDP for indre by (1998), S-4098 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 1
Quantitative data	Number of buildings: 5 Number of storeys: 2–7 Property area: 2200 m2 Built area: 1280 m2 Total built area: 8000 m2


Aerial view of the site (2019)


Aerial view of the site (2004)

Case 25: Helga Vaneks vei 1 A-J, 3 A-G (Mortensrud Torg)

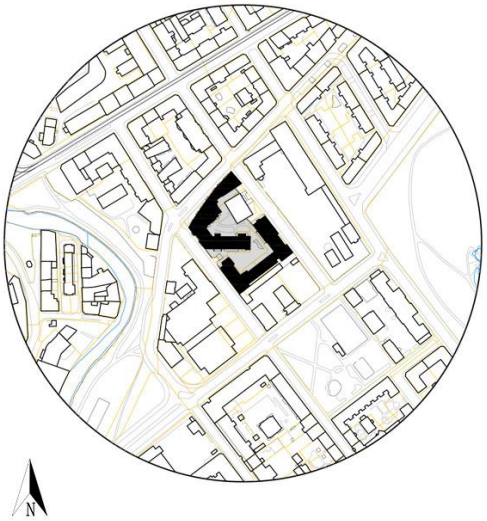


Timeframe	Start year: 2009 Completion year: 2013
Planning instruments	KP 2004, KDP 12, KDP 7, KDP 14, KDP 8, S-4441 (2009)
Planning instrument set	P1
Position in urban tissue	Outside ting road 3
Constituted tissue type	MIXED 6
Quantitative data	Number of buildings: 6 Number of storeys: 4–5 Property area: 8730 m2 Built area: 5870 m2 Total built area: 12300 m2


Aerial view of the site (2019)

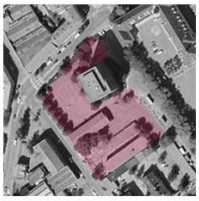

Aerial view of the site (2009)

Case 26: Herslebs gate 17A-C, 21-25, Lakkegata 65, 67A-B



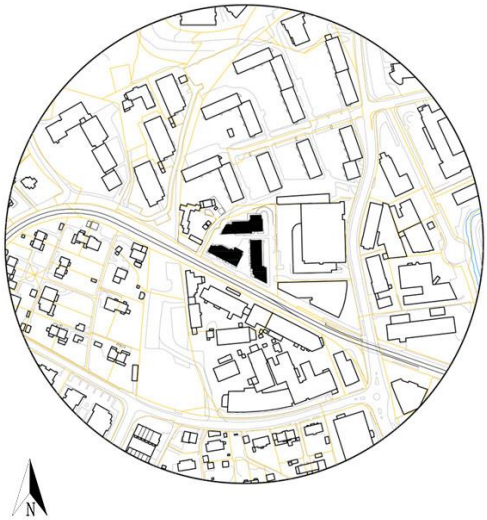
Timeframe	Start year: 2005 Completion year: 2007
Planning instruments	KP 2000, KDP for indre by (1998), S-4162 (2005)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 2 Number of storeys: 5–7 Property area: 6500 m2 Built area: 6450 m2 Total built area: 16000 m2

Aerial view of the site (2019)



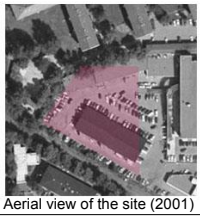
Aerial view of the site (2004)

Case 27: Hoffsveien 6A-G, 8A-D, 12A-F (Skøyenhagen)



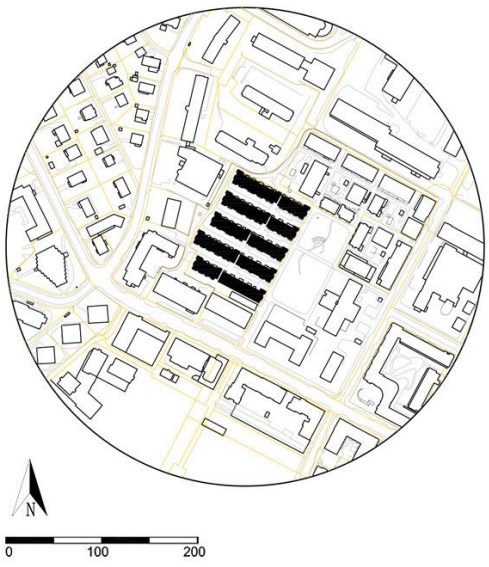
Timeframe	Start year: 2002 Completion year: 2005
Planning instruments	KP 2000, S-4080 (2004)
Planning instrument set	P3
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 3
Quantitative data	Number of buildings: 3 Number of storeys: 4–6 Property area: 4800 m2 Built area: 1430 m2 Total built area: 6700 m2

Aerial view of the site (2019)



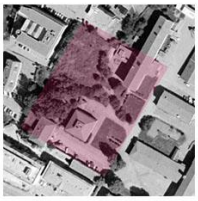
Aerial view of the site (2001)

Case 28: Kanonhallveien (10A-J, 12A-E, 14A-N, 16A-F, 18A-C, 20A-L, 22A-F, 24A-P, 26A-H, 28A-B, 30A-G, 32A-E, 34A-L, 36A-K, 38A-F, 40A-B, 42A-E, 44A-G, 46A-J, 48A-K, 50A-H, 52A-B, 54A-E, 56A-G, 58A-J, 60A-K, 62A-H, 64A-B)



Timeframe	Start year: 2004 Completion year: 2005
Planning instruments	KP 2000, KDP for indre by (1998), S-4083 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 10 Number of storeys: 3–5 Property area: 10900 m2 Built area: 4850 m2 Total built area: 19800 m2

Aerial view of the site (2019)

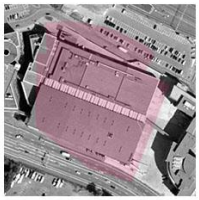


Aerial view of the site (2003)

Case 29: Karenslyst Allé 40-50 (Skøyen torget borettslag), Messepromenaden 1-11 and 2-10, Hoffselvpromenaden 2-4 (Sjølyststranda)

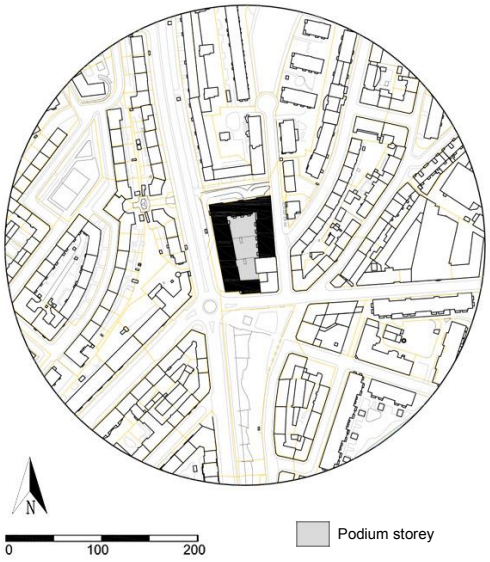
Timeframe	Start year: 2002 Completion year: 2005
Planning instruments	KP 2000, KDP 9, KDP 1 S-4083 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 6
Quantitative data	Number of buildings: 7 Number of storeys: 8–9 Property area: 18600 m2 Built area: 5400 m2 Total built area: 46000 m2

Aerial view of the site (2019)



Aerial view of the site (2001)

Case 30: Kingos gate 6-10, Landstads gate 2, Uelands gate 51-55, Waldemar Thranes gate 72 (Kiellandshus)

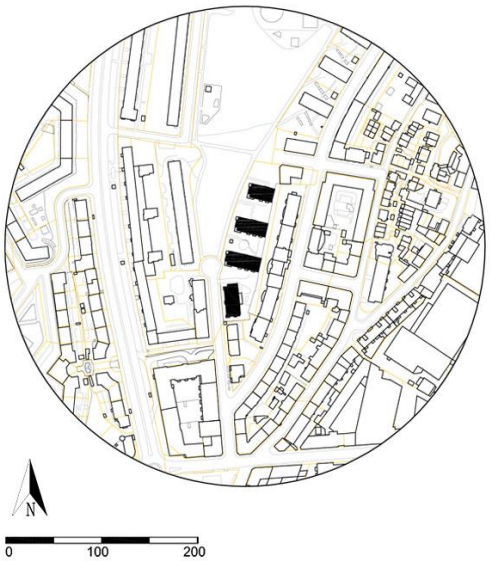


Timeframe	Start year: 2002 Completion year: 2006
Planning instruments	KP 1996, S-3110 (1989)
Planning instrument set	P3
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	MIXED 1
Quantitative data	Number of buildings: 1 Number of storeys: 6–7 Property area: 5100 m2 Built area: 5100 m2 Total built area: 25800 m2

Aerial view of the site (2019)

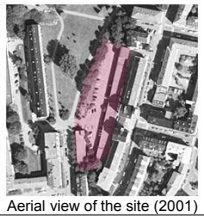
Aerial view of the site (2004)

Case 31: Kingos gate 15-21



Timeframe	Start year: 2003 Completion year: 2005
Planning instruments	KP 2000, KDP for indre Oslo (1998), S-4002 (2002)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	MIXED 1
Quantitative data	Number of buildings: 4 Number of storeys: 7 Property area: 6700 m2 Built area: 1800 m2 Total built area: 12500 m2

Aerial view of the site (2019)



Aerial view of the site (2001)

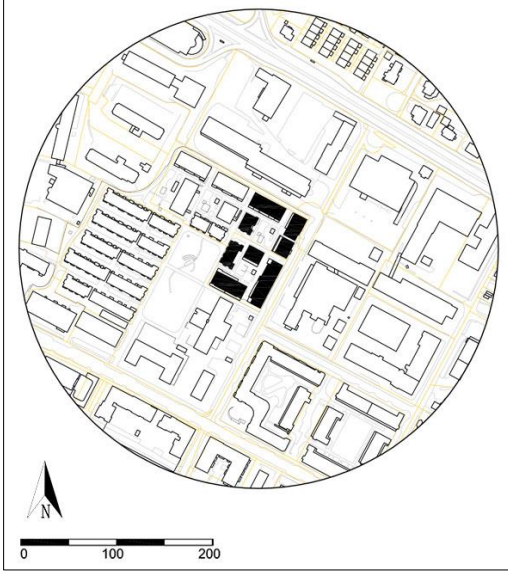
Case 32: Konows gate 83A-C

Timeframe	Start year: 2008 Completion year: 2011
Planning instruments	KP 2000, KDP for indre Oslo (1998), S-4136 (2005)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 7
Quantitative data	Number of buildings: 3 Number of storeys: 6–7 Property area: 6030 m2 Built area: 2050 m2 Total built area: 10000 m2

Aerial view of the site (2019)

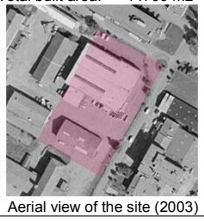
Aerial view of the site (2009)

Case 33: Kruttveien (1A-B, 3A-D, 5A-B, 7A-D, 9, 11A-C, 13A-C, 15A-C), Petter Møllers vei (4A-B, 6A-B), Børsteveien (2A-B)



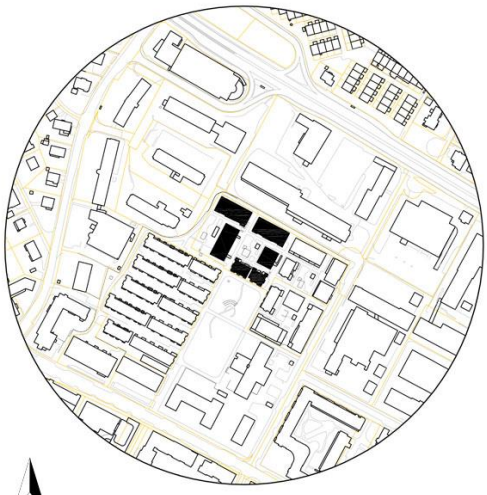
Timeframe	Start year: 2005 Completion year: 2007
Planning instruments	KP 2000, KDP for indre by (1998), S-4083 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 7 Number of storeys: 3–8 Property area: 6800 m2 Built area: 3200 m2 Total built area: 14700 m2

Aerial view of the site (2019)



Aerial view of the site (2003)

Case 34: Kruttveien (2A-E, 4A-B, 6A-E, 8A-E, 10A-D, 12), Børsteveien (4A-B, 6A-B), Kanonhallveien 66A-B

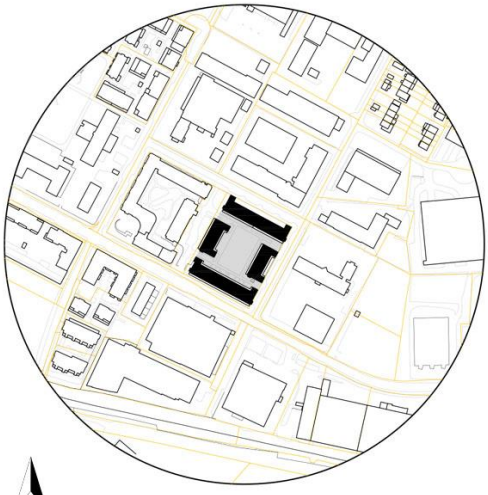


Timeframe	Start year: 2005 Completion year: 2007
Planning instruments	KP 2000, KDP for indre by (1998), S-4083 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 6 Number of storeys: 3–8 Property area: 6000 m2 Built area: 2500 m2 Total built area: 16400 m2

Aerial view of the site (2019)

Aerial view of the site (2003)

Case 35: Leyrins gate 3, 5A-E, 7, Lørenveien 46, 48A-K, 50, Lørenvangen 18-20, Vekslerveien 5-7

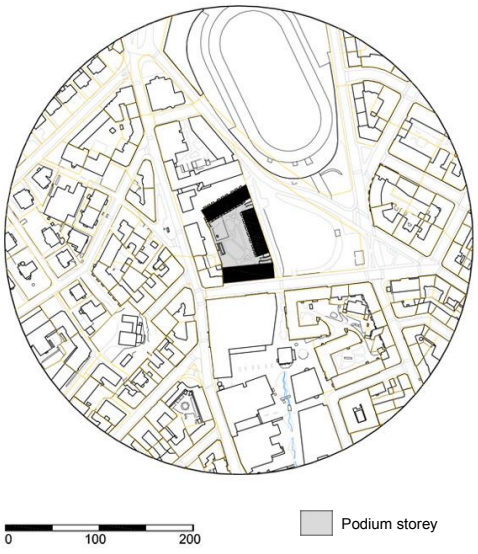


Timeframe	Start year: 2005 Completion year: 2008
Planning instruments	KP 2004, KDP 15 S-4189 (2005)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 2
Quantitative data	Number of buildings: 4 Number of storeys: 4–6 Property area: 7400 m2 Built area: 6300 m2 Total built area: 21800 m2

Aerial view of the site (2019)

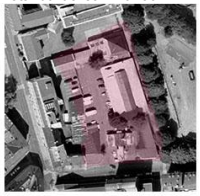
Aerial view of the site (2004)

Case 36: Lille Bislett 2-26



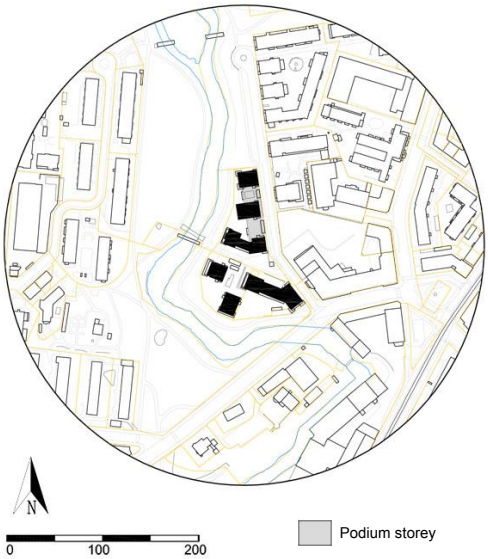
Timeframe	Start year: 2005 Completion year: 2007
Planning instruments	KP 1991,KDP 13, S-4124
Planning instrument set (2004)	P1
Position in urban tissue	Between ring road 1 and ring road 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 3 Number of storeys: 5–7 Property area: 5000 m2 Built area: 5000 m2 Total built area: 19400 m2

Aerial view of the site (2016)



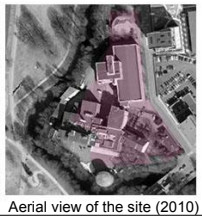
Aerial view of the site (2004)

Case 37: Lillogata 2-6, 8A-B, 10-18 (Idun)



Timeframe	Start year: 2010 Completion year: 2012
Planning instruments	KP 2004, KDP 4, KDP 13 S-4488 (2009)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 8
Quantitative data	Number of buildings: 6 Number of storeys: 6–8 Property area: 8000 m2 Built area: 4900 m2 Total built area: 19850 m2

Aerial view of the site (2019)



Aerial view of the site (2010)

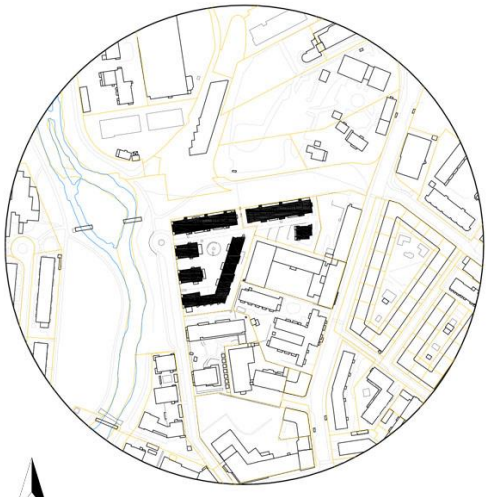
Case 38: Lillogata 3A-D

Timeframe	Start year: 2007 Completion year: 2009
Planning instruments	KP 2004, KDP 4, KDP for indre Oslo, S-4325 (2007)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 8
Quantitative data	Number of buildings: 2 Number of storeys: 6–8 Property area: 4330 m2 Built area: 3700 m2 Total built area: 16050 m2

Aerial view of the site (2019)

Aerial view of the site (2008)

Case 39: Lillogata 5 A-S (Elvebredden)



Timeframe	Start year: 2002 Completion year: 2004
Planning instruments	KP 2000, KDP 4, KDP for indre Oslo, S-3904 (2002)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 8
Quantitative data	Number of buildings: 6 Number of storeys: 6–8 Property area: 10600 m2 Built area: 7400 m2 Total built area: 34400 m2

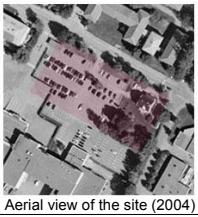
Aerial view of the site (2019)

Aerial view of the site (2008)

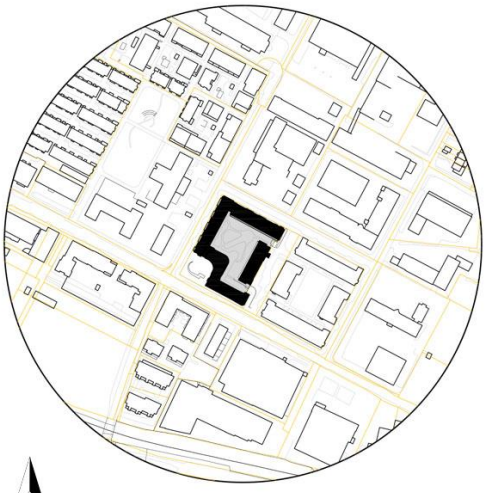
Case 40: Lørenveien 41 A-G, 43 A-C (Lørenlunden- see brochure; part is still under construction)

Timeframe	Start year: 2009 Completion year: 2012
Planning instruments	KP 2000, KDP 13 (1998) S-4129 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 2
Quantitative data	Number of buildings: 2 Number of storeys: 4–7 Property area: 7800 m2 Built area: 1750 m2 Total built area: 11600 m2

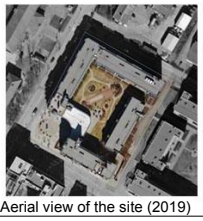

Aerial view of the site (2019)


Aerial view of the site (2004)

Case 41: Lørenveien 44A-C, Vekslerveien 1, Leyrinsgate 2 (Løren Torg)

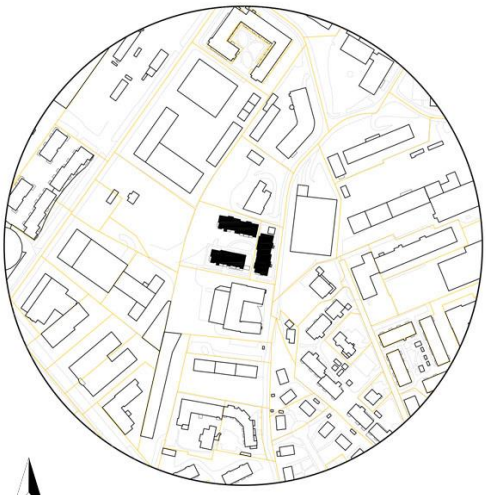


Timeframe	Start year: 2005 Completion year: 2008
Planning instruments	KP 2004, KDP for Økern, S-4189 (2005)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 2
Quantitative data	Number of buildings: 2 Number of storeys: 2–6 Property area: 6400 m2 Built area: 5900 m2 Total built area: 17900 m2

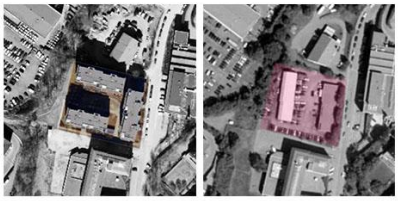

Aerial view of the site (2019)


Aerial view of the site (2004)

Case 42: Malerhaugveien 24A-B, 26A-D



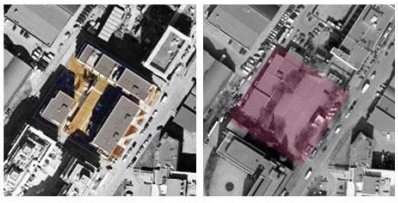
Timeframe	Start year: 2001 Completion year: 2004
Planning instruments	KP 2000, KDP for indre Oslo (1998), Planleggingsprogram for Ensjø, S-3865 (2001)
Planning instrument set	P2
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 3 Number of storeys: 6–7 Property area: 6400 m2 Built area: 2700 m2 Total built area: 12600 m2



Aerial view of the site (2019) Aerial view of the site (2007)

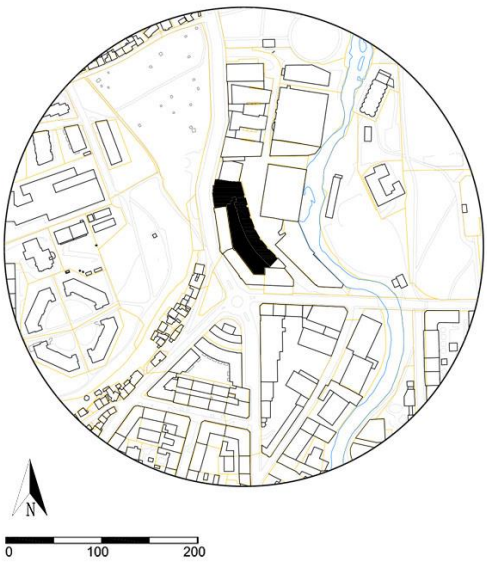
Case 43: Malerhaugveien 34A-F

Timeframe	Start year: 2008 Completion year: 2013
Planning instruments	KP 2004, KDP for indre Oslo (1998), Planleggingsprogram for Ensjø, S-4140 (2005)
Planning instrument set	P2
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 3 Number of storeys: 5 Property area: 5300 m2 Built area: 3370 m2 Total built area: 9500 m2



Aerial view of the site (2019) Aerial view of the site (2011)

Case 44: Maridalsveien 13A-T, Vulkan 8-24

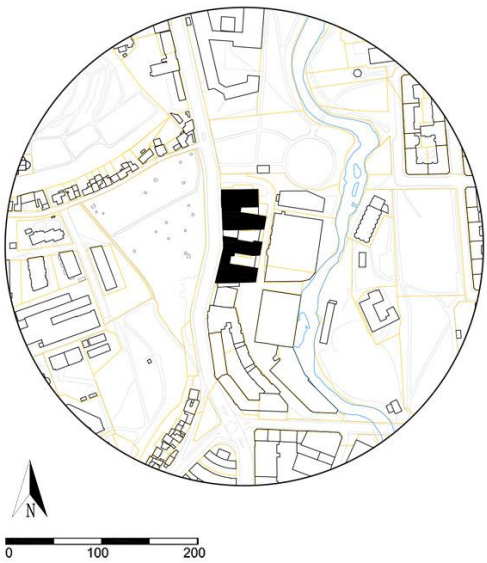


Timeframe	Start year: 2008 Completion year: 2011
Planning instruments	KP 2004, KDP for indre Oslo (1998), KDP 4, S-4268 (2006)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 1 Number of storeys: 5–9 Property area: 3500 m2 Built area: 3500 m2 Total built area: 15300 m2


Aerial view of the site (2019)


Aerial view of the site (2009)

Case 45: Maridalsveien (15A-F, 17-21), Vulkan 28-42

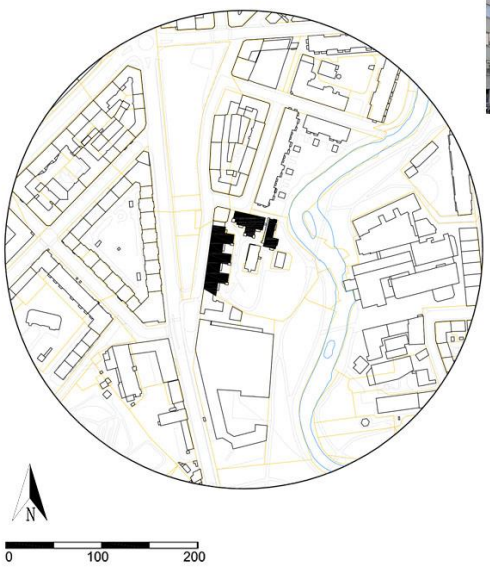


Timeframe	Start year: 2010 Completion year: 2012
Planning instruments	KP 2004, KDP for indre Oslo (1998), KDP 4, S-4268 (2006)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 2 Number of storeys: 3–8 Property area: 4250 m2 Built area: 3700 m2 Total built area: 15000 m2


Aerial view of the site (2019)

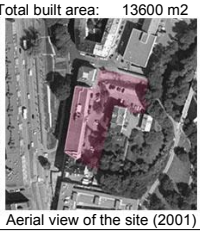

Aerial view of the site (2011)

Case 46: Maridalsveien 33G-M, Hauchs gate 1-7, 9A-V



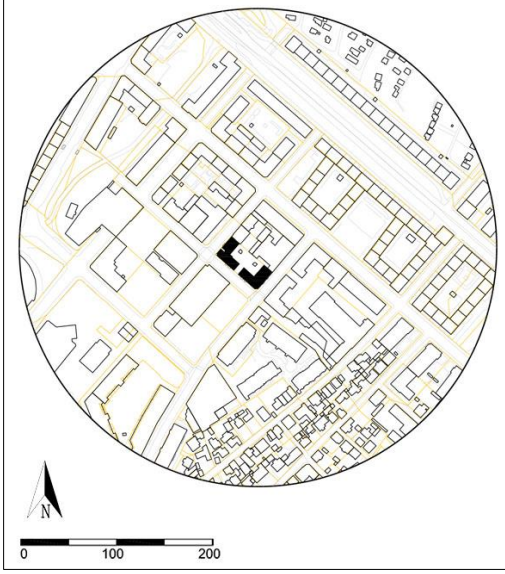
Timeframe	Start year: 2001 Completion year: 2004
Planning instruments	KP 1984, S-3062 (1989)
Planning instrument set	P3
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 3 Number of storeys: 6–7 Property area: 10000 m2 Built area: 2050 m2 Total built area: 13600 m2

Aerial view of the site (2019)

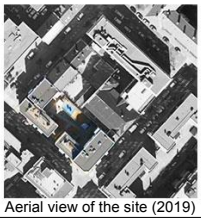


Aerial view of the site (2001)

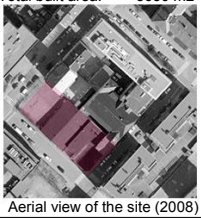
Case 47: Marstrandgata 1, 3A-E, 5-7



Timeframe	Start year: 2004 Completion year: 2012
Planning instruments	KP 2000, KDP for indre Oslo (1998), S-4010 (2003)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 2 Number of storeys: 4–6 Property area: 1430 m2 Built area: 1400 m2 Total built area: 5630 m2

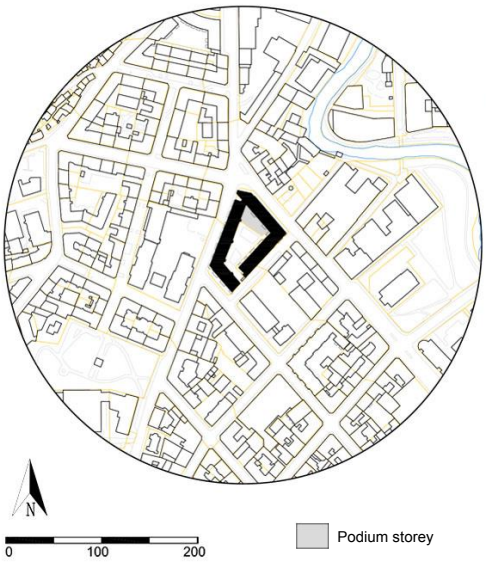


Aerial view of the site (2019)

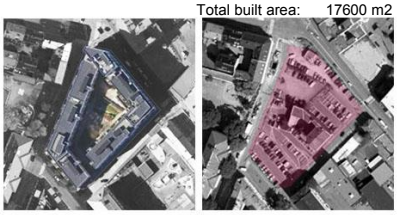


Aerial view of the site (2008)

Case 48: Møllergata 44-58, Hausmanns gate 45, Jess Carlsens gate 4-12, Osterhaus' gate 26

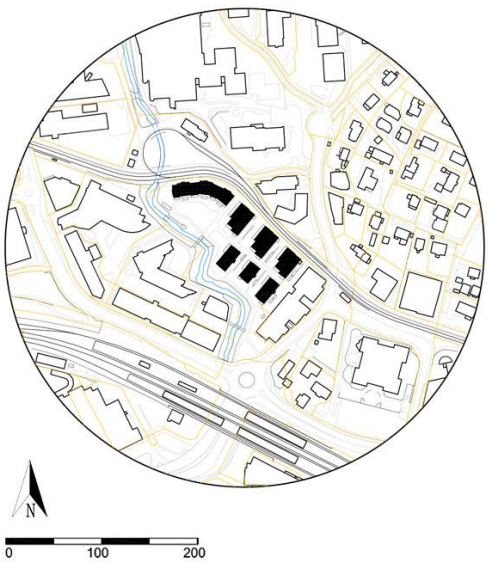


Timeframe	Start year: 2002 Completion year: 2004
Planning instruments	KP 2000, KDP for indre Oslo (1998), S-3913 (2002)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 1 Number of storeys: 5–10 Property area: 4850 m2 Built area: 3100 m2 Total built area: 17600 m2

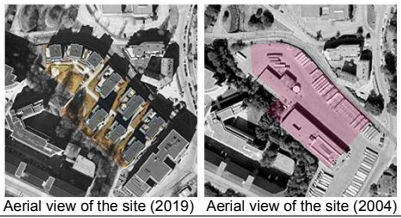


Aerial view of the site (2019) Aerial view of the site (2001)

Case 49: Nedre Skøyen vei 4-16, 10 A-C

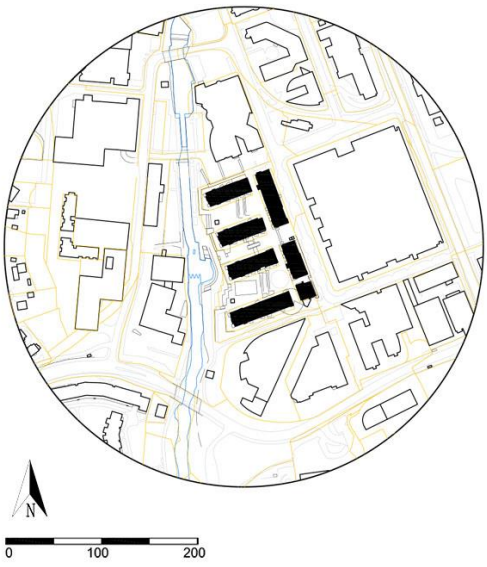


Timeframe	Start year: 2005 Completion year: 2007
Planning instruments	K P 2000, KDP for indre Oslo (1998), S-3913 (2002)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 4
Quantitative data	Number of buildings: 1 Number of storeys: 4–6 Property area: 14000 m2 Built area: 3100 m2 Total built area: 16600 m2



Aerial view of the site (2019) Aerial view of the site (2004)

Case 50: Nydalen Allé 1-29

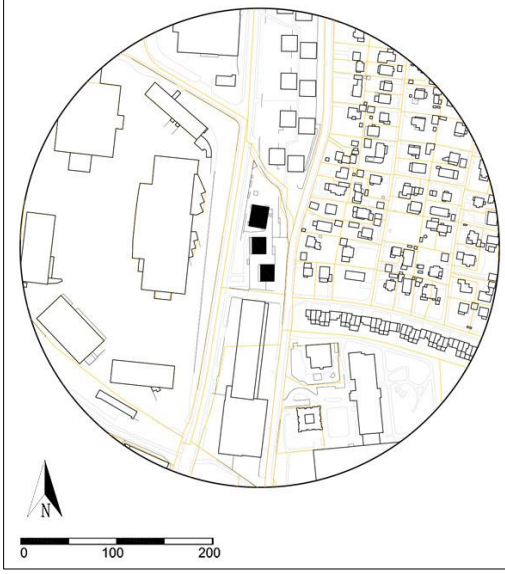


Timeframe	Start year: 2003 Completion year: 2006
Planning instruments	KP 2004, KDP 3 V080306 (2006)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 6
Quantitative data	Number of buildings: 7 Number of storeys: 5–8 Property area: 15000 m2 Built area: 4900 m2 Total built area: 31500 m2


Aerial view of the site (2019)


Aerial view of the site (2001)

Case 51: Økern Torgvei 5-7

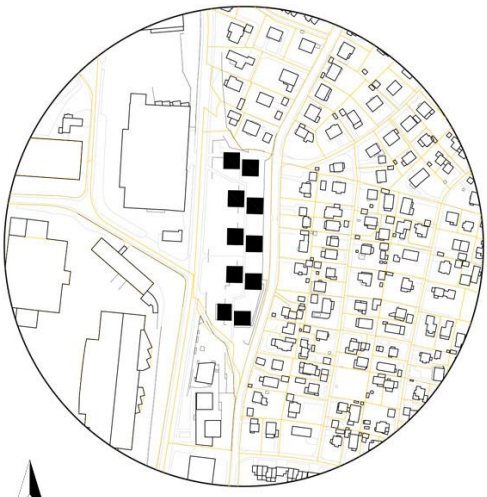


Timeframe	Start year: 2009 Completion year: 2011
Planning instruments	KP 2004, KDP 15 S-4259 (2006)
Planning instrument set	P1
Position in urban tissue	Outside ring road 3
Constituted tissue type	MIXED 5
Quantitative data	Number of buildings: 3 Number of storeys: 4–8 Property area: 7250 m2 Built area: 2400 m2 Total built area: 7200 m2


Aerial view of the site (2019)


Aerial view of the site (2005)

Case 52: Økern Torgvei 9A-K

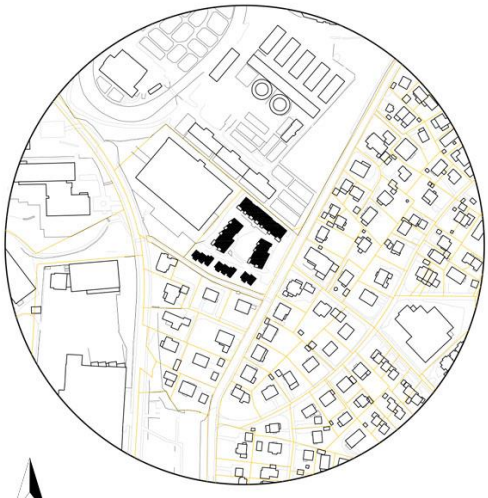


Timeframe	Start year: 2006 Completion year: 2008
Planning instruments	KP 2004, KDP 15 S-4259 (2006)
Planning instrument set	P1
Position in urban tissue	Outside ring road 3
Constituted tissue type	MIXED 5
Quantitative data	Number of buildings: 10 Number of storeys: 5–8 Property area: 15100 m2 Built area: 2720 m2 Total built area: 16320 m2


Aerial view of the site (2019)

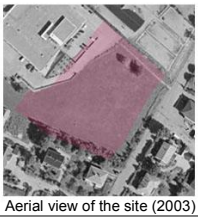

Aerial view of the site (2005)

Case 53: Økernveien 196-218

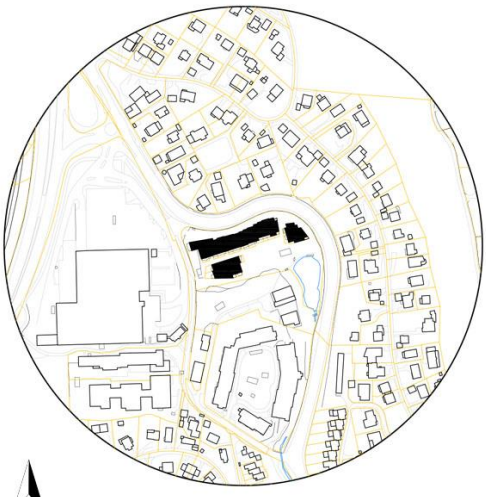


Timeframe	Start year: 2006 Completion year: 2008
Planning instruments	KP 2004, KDP 15 S-4229 (2006)
Planning instrument set	P1
Position in urban tissue	Outside ring road 3
Constituted tissue type	MIXED 5
Quantitative data	Number of buildings: 6 Number of storeys: 3–5 Property area: 7000 m2 Built area: 2000 m2 Total built area: 6700 m2


Aerial view of the site (2019)

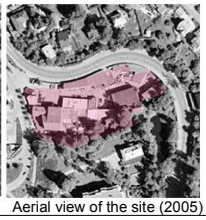

Aerial view of the site (2003)

Case 54: Østensjøveien 81A-G

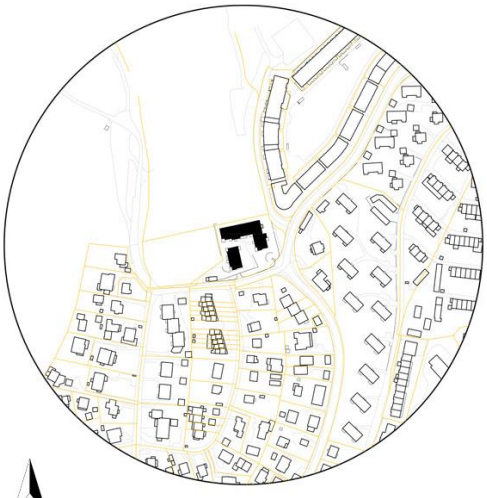


Timeframe	Start year: 2007 Completion year: 2013
Planning instruments	KP 2004 S-4244 (2006)
Planning instrument set	P3
Position in urban tissue	Outside ring road 3
Constituted tissue type	MIXED 2
Quantitative data	Number of buildings: 3 Number of storeys: 4–6 Property area: 8400 m2 Built area: 2200 m2 Total built area: 10000 m2


Aerial view of the site (2019)

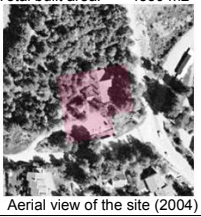

Aerial view of the site (2005)

Case 55: Østreheimsveien 34-38

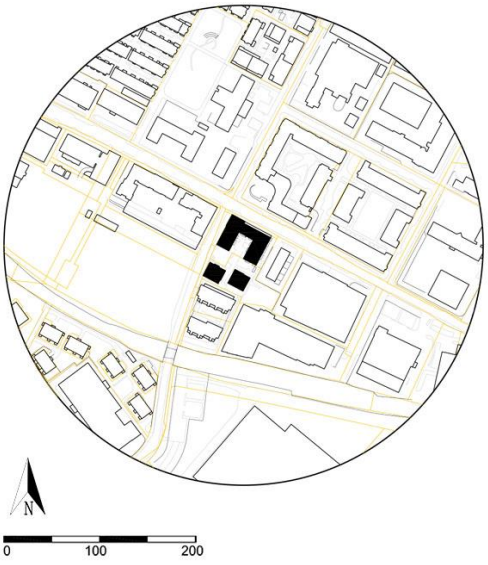


Timeframe	Start year: 2002 Completion year: 2004
Planning instruments	KP 2000 S-3964 (2003)
Planning instrument set	P3
Position in urban tissue	Outside ring road 3
Constituted tissue type	MIXED 7
Quantitative data	Number of buildings: 2 Number of storeys: 3–5 Property area: 3900 m2 Built area: 1700 m2 Total built area: 4550 m2


Aerial view of the site (2019)


Aerial view of the site (2004)

Case 56: Peter Møllers vei 5A-B (Lørenlunden)

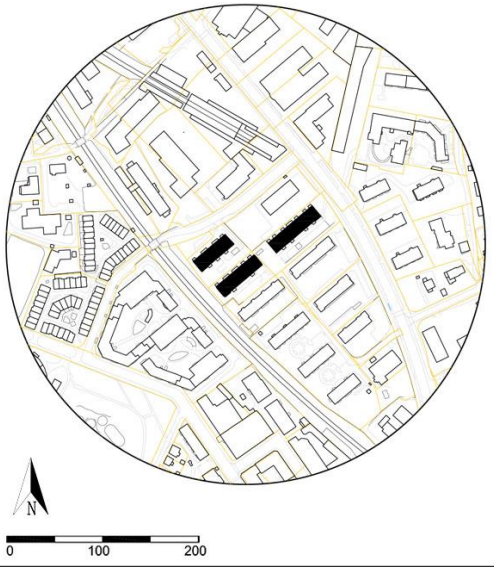


Timeframe	Start year: 2006 Completion year: 2010
Planning instruments	KP 2000, KDP 13 (1998), S-4129 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 2
Quantitative data	Number of buildings: 3 Number of storeys: 5–7 Property area: 7500 m2 Built area: 1800 m2 Total built area: 6200 m2


Aerial view of the site (2019)


Aerial view of the site (2004)

Case 57: Rolf Hofmos gate 11-19



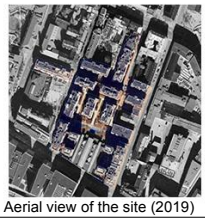
Timeframe	Start year: 2007 Completion year: 2009
Planning instruments	KP 2004, VPOR Ensjø, Planleggingsprogram for Ensjø, S-4293 (2007)
Planning instrument set	P2
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MOD 2
Quantitative data	Number of buildings: 3 Number of storeys: 6 Property area: 7900 m2 Built area: 2200 m2 Total built area: 13200 m2

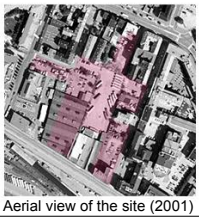

Aerial view of the site (2019)


Aerial view of the site (2004)

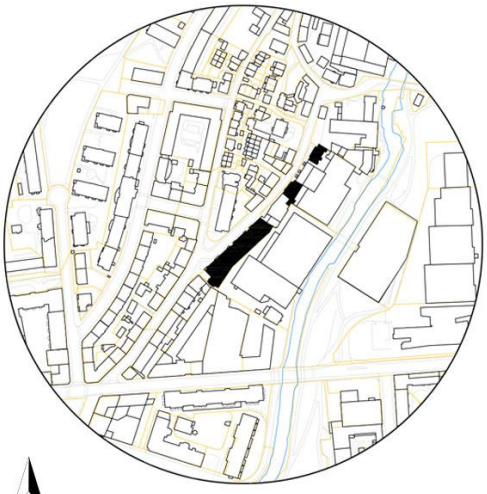
Case 58: Rubina Ranas gate 1-9, 6-12, Mandalls gate 10-18, Platous gate 29-33, Schweigaards gate 26, 30-32

Timeframe	Start year: 2004 Completion year: 2006
Planning instruments	KP 2000, KDP for indre Oslo (1998), S-4095 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 13 Number of storeys: 7–8 Property area: 11000 m2 Built area: 6300 m2 Total built area: 50400 m2


Aerial view of the site (2019)

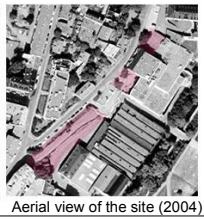

Aerial view of the site (2001)

Case 59: Sagveien 1-15, 19

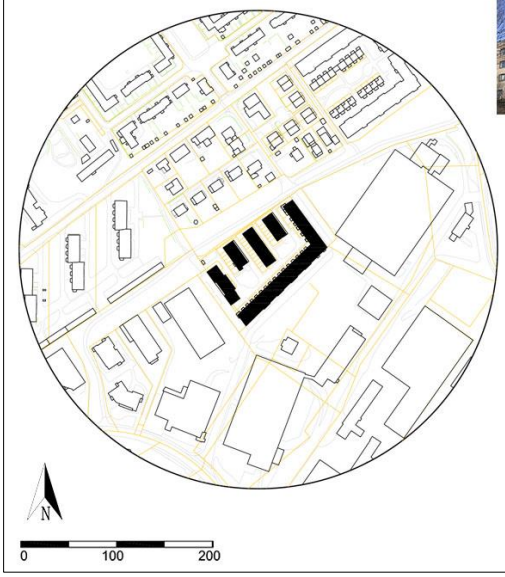


Timeframe	Start year: 2005 Completion year: 2007
Planning instruments	KP 2000, KDP 4, KDP for indre Oslo (1998), S-4151 (2005)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 3 Number of storeys: 3–5 Property area: 2000 m2 Built area: 2000 m2 Total built area: 8100 m2


Aerial view of the site (2019)

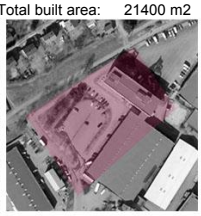

Aerial view of the site (2004)

Case 60: Sigurd Hoels vei 42-108 (Hagekvartalet)



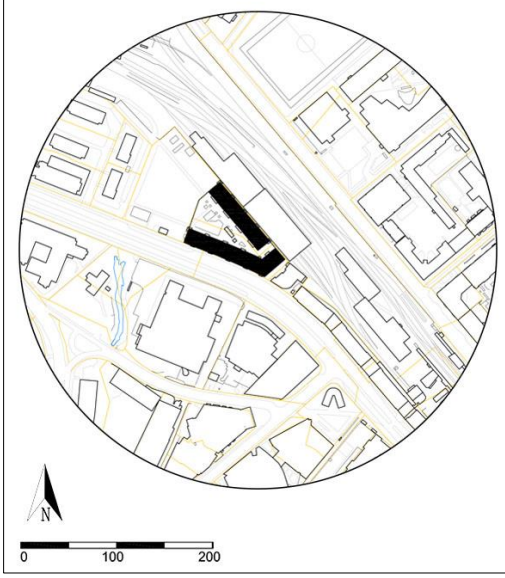
Timeframe	Start year: 2010 Completion year: 2012
Planning instruments	KP 2000, VPOR for Ensjø, Planleggingsprogram for Ensjø, S-4420 (2008)
Planning instrument set	P2
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 5 Number of storeys: 4–7 Property area: 10400 m2 Built area: 4000 m2 Total built area: 21400 m2

Aerial view of the site (2019)



Aerial view of the site (2010)

Case 61: Sørkedalsveien 7, 9A-E, 11A-H (Nye Major)

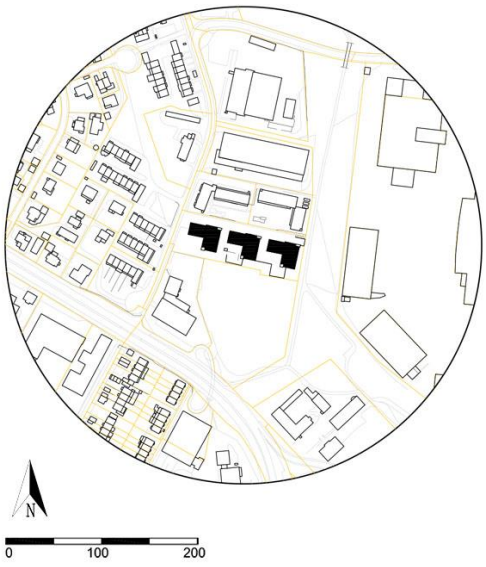


Timeframe	Start year: 2001 Completion year: 2004
Planning instruments	KP 1996, S-3954 (2004)
Planning instrument set	P3
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	MIXED 1
Quantitative data	Number of buildings: 5 Number of storeys: 6–9 Property area: 6100 m2 Built area: 5100 m2 Total built area: 23000 m2

Aerial view of the site (2019)

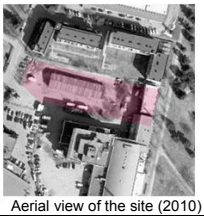
Aerial view of the site (2004)

Case 62: Spireaveien 12A-C (Spirea parken)



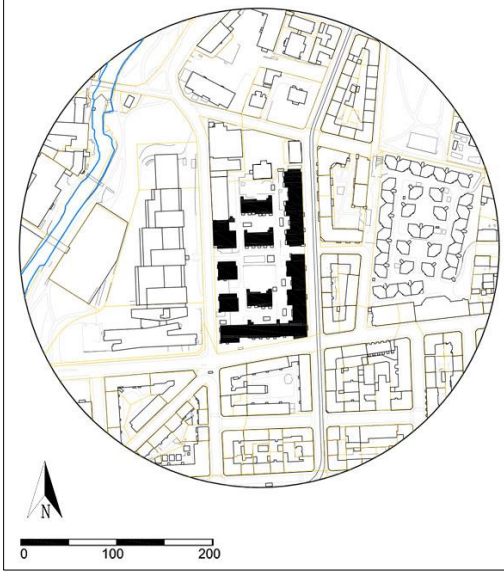
Timeframe	Start year: 2009 Completion year: 2012
Planning instruments	KP 2004, KDP 15 S-4349 (2007)
Planning instrument set	P1
Position in urban tissue	Outside ring road 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 3 Number of storeys: 5–8 Property area: 6100 m2 Built area: 1800 m2 Total built area: 11700 m2

Aerial view of the site (2019)



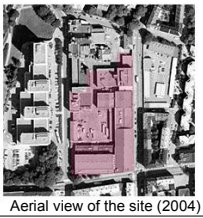
Aerial view of the site (2010)

Case 63: Toftes gate (11A-G, 13A-F, 15A-C, 17, 19A-C, 21A-B, 23), Thorvald Meyers gate (4A-B, 6-10, 12A-E, 14, 16A-J), Sannergata 6A-E (Ringnes park, vest sameie)



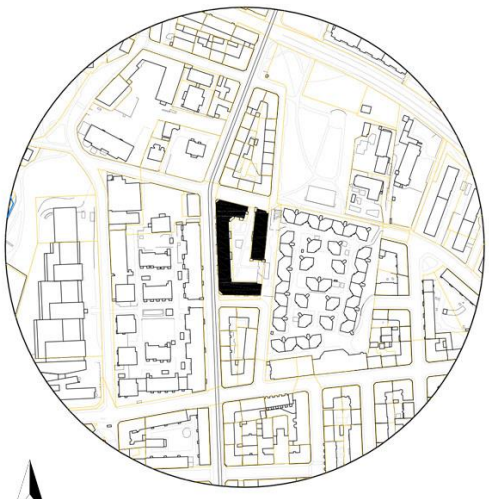
Timeframe	Start year: 2006 Completion year: 2008
Planning instruments	KP 2004, KDP 4, S-4239 (2006)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 8 Number of storeys: 3–8 Property area: 16700 m2 Built area: 6300 m2 Total built area: 40500 m2

Aerial view of the site (2019)



Aerial view of the site (2004)

Case 64: Toftes gate 2-8, 10A-C, 12, Biermanns gate 9-11 (Ringnes park Øst)



Timeframe	Start year: 2004 Completion year: 2005
Planning instruments	KP 2000, KDP 4, S-4093 (2004)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 2 Number of storeys: 6 Property area: 4700 m2 Built area: 2600 m2 Total built area: 15000 m2

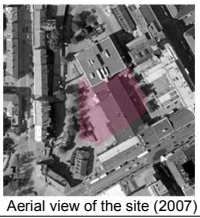
Aerial view of the site (2019)

Aerial view of the site (2001)

Case 65: Trondheimsveien 2D-G

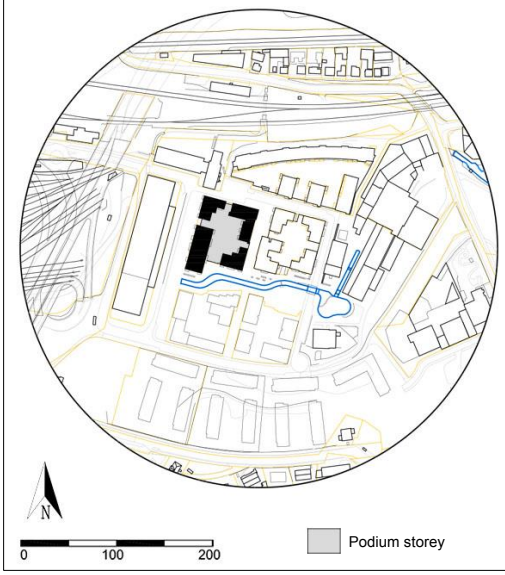
Timeframe	Start year: 2006 Completion year: 2009
Planning instruments	KP 2004, KDP 4, S-4191 (2005)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 2
Quantitative data	Number of buildings: 2 Number of storeys: 6–7 Property area: 3000 m2 Built area: 3000 m2 Total built area: 11300 m2

Aerial view of the site (2019)



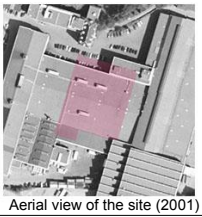
Aerial view of the site (2007)

Case 66: Turbinveien 1-5, Smeltedigelen 2 (Kværnerbyen)



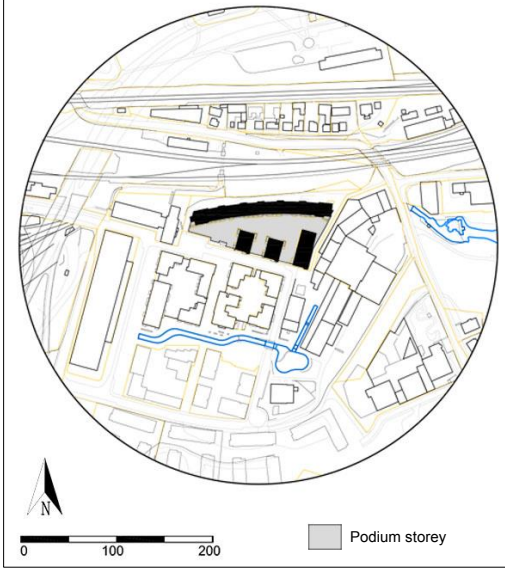
Timeframe	Start year: 2007 Completion year: 2009
Planning instruments	KP 2004, KDP for indre Oslo (1998), S-4198 (2005)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 4 Number of storeys: 7 Property area: 4050 m2 Built area: 4050 m2 Total built area: 20000 m2

Aerial view of the site (2019)



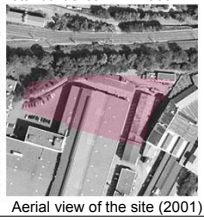
Aerial view of the site (2001)

Case 67: Turbinveien 4B-24 (Kværnerbyen)



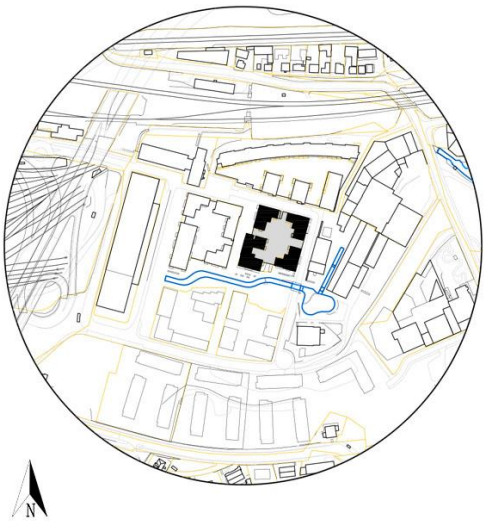
Timeframe	Start year: 2007 Completion year: 2012
Planning instruments	KP 2004, KDP for indre Oslo (1998), S-4198 (2005)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 4 Number of storeys: 8–9 Property area: 9400 m2 Built area: 7000 m2 Total built area: 27900 m2

Aerial view of the site (2019)



Aerial view of the site (2001)

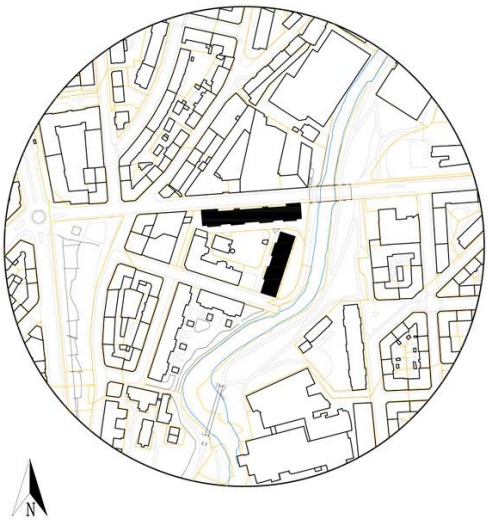
Case 68: Turbinveien 7-13 (Kværnerbyen)



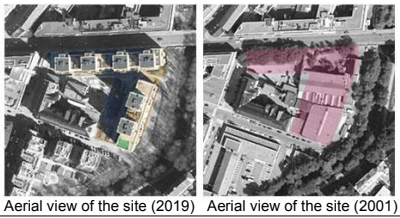
Timeframe	Start year: 2006 Completion year: 2008
Planning instruments	KP 2004, KDP for indre Oslo (1998), S-4198 (2005)
Planning instrument set	P1
Position in urban tissue	Between ring roads 2 and 3
Constituted tissue type	TRANSF 1
Quantitative data	Number of buildings: 4 Number of storeys: 6–7 Property area: 3500 m2 Built area: 3500 m2 Total built area: 15000 m2

Aerial view of the site (2019) Aerial view of the site (2001)

Case 69: Waldemar Thranes gate 75-77, Darres gate 10-16, 30 (Waldemars hage, building step 2)

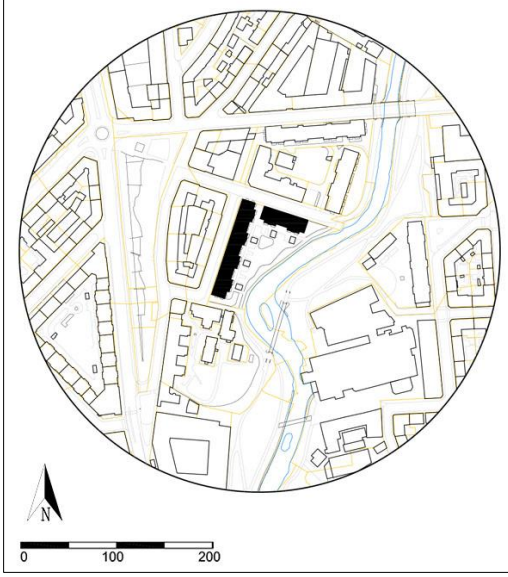


Timeframe	Start year: 2006 Completion year: 2009
Planning instruments	KP 2004, KDP 4, KDP for indre Oslo (1998), S-3893 (2002)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 1
Quantitative data	Number of buildings: 2 Number of storeys: 8–12 Property area: 6400 m2 Built area: 2700 m2 Total built area: 25500 m2



Aerial view of the site (2019) Aerial view of the site (2001)

Case 70: Waldemars Hage 1-6 (building step 1)

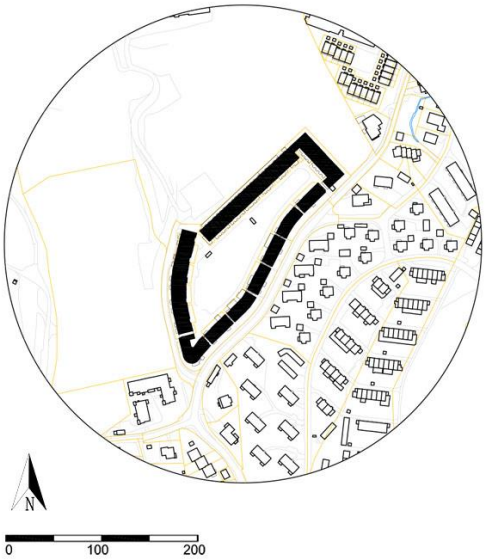


Timeframe	Start year: 2002 Completion year: 2005
Planning instruments	KP 2004, KDP 4, KDP for indre Oslo (1998), S-3893 (2002)
Planning instrument set	P1
Position in urban tissue	Between ring roads 1 and 2
Constituted tissue type	TRAD 1
Quantitative data	Number of buildings: 2 Number of storeys: 6–11 Property area: 6800 m2 Built area: 2400 m2 Total built area: 21000 m2

Aerial view of the site (2019)

Aerial view of the site (2004)

Case 71: Årvollveien 52A-X, 54A-X, 56A-X, 58A-V, 60A-L, 62A-E



Timeframe	Start year: 2003 Completion year: 2006
Planning instruments	KP 2000 S-3936 (2002)
Planning instrument set	P3
Position in urban tissue	Outside ring road 3
Constituted tissue type	MIXED 7
Quantitative data	Number of buildings: 9 Number of storeys: 3–6 Property area: 21100 m2 Built area: 7400 m2 Total built area: 28300 m2

Aerial view of the site (2019)

Aerial view of the site (2004)

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