https://doi.org/10.7577/formakademisk.2605

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, p. 393). 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” (Guttu & 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.

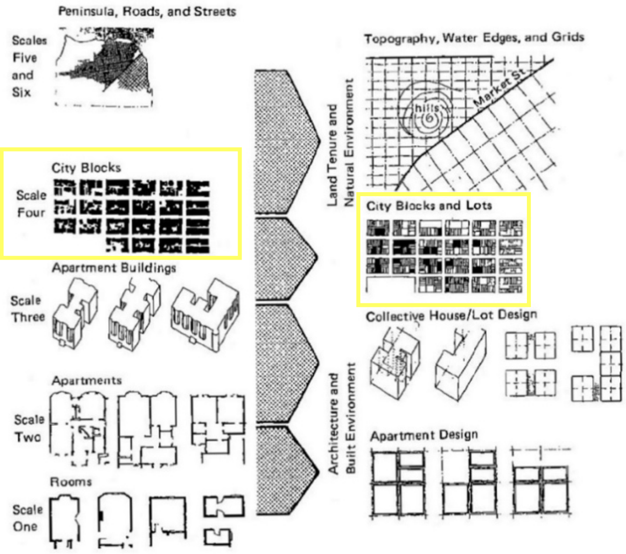


Figure 1. Modularity in the built landscape (Moudon, 1994/2007) describes the different spatial scales and the ways a building fits into the urban tissue. The intermediate scale between the whole city and a single building is marked in yellow.

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.

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 master plan (e.g. KP 2015), District master plan (e.g. KDP-3) and 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 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).

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 Lehmann'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.

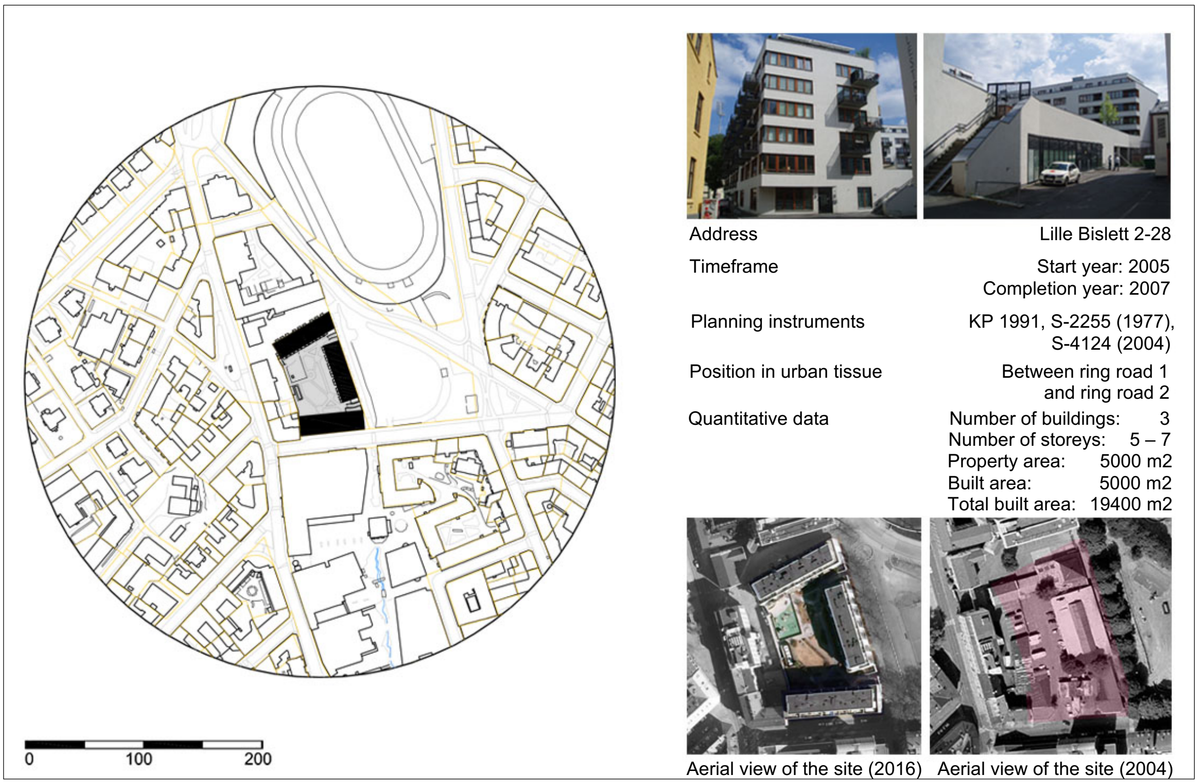


Figure 2. Example of a data sheet with an initial case description (image sources: own photos [above] and Plan- og bygningsetaten, Oslo kommune [below]).

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.

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.

Below: Section of the map with the highest concentration of cases (70 of 71).

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).

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.

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.

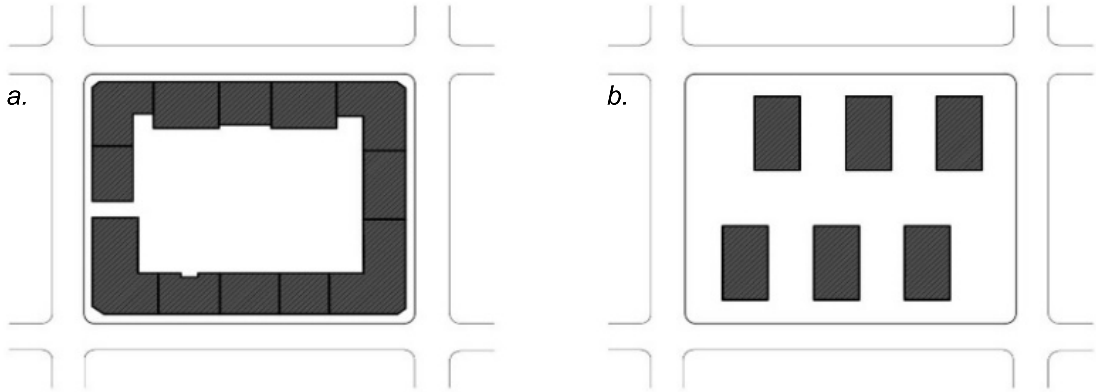


Figure 4. Two reference patterns of urban tissue: a) the traditional and b) the modernist.

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.

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.

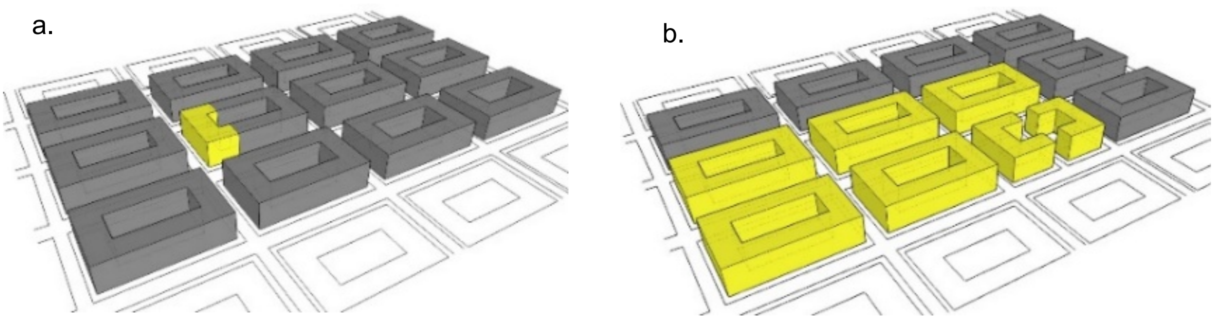


Figure 5. Presumed types of intervention in the urban tissue (presented by using the example of traditional tissue type): a) infill and b) part of the land use transformation area.

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, 7 and 8). 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 2 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 Figures 6, 7 and 8, with an overview of all 71 cases by the types of constituted tissue they were situated in provided in Figure 9.

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 7), which was constructed above a railroad.

Table 2. 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 of various urban block types, building types and other built elements	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	
	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**

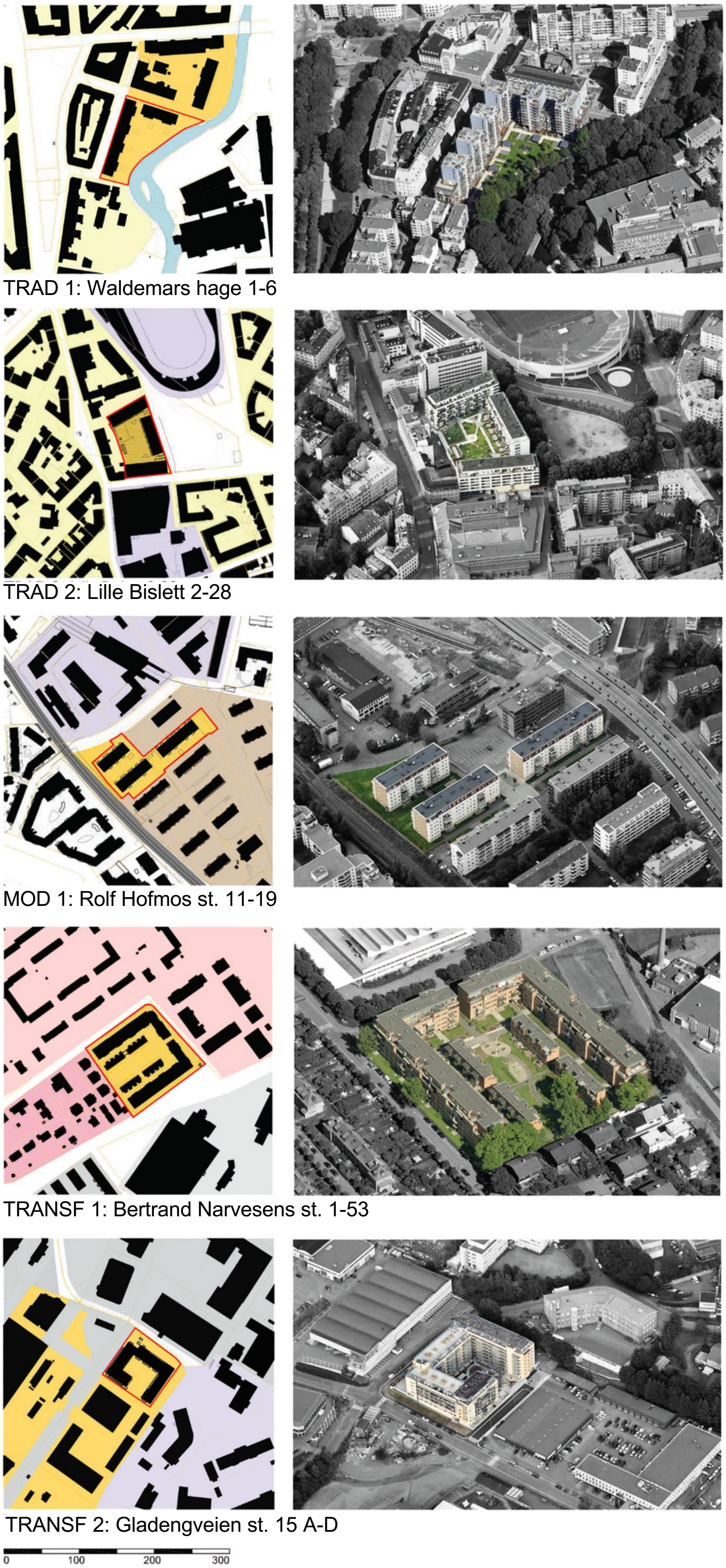


Figure 6.
Examples of constituted tissue type analysis: variations of the traditional tissue (TRAD 1, TRAD 2), a variation of the modernist tissue (MOD 1) and the transformation tissues (TRANSF 1 and TRANSF 2).

Photograph source: Blom AS.

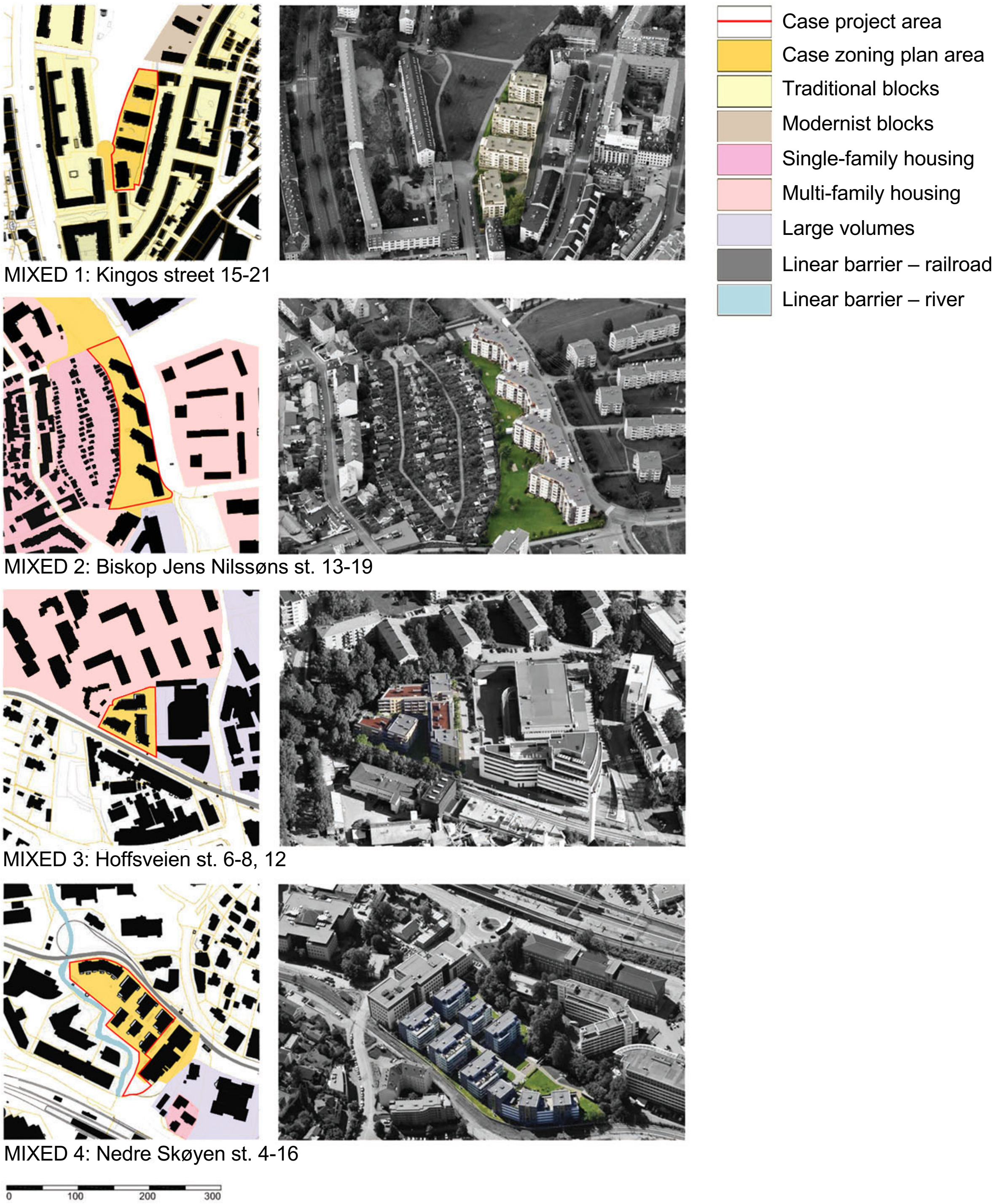


Figure 7. Examples of constituted tissue type analysis: mixed tissue types (MIXED 1 to MIXED 4). Photograph source: Blom AS.

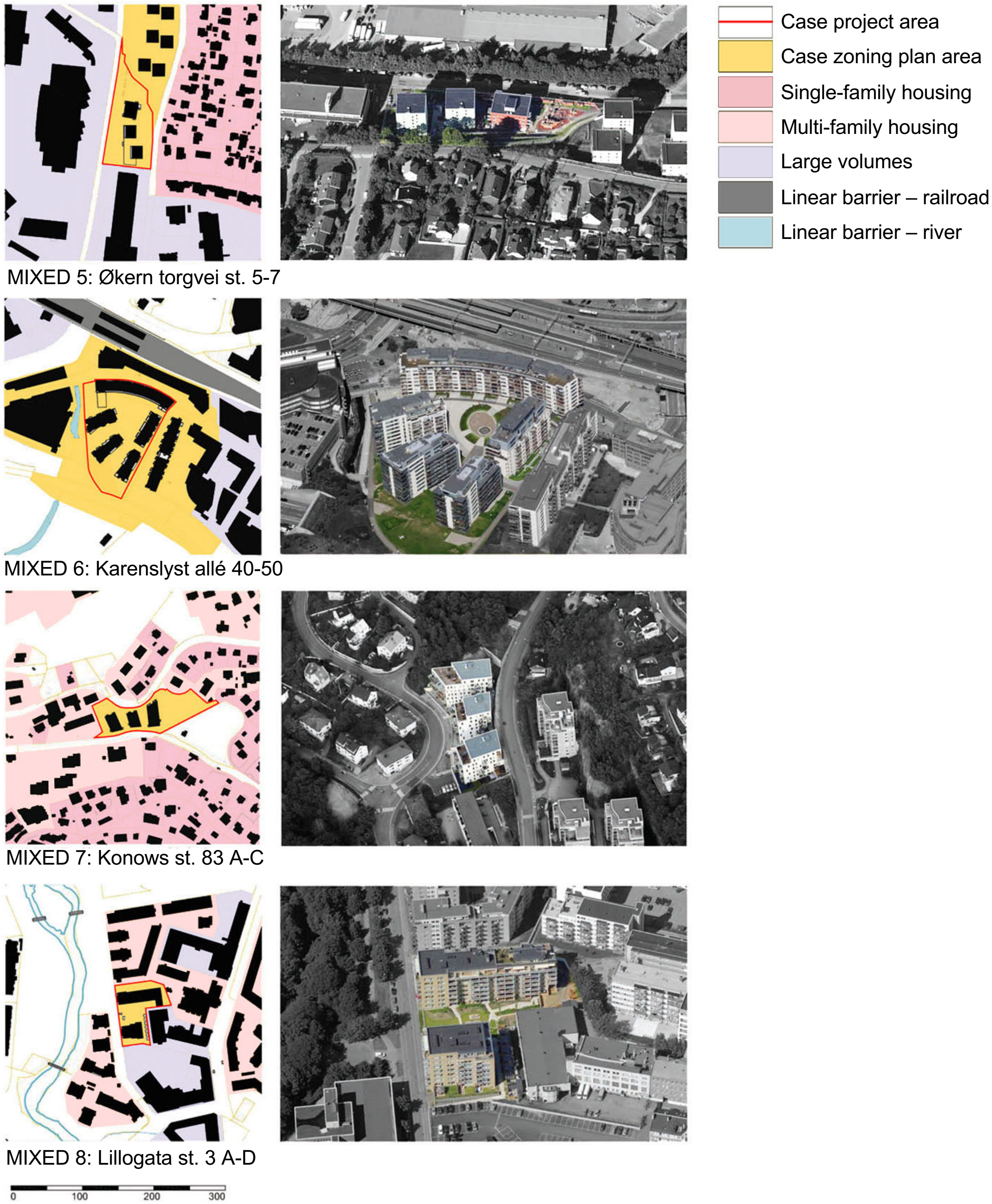


Figure 8. Examples of constituted tissue types analysis: mixed tissue types (MIXED 5 to MIXED 8). Photograph source: Blom AS.

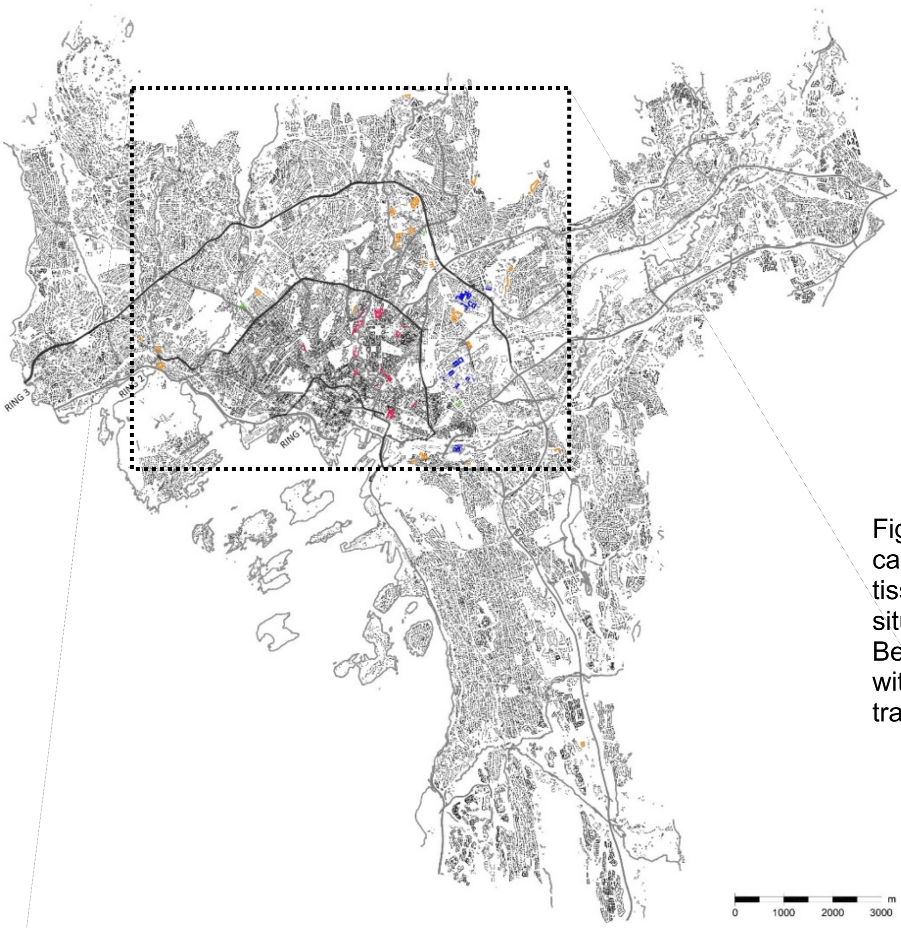
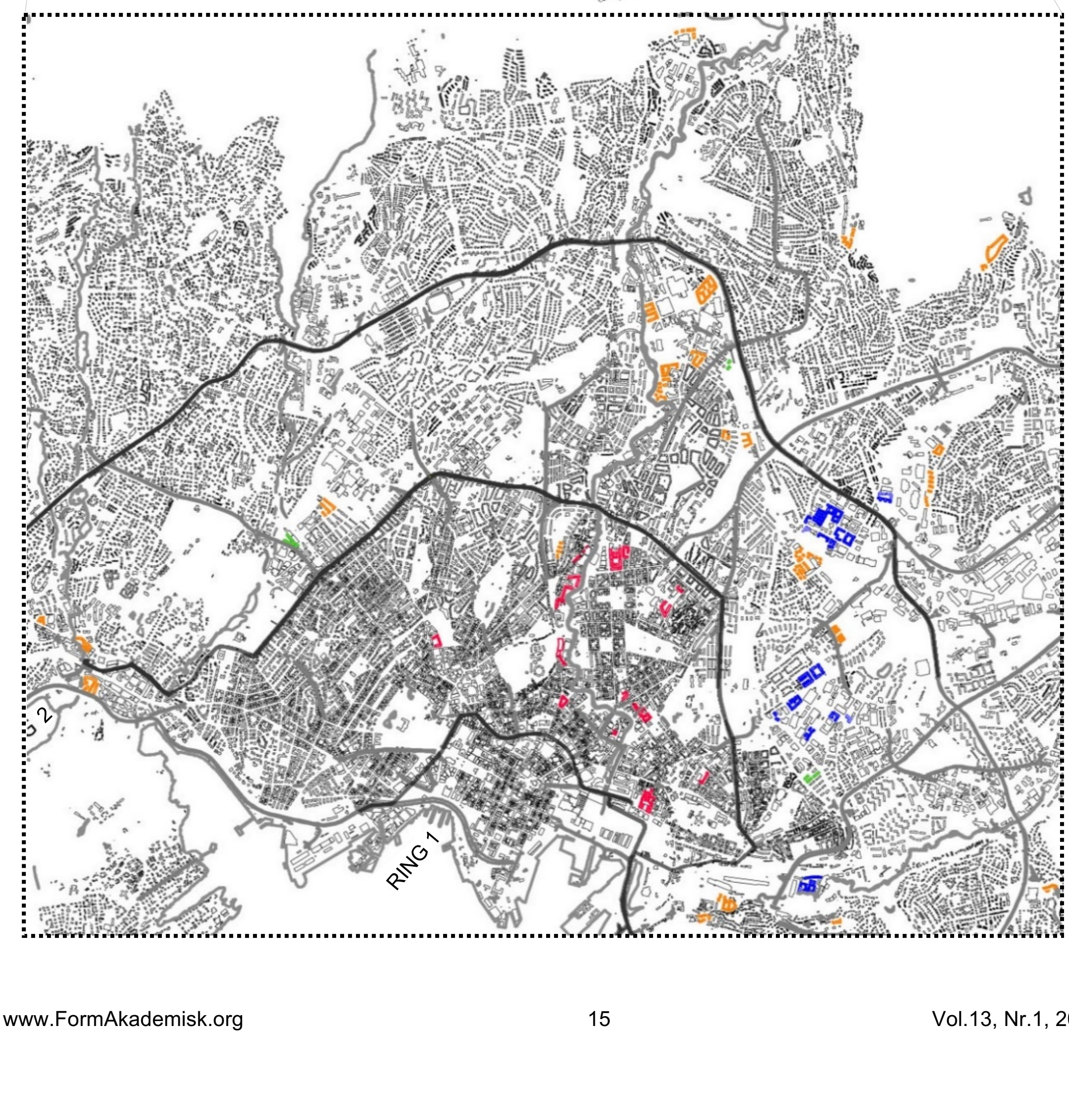


Figure 9. Overview of the 71 cases by types of constituted tissue in which they are situated.
Below: Section of the map with the highest concentration of cases (70 of 71).



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 10). However, entirely new urban blocks were also found in land use transformation areas.

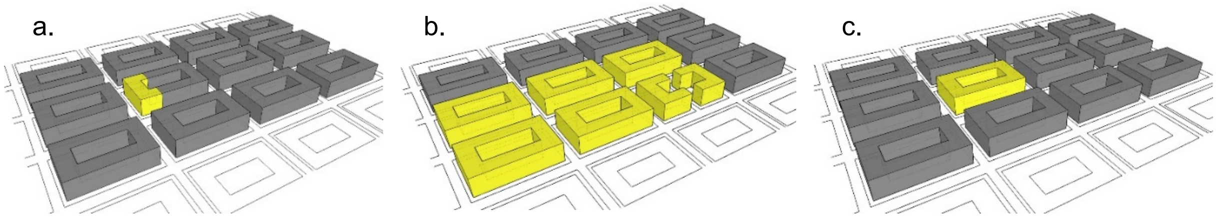


Figure 10. Identified types of intervention (presented by using the example of the traditional tissue type): a) infill as part of the urban block, b) part of the land use transformation area and c) infill as an entirely new urban block.

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 11. 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 (Figures 12 and 13). 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 (Figure 14).

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.

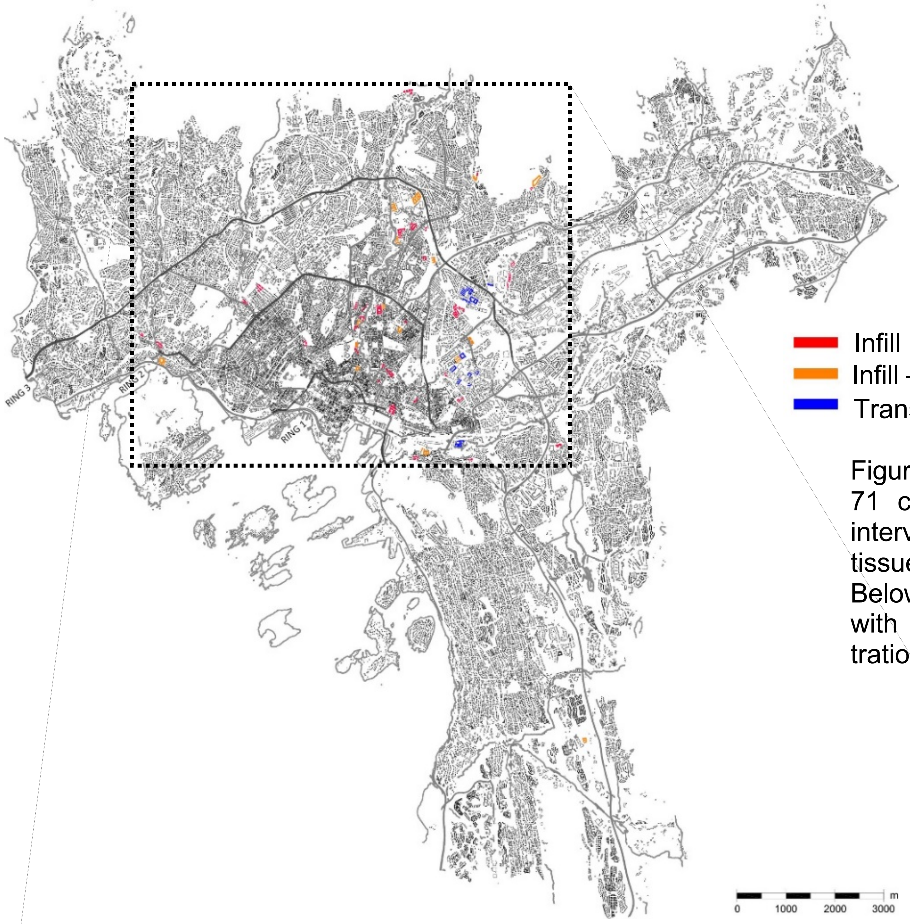
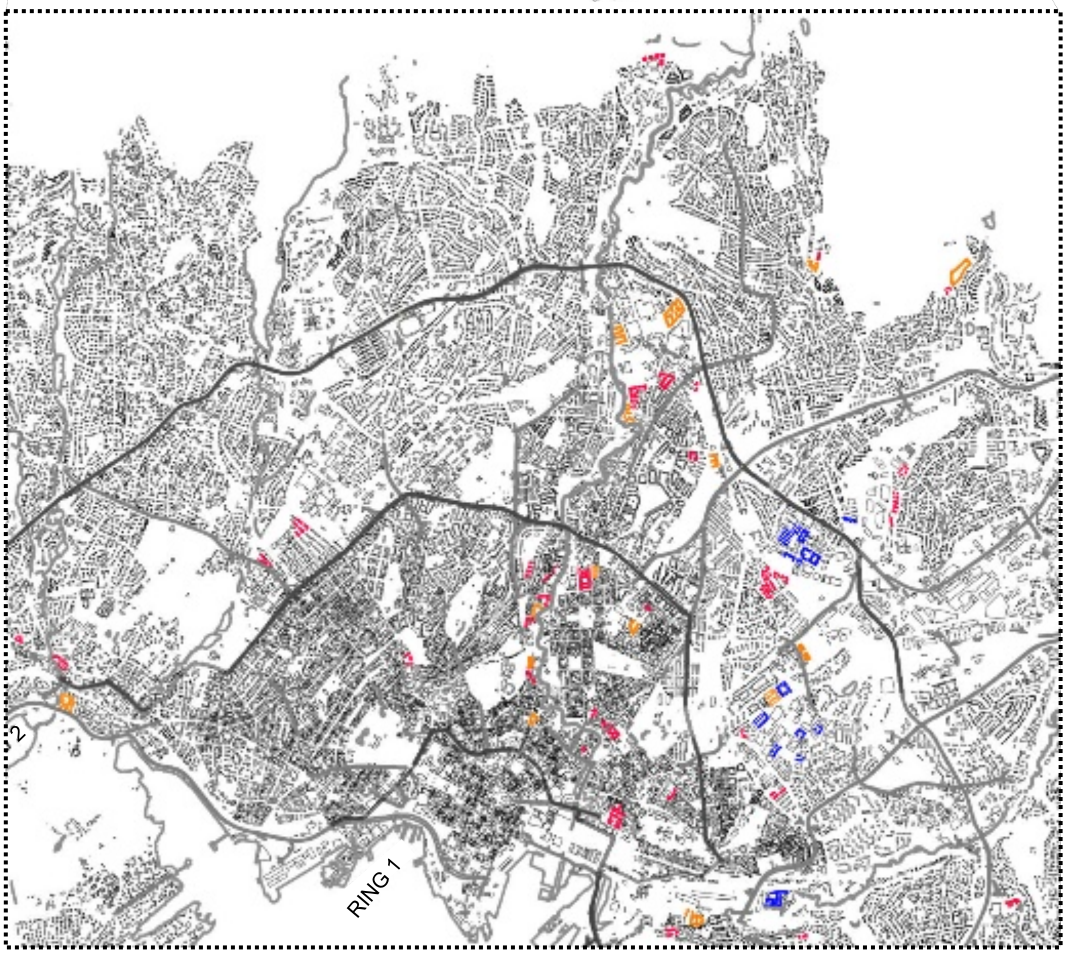


Figure 11. Overview of the 71 cases by the types of intervention in the urban tissue.
Below: Section of the map with the highest concentration of cases (70 of 71).



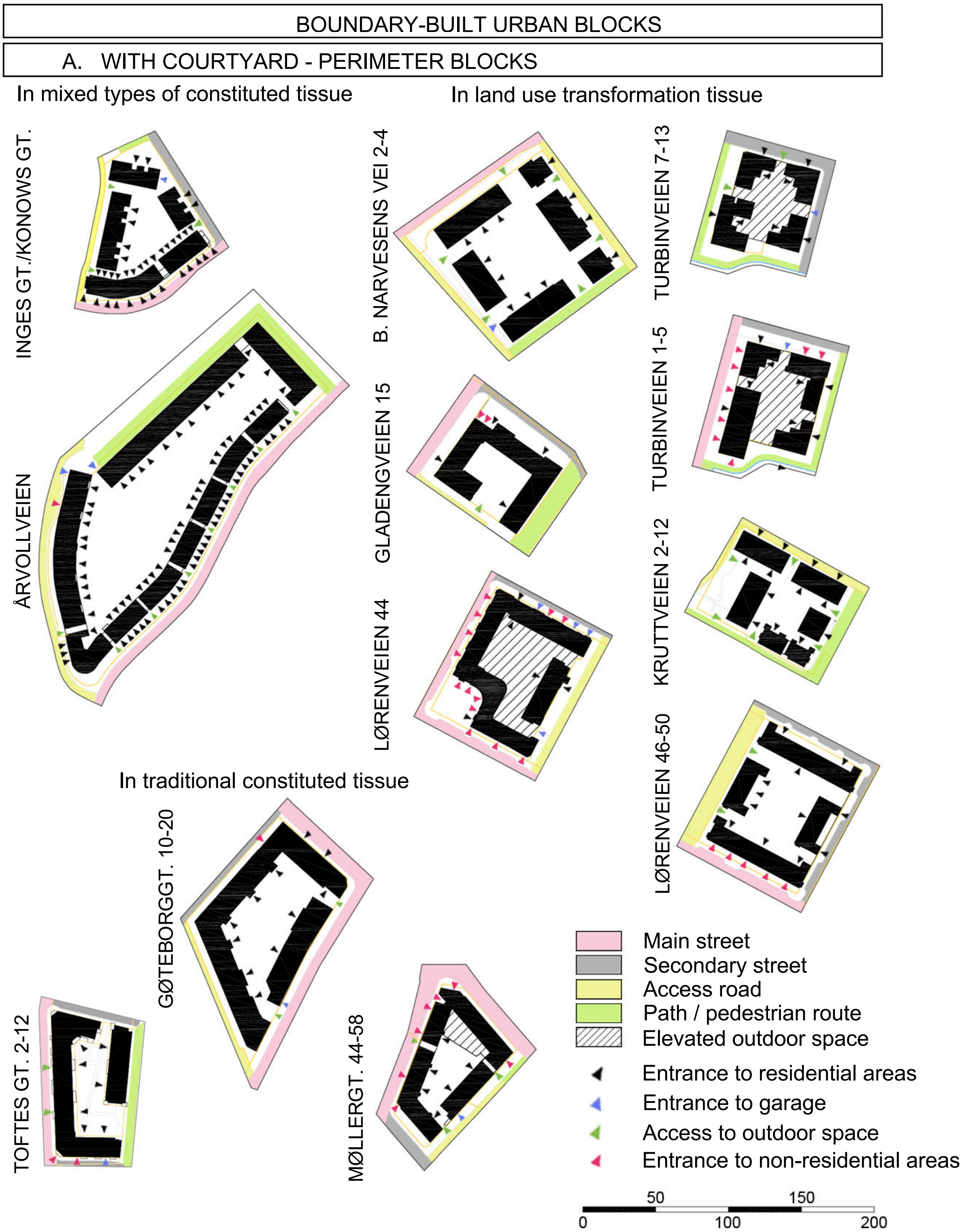


Figure 12. New urban blocks, the boundary-built type with courtyard.

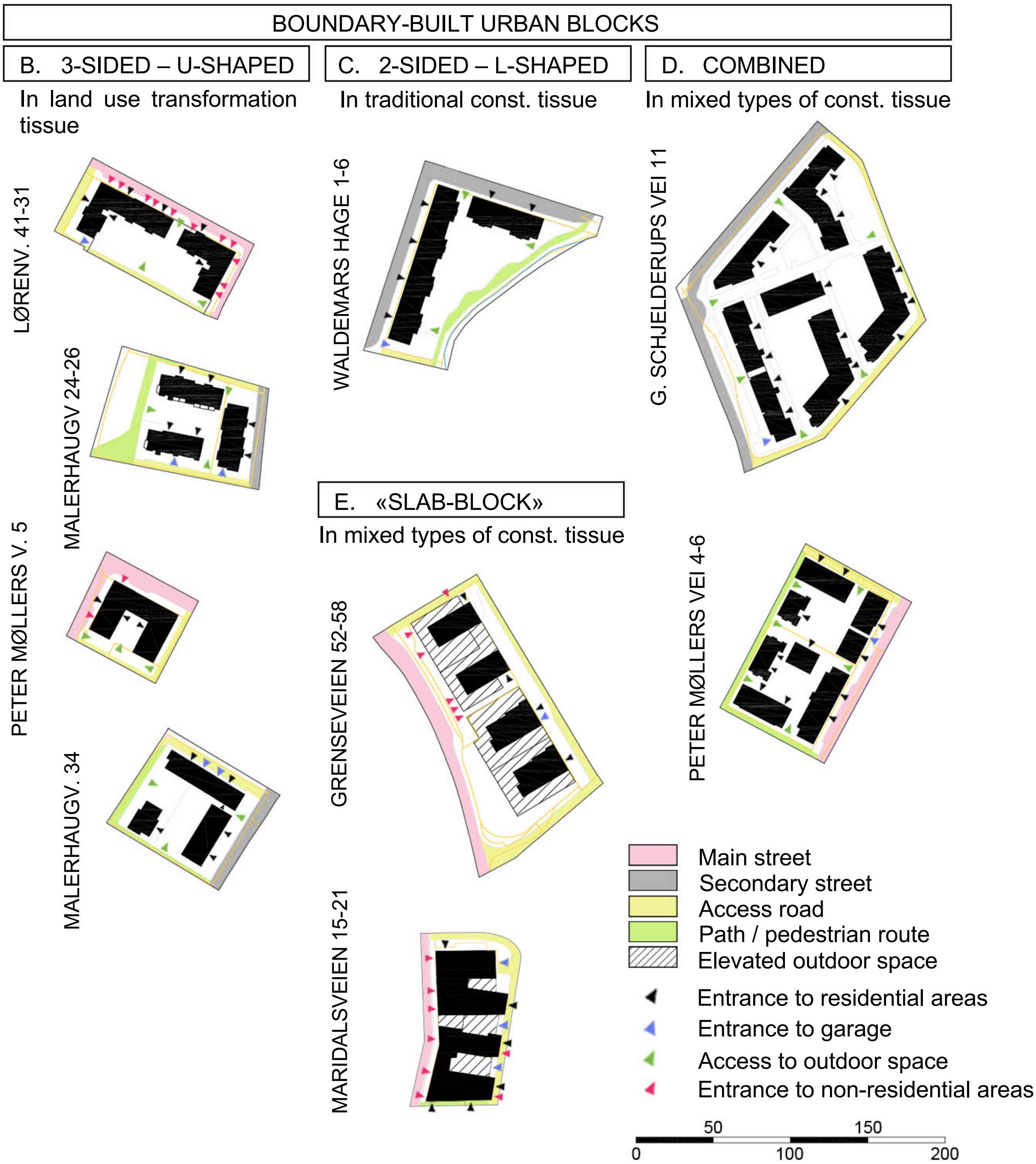


Figure 13. New urban blocks, boundary-built types: U-shaped, L-shaped, combined and "slab-block."

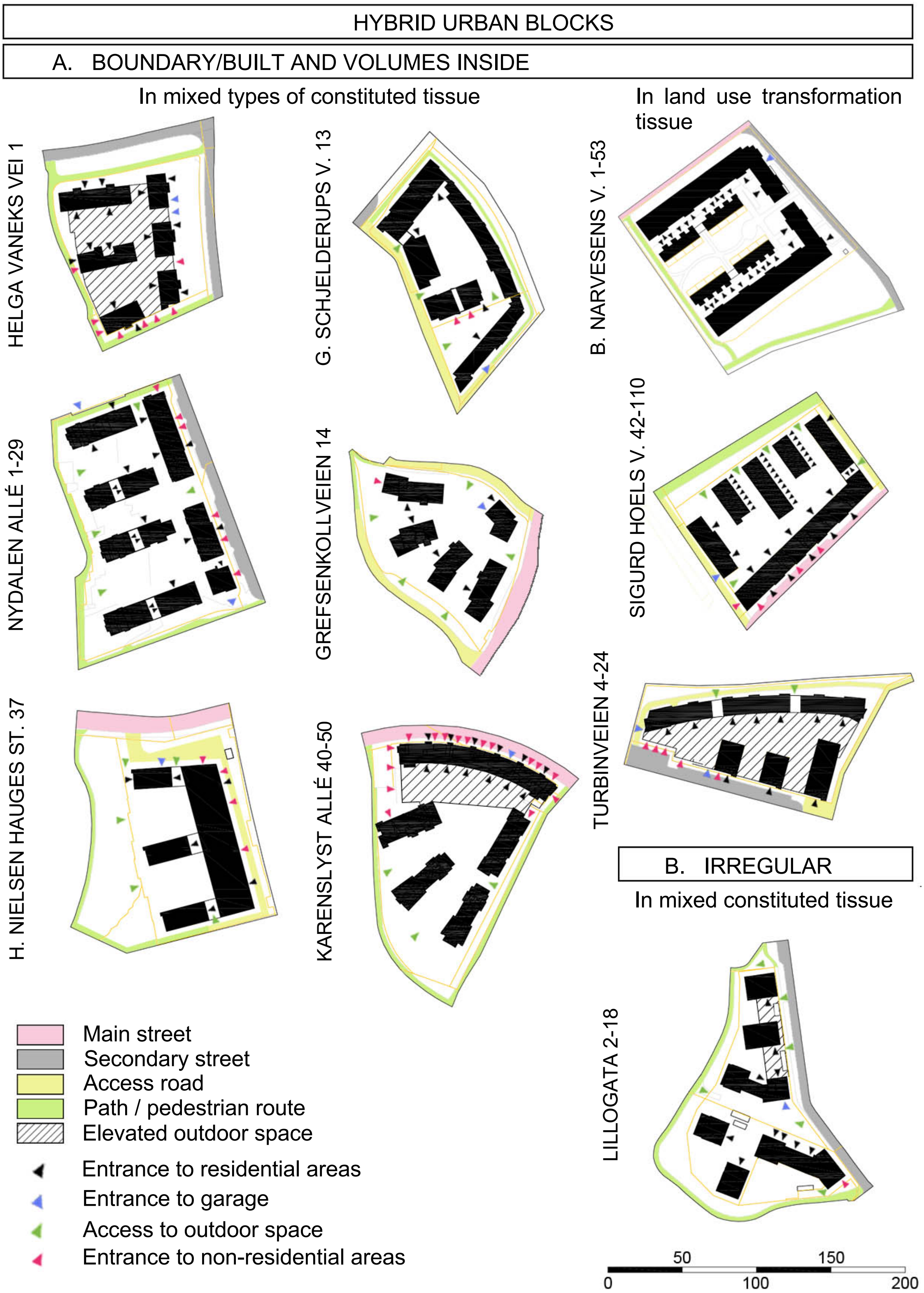


Figure 14. New urban blocks, hybrid types.

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 (37 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* (17 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 (Guttu & Thorén, 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 12), 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 12).

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.

Gordana Zurovac
PhD candidate, M. Arch
Norwegian University of Life Sciences (NMBU), Faculty of Landscape and Society, Ås, Norway
goma@nmbu.no
gotza_m@yahoo.com

References

Albrechts, L. (2004). Strategic (spatial) planning reexamined. *Environment and Planning B: Planning and design, 31*(5), 743–758.

Beunderman, J., Hall, C., & Vrolijks, L. (2009). *Housing intensification in seven South London town centres*. http://www.urhahn.com/wp-content/uploads/housing-intensification-in-seven-south-london-town-centres-lowres.pdf

Bjerkeset, S., & Aspen, J. (2015). Gaven til byen – Tjuvholmen og offentlige byrom [The gift for the city – Tjuvholmen and public spaces]. *Nytt Norsk Tidsskrift, 32*(04), 329–340.

Børrud, E. (2012). Planlegging av en allerede bygget by [Planning of an already built city]. In N. Aarsæther, E. Falleth, T. Nyseth, & R. Kristiansen (Eds.), *Utfordringer for norsk planlegging* [Challenges for Norwegian planning] (pp. 204–222). Kristiansand: Cappelen Damm Høyskoleforlaget.

Børrud, E., & Syvertsen, L. S. K. (2012). Tett, tettere, transformert? Fortetting av Oslos byggesone 2000–2010 [Dense, denser, transformed? Densification of Oslo's building zone 2000–2010]. *Arkitektur N, 14*(5), 39–48.

Çalişkan, O., & Marshall, S. (2011). Urban morphology and design: Introduction. *Built Environment, 37*(4), 381–392.

Castex, J., Depaule, J.-C., & Panerai, P. (1989). *Urbane forme* [*Urban forms*]. Beograd: Građevinska knjiga.

Curie, F., Perret, J., & Ruas, A. (2010). *Simulation of urban blocks densification.* Paper presented at the 13th AGILE International Conference on Geographic Information Science.

Dahl, P.-J. (2014). Densifying the suburban metropolis: Architecture as an instrument for urban planning. *Nordic Journal of Architectural Research, 26*(2), 57–81. http://arkitekturforskning.net/na/article/view/495

Dündar, Ö. (2001). Models of urban transformation: Informal housing in Ankara. *Cities, 18*(6), 391–401.

Futcher, J., Mills, G., Emmanuel, R., & Korolija, I. (2017). Creating sustainable cities one building at a time: Towards an integrated urban design framework. *Cities, 66*, 63–71.

Godø, M. (2019). Er karré passé? [Is urban block passé?] *Arkitektnytt*, *75*(01), 10–24.

Grønning, M. (2011). What is the Fjord City? *Territorio, 56*, 141–150. https://doi.org/10.3280/TR2011-056022

Guttu, J., Nyhuus, S., Saglie, I.-L., & Thorén, A.-K. H. (1997). *Boligfortetting i Oslo: konsekvenser for grønnstruktur, bokvaliteter og arkitektur* [*Housing densification in Oslo: consequences for green structure, living qualities and architecture*]. Oslo: Norsk institutt for by- og regionforskning.

Guttu, J., & Schmidt, L. (2008). *Fortett med vett. Eksempler fra fire norske byer* [*Densify with sense. Examples from four Norwegian cities*]. Oslo: Husbanken Region vest.

Guttu, J., & Thorén, A.-K. H. (1996). *Fortetting med kvalitet. Bebyggelse og grønnstruktur* [*Densification with quality. Settlement and green structure*]. Oslo: Miljøverndepartementet [Ministry of Environment].

Güzey, Ö. (2014). Neoliberal urbanism restructuring the city of Ankara: Gated communities as a new life style in a suburban settlement. *Cities, 36*, 93–106.

Hall, A. C. (1997). Dealing with incremental change: An application of urban morphology to design control. *Journal of Urban Design, 2*(3), 221–239. https://doi.org/10.1080/13574809708724407

Hanssen, G. S., Hofstad, H., Saglie, I.-L., Næss, P., & Røe, P. G. (2015). Hvorfor studere den kompakte byen? [Why study the compact city?] In G. S. Hanssen, H. Hofstad, & I.-L. Saglie (Eds.), *Kompakt byutvikling - Muligheter og utfordringer* [Compact urban development – Possibilities and challenges] (pp. 13–25). Oslo: Universitetsforlaget.

Hernandez-Palacio, F. (2014). On the feasibility and effectiveness of urban densification in Norway. *Nordic Journal of Architectural Research, 26*(2), 83–112. http://arkitekturforskning.net/na/article/view/496

Jabareen, Y. R. (2006). Sustainable urban forms their typologies, models, and concepts. *Journal of Planning Education and Research, 26*(1), 38–52.

Komossa, S. (2009). *Towards new architectural and urban models: The Dutch urban block, public domain and city economy.* Paper presented at the 4th International Conference of the International Forum on Urbanism (IFoU).

Komossa, S., Meyer, H., Risselada, M., Thomaes, S., & Jutten, N. (2005). *Atlas of the Dutch urban block*. Bussum: Thoth.

Krier, L. (2007). "Critiques" and "Urban components". In M. Larice & E. Macdonald (Eds.), *The urban design reader* (pp. 231–250). London: Routledge. (Original work published in 1984).

Kropf, K. (2006). Against the perimeter block. *Urban Design Quarterly, 97*, 12–13.

Kropf, K. (2011). Morphological investigations: Cutting into the substance of urban form. *Built Environment, 37*(4), 393–408.

Larkham, P. J., & Jones, A. N. (Eds.). (1991). *A glossary of urban form* (Vol. 26). Birmingham: University of Birmingham.

Lehmann, S. (2010). *The principles of green urbanism: Transforming the city for sustainability*. London: Earthscan.

Lucan, J. (2012). *Où va la ville aujourd'hui?* [*Where is the city going today?*] Paris: École d'architecture de la ville & des territoires à Marne-la-Vallée.

McCormick, K., Anderberg, S., Coenen, L., & Neij, L. (2013). Advancing sustainable urban transformation. *Journal of Cleaner Production, 50*, 1–11.

Moudon, A. V. (2007). Getting to know the built landscape. In M. Larice & E. Macdonald (Eds.), *The urban design reader* (pp. 256–281). New York: Routledge. (Original work published in 1994).

Næss, P., & Andrade, V. (2013). Housing, mobility and urban sustainability – examples and best practices from contemporary cities. *Nordic Journal of Architectural Research, 22*(1/2), 9–20. Retrieved from http://arkitekturforskning.net/na/article/view/61

Organisation for Economic Co-operation and Development. (2012). *Compact City Policies*. *A Comparative Assessment*. Paris, France: OECD Publishing. https://doi.org/10.1787/9789264167865-en

Oikonomou, M. (2016). The Greek urban block since the establishment of the Greek state in 19th century – A chronicle about morphology and urban form. *International Planning History Society Proceedings, 17*(2), 413–422. http://dx.doi.org/10.7480/iphs.2016.2.1250

Oslo kommune. (2012). *Utearealnormer – Normer for felles leke- og uteoppholdsarealer for boligbygging i indre Oslo* [*Norms for outdoor areas for housing in inner Oslo*]. Oslo: Plan- og bygningsetaten [Planning and Building Services].

Oslo kommune. (2013). *God boligfortetting i Oslo – Eksempelsamling* [*Good housing densification in Oslo – Collection of examples*]. Oslo: Plan- og bygningsetaten [Planning and Building Services]. http://infill.no/wp-content/uploads/2013/05/God_boligfortetting_i_Oslo_eksempelsamling.pdf.

Palermo, P. C., & Ponzini, D. (2010). *Spatial planning and urban development: Critical perspectives* (Vol. 10). Dordrecht: Springer Science & Business Media.

Racine, F. (2016). Developments in urban design practice in Montreal: A morphological perspective. *Urban Morphology, 20*(2), 122–137.

Rådberg, J., & Friberg, A. (1996). *Svenska stadstyper : historik, exempel, klassificering* [*Swedish urban types: history, example, classification*]. Stockholm: Kungliga tekniska högskolan (KTH).

Røe, P. G. (2015). Iscenesettelser av den kompakte byen – som visuell representasjon, arkitektur og salgsobjekt [Staging of the compact city – as visual representation, architecture and sales object]. In G. S. Hanssen, H. Hofstad, & I.-L. Saglie (Eds.), *Kompakt byutvikling - Muligheter og utfordringer* [*Compact urban development – Possibilities and challenges*] (pp. 48–57). Oslo: Universitetsforlaget.

Schmidt, L. (2007). *For tett? Fortetting, planprosess og bokvalitet i nye byboligprosjekter* [*Too dense? Densification, planning process and living quality in new housing projects*] (Vol. 12). Oslo: Norsk institutt for by- og regionforskning.

Schmidt, L., & Thorén, A.-K. H. (2001). *Bebyggelsestyper og bokvalitet i by: en studie av storgårdskvartalet* [*Building types and living quality in city: a study of urban block*] (Vol. 9). Oslo: Norsk institutt for by- og regionforskning.

Stead, D., & Marshall, S. (2001). The relationships between urban form and travel patterns. An international review and evaluation. *European Journal of Transport and Infrastructure Research, 1*(2), 113–141.

Thorén, A.-K. H., & Nyhuus, S. (1994). *Planlegging av grønnstruktur i byer og tettsteder* [*Planning of green structure in cities and settlements*]. *- DN-håndbok 6. Direktoratet for naturforvaltning*. Trondheim: Direktoratet for naturforvaltning.