Urban conservation and urban morphology in Kiruna, Sweden

Jennie Sjöholm and **Erik Hidman**
Division of Architecture and Water, Luleå University of Technology, 971 87 Luleå, Sweden. E-mail: jennie.sjoholm@ltu.se, ORCID 0000–0002–0440–1464;
E-mail: erik.hidman@ltu.se, ORCID 0000–0001–9191–9677

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Abstract. *This paper investigates the interaction between urban conservation and urban morphology. This relationship was studied using the three basic components of urban morphology – resolution, form and time – in the context of the urban transformation of Kiruna. Kiruna is a mining town in northern Sweden where, as a result of the subsidence caused by mining, a new town centre is being built on a new site and extensive parts of the existing settlement are being demolished. The empirical data comprises conservation plans adopted by the authorities and residents' perceptions of the town identified through an urban living lab study. The mapping of stakeholders' perceptions of urban environments that are important to Kiruna's character enabled identification of characteristic features of the town's urban form and selection of the most significant areas for in-depth analysis. The study shows that traditional containment relationships between form elements, which are internationally recognized as desirable, did not prevail in the case of Kiruna. Therefore, contemporary urban planning and design ideas need to be adapted to the local context rather than only based on the overall understanding of urban form.*

Keywords: urban conservation, urban morphology, built heritage, urban living lab, urban transformations, Kiruna

Introduction

Kiruna is a mining town in the northernmost part of Sweden of approximately 18 000 inhabitants, which is a node in this sparsely-populated inland area. The state-owned company Luossavaara-Kiirunavaara AB (LKAB) continues to mine iron ore in the Kiirunavaara mine. The iron ore deposits stretch under the town at a depth of 1365 m and, as constant mining activity is causing subsidence, the built environments are being affected. Therefore, in 2004, the Kiruna Council decided to relocate the town in order to enable mining to continue. In 2012, there was an urban design competition for a new town centre, to be located north-east of the current town (Figure 1). The first building of the new town centre, a new town hall, was inaugurated in 2018. A new railway route, sewage system and electricity supply system have been built. Several buildings from previous residential areas were demolished in 2015, and demolitions are still ongoing. The entire town is a heritage site of national interest (National Heritage Board, 1990) and, starting in 2017, a

handful of historical buildings are being relocated. Most of the relocated buildings have so far been placed in a new residential area built by LKAB, which is situated north-west of the current settlement (Figure 1), but some historical buildings will also be relocated near to the new town centre. As demolition continues, a park will act as an evolving buffer zone between the industrial area and the town.

This urban transformation means that it is important to consider urban conservation aspects: what is sufficiently valuable to retain, and how original form and design can influence the new. Both the identification of characteristic features of the town, significant for its heritage values, and the prospect of transferring these to the 'new Kiruna' will affect the outcome of the urban transformation. Hence planners and decision-makers need to reflect on how significant features of the town can be maintained. Although Kiruna is a special case because of the inevitable relocation of a town due to the mining subsidence, it can nevertheless stimulate a wider discussion of urban conservation that aims to understand the relationship between heritage values and the physical, tangible dimensions of built heritage. The conflict between conservation and natural resource exploitation is not unprecedented. In Eastern Europe, for example, many towns and villages have been relocated or demolished to facilitate coal mining, such as the old town of Most in Czech (Spurný, 2019) and numerous villages in eastern Germany (Ess, 2019). These historic sites have in common that conservation *in situ* is not feasible, and the only options are moving or demolishing structures. This paper focuses on how a historical urban landscape can be described through its urban form, and discusses how this can guide urban planning practice. The main research question is how urban conservation interacts with urban morphology.

Conservation is a broad concept, which includes actions for dynamically managing change (Feilden, 2007, p. 3). Conservation often addresses the management of historic buildings. Although buildings are an important part of built heritage and historic environments, additional dimensions must be considered, as highlighted by UNESCO (2011) in its *Recommendation on the historic urban landscape*. Urban areas are considered to be 'the result of a historic layering of cultural and natural values and attributes', which includes not only features such as topography, built environment, infrastructure, open spaces and gardens, but also land use patterns, spatial organisation and visual relationships (UNESCO, 2011, articles 8 and 9). The recommendation also includes aspects such as 'social and cultural practices and values, economic processes and the intangible dimensions of heritage as related to diversity and identity' (UNESCO, 2011, article 9). Social, cultural and economic processes will, in turn, affect urban form and building traditions (Gauthier, 2005). Thus a consideration of urban morphology can be useful in the conservation of historic environments (Pendlebury, 2009).

Urban morphology is an interdisciplinary field of study in which a range of disciplines can collaborate by studying urban form to explain, for instance, the social, economic and cultural phenomena connected to the form (Moudon, 1997). Citizen participation in urban planning has been argued to contribute knowledge and experience, both of which complement the expertise of planners (Olsson and Berglund, 2013). We argue that studying urban form affords the possibility to include both official and lay perspectives in the transdisciplinary setting of urban conservation planning. An urban morphological approach to urban conservation also has the potential to compare and adapt contemporary urban design practices to the context-specific local urban historical environment and building traditions. The transformation of local urban landscapes has been a focus of urban morphologists such as Saverio Muratori. Muratori understood urban transformation to be based on cultural behaviour as 'laws of continuity' that produced certain urban patterns in space and time. According to Muratori, by understanding and making reference to 'all the components that it [urban form] encompasses and to the ensemble to which it belongs', contemporary urban design practice

Figure 1. Kiruna, Sweden. Top right: location. The upper map shows the existing town, identifying the areas expected to be affected by mining activities over the coming decades, and the locations of the existing town centre, the planned new town centre, and the new mining company area. The lower map shows Kiruna's expansion together with the locations of the original mining company area, service and supply town, and railway area.

could adapt to the historical urban landscape (Marzot, 2002, p. 63). The urban morphological analysis then becomes a search for the pattern of place, including 'the larger patterns in which it is embedded, the patterns of the same size that surround it, and the smaller patterns which are embedded in it' (Alexander *et al*., 1977, p. xiii).

Methodology

This paper applies urban morphological theory focused on the basic components – resolution, form and time (Moudon, 1997) – to set up a framework for studying urban form in relation to urban conservation. The principles facilitate analysis of individual entities, their laws of continuity and connections to other entities in the system that is the built environment. The methodology also draws on Kropf (2014, 2017), in particular the practical implementation of urban morphological analysis.

According to Moudon (1997), resolution refers to different scales in which form should be understood. This is based on a notion that the built environment needs to be understood from the largest regional scale down to its smallest detailed parts (Alexander *et al*., 1977; Kropf, 2014; Moudon, 1997). Each scale factor is connected to larger and smaller entities that together express the physical environment as a whole. The different resolutions can be linked to one another through what Kropf (2014) describes as part-to-whole relationships. Parts are the smaller entities that, together with neighbouring entities, create a holistic impression. An urban morphological analysis therefore accepts that one entity affects the image of the whole but does not solely create that image.

According to Moudon (1997), form is commonly divided into the elements of buildings, plots and streets. More recent discussions have added further elements such as topography, vegetation, and blocks (Kropf, 2017). Again, each element is considered to affect the image of the whole, but is not completed without its connected forms (Alexander *et al*., 1977; Kropf, 2014; Moudon, 1997). The elements facilitate a decoding of the built environment into its parts, where elements can be studied individually and in relation to each other. Kropf (2014) described relationships between these elements as containment relationships since the streets contain the plots and the plots contain the buildings. However, there are certain forms – denoted as interlocking systems by Kropf (2014, 2017) – that lack these hierarchical relationships.

Time is the acknowledgement of the historic dimension of form. In other words, it covers the phenomenon through which form is transformed and replaced over time (Moudon, 1997), as well as being affected by factors such as local and historical building codes and technological development (Gauthier, 2005; Marzot, 2002).

The present study focused on analysing the scales of building, plot and street, and further aimed to explain how these factors are related to parts and the holistic impression of Kiruna's urban morphology. Other form elements, such as open spaces and blocks, were also found to be relevant during the analysis. This work investigated the most important processes leading to the contemporary urban form. In the analysis, descriptions of urban form were summarized in tables and then mapped to empirical data in order to identify physical characteristics of Kiruna as a heritage site. The research process was iterative, as descriptions and mapping provided supplementary insights about the neighbourhoods under study. The process is further explained below.

The urban morphology of Kiruna

Kiruna was established in a company town tradition. Company towns are linked to industrialization and exploration of natural resources, and the majority of these types of settlements were built between 1830 and 1930 (Garner, 1992). The company towns were usually built by a single company, to enable the extraction of natural resources in areas of limited population. Ahnlund and Brunnström (1993) proposed a typology of company

towns, based on the degree of planning and the expected degree of permanency of the towns. 'Company towns' and 'model company towns' were more planned and better organised than 'company locations'. In model company towns the company provided more than was needed for the industry, and included housing of good standard, schools and parks, as well as social welfare systems. 'Shanty towns', on the other hand, usually lacked comprehensive planning and were usually intended to be temporary. Sometimes 'service and supply towns' developed adjacent to the company towns, providing housing and facilities not controlled by the company.

Historical development

The town of Kiruna, founded by the mining company LKAB, was formally established in 1900 (Figure 2). The company area was designed as a model company town, with LKAB prioritizing good housing for its workers, but also investing in infrastructure including a hospital, a fire station and schools (Brunnström, 1981). A service and supply town with a commercial area and privately-owned houses was established adjacent to the company area. A railway area, with a station, a hotel, and housing, was also built. Some of Sweden's most renowned planners, architects and artists were involved in designing the town. For example, Gustaf Wickman designed most of LKAB's workers' housing, along with public buildings such as the church, company hotel and fire station. Wickman (1858–1916) had one of Sweden's largest architecture firms in the early 1900s. He designed a wide range of buildings, often commissioned by the growing number of business and finance corporations, including banks, offices, factories, restaurants, and housing. Per Olof Hallman planned the layout for the service and supply town. Hallman (1869–1941), an architect and town planner, designed plans for towns across Sweden. He introduced a new planning ideal in Sweden, influenced by Camillo Sitte amongst others, where the plans were adopted to the specific sites and its topography rather than being outlined in a generic grid system. The Kiruna layout took the terrain into account, with winding streets designed to both act as windbreaks and provide scenic views over the surrounding landscape.

The company area consists of large plots in which company-related housing and utility buildings (such as a company hotel and administrative buildings) were built. In the oldest parts, with housing units typical for the area, the buildings are located along the streets connecting the town with the mine. Later development areas within the company town were commonly planned and built as individual projects built by one contractor. The urban layout of each area displays then-current ideas of good practice, ranging from grid-inspired structures to modernistic housing blocks. The density of the company area has also been increased by infill projects carefully integrated with their surroundings. Streets, plots, and buildings have no hierarchy or distinction, but rather follow the logic of the design or project of which they form part. This makes it appropriate to explain the area as an interlocking system (Kropf, 2014).

The service and supply town has a more coherent structure. The winding streets make up a grid pattern with blocks typically measuring 95×95 m, although diverse in their geometry. Each block is divided into several plots, and buildings (mainly detached housing) are aligned along the streets and complemented with utility buildings to the rear of the plots. Public buildings were not designed as prominent features, and instead of providing a main square or park, many small green areas were created at road junctions. There are also areas within the urban layout that follow their own logic. The so-called 'Thule area', built by LKAB within the service and supply town during the 1920s, is one example. The area conforms to a grid structure, but each block comprises a plot commonly consisting of four buildings aligned with the streets. The buildings in the north and south of the plots date back to the 1920s, while the buildings in the east and west of the plots are careful additions from the 1950s, visually integrated through scale and colour.

Figure 2. Aerial photograph of Kiruna *c*. 1960, with Kiirunavaara in the south and Luossavaara in the north (source: the Swedish National Land Survey).

Kiruna continued to grow during the economic boom after the Second World War due to LKAB's iron ore production. The three separately-planned areas – the company area, the service and supply town, and the railway area – merged and Kiruna was granted town rights in 1948, resulting in the construction of the Town Hall between 1959 and 1962. Major parts of the town centre, and certain parts of the separate housing areas within the original service and supply town, were replaced. Small-scale, predominantly wooden buildings were replaced with strikingly contrasting large-scale buildings, including a salient redesign of a block by Ralph Erskine. During the 1950s and 1960s, new areas were developed to provide housing for the growing population. Throughout this period, LKAB financed several housing developments, including some outside its company area, utilising

new land to develop the town (Brunnström, 1993).

During the late 1970s and early 1980s, the built environments of Kiruna were officially recognized as being of cultural significance. The local authority produced a conservation plan and protected a large number of historical buildings in detailed development plans, after which the entire town was designated as a heritage site of national interest. Brunnström's research about Kiruna and company towns has been influential; in addition to contributing to the drafting of a conservation plan and the subsequent measures of protection, it was also widely disseminated among Kiruna's inhabitants (Sjöholm, 2015).

Empirical data

The empirical data used in this study comprised conservation planning documents from the local authority as well as an urban living lab among the town's inhabitants. Buildings, places, and environments highlighted in this material were mapped, and the three areas identified as the most significant were selected for further analysis (Figure 3). The planning documents included a conservation plan adopted by the local authority in the 1980s that identified areas, parks and buildings worthy of protection (Kiruna Council, 1984), along with a historical environment analysis produced in the urban transformation planning process (Kiruna Council, 2014).

The urban living lab was part of an interactive study carried out in Kiruna during the spring of 2016 that investigated local perspectives concerning attractive and socially-sustainable urban environments. An urban living lab is a co-creative research environment in which researchers and other participants collaborate to gain knowledge regarding certain issues of interest (Schuurman *et al*., 2011). The living lab in Kiruna included various workshops using tools such as post-its, maps, and photo assignments, and the inclusion of recurring participants was pivotal to capturing in-depth knowledge and affirming the outcomes (Hidman, 2018, pp. 28–9). The main topic of the lab was identifying attractive urban environments in the context of Kiruna, as well as how attractive urban environments could be developed in the urban transformation. The outcome included numerous maps of the existing town in which participants had indicated different categories of their urban environment. All of these categories were derived from collaboration within the lab, and stem from participants' perceptions of an attractive urban environment (Hidman, 2018, pp. 36–8). The categories selected for this study were 'architecture and construction' (buildings and areas perceived to have qualities of attractiveness), and 'culture and history' (buildings and areas perceived as contributing to the identity of Kiruna).

Figure 3 illustrates all of the places referred to in the empirical data (both the planning documents and the urban living lab). We interpreted these places to be significant parts of Kiruna as a heritage site because they were officially recognized and/or highlighted as important by inhabitants. These assessments sometimes overlapped, and some areas were not recognized at all. In this way, some areas have a higher degree of significance, and represent characteristic features representative of Kiruna, while other areas have significantly lower significance.

Areas of significance

The conservation plan (Kiruna Council, 1984) identified seven historical environments based on heritage values: three are located within the company area; three within the service and supply town; and the entire railway area. The plan of the service and supply town, designed by Hallman, was highlighted. Four parks, together with a large number of buildings both within and outside the seven designated historical environments, were also included. The majority of the identified buildings were built before 1930, but a few buildings from the 1950s and 1960s were included. The historical environment analysis (Kiruna Council, 2014) reaffirmed the historical environments identified in the conservation plan and added

Figure 3. Kiruna. The upper map shows all of the buildings, places, and built environments highlighted in the empirical data. The lower map shows the three areas selected for further analysis; more specifically part of the mining company area, part of the town centre and the Thule area.

a few areas developed between the 1940s and the 1960s.

In contrast, the urban living lab provided more varied outcomes. This could be explained by participants considering their individual knowledge, along with the places in which they had lived or experienced through visits, while making their assessments. There was a general consensus among participants that some areas and buildings are important for Kiruna and the town's identity. A comment regarding good neighbourhood form – there is a need for coherence between buildings and their surroundings as surroundings influence the general impression of a place – was made by one participant and accepted by the group. The areas referred to most frequently were parts of the mining company area, the railway area, the town centre, and the Thule area. Among the most significant areas identified from the data (Figure 3), part of the company area, part of the town centre, and the Thule area were selected for in-depth analysis.

The company area

The selected part of the company area (Figure 4, Table 1) includes Kiruna's first built-up areas, where LKAB built administrative buildings, a company hotel, and residential buildings for both workers and engineers. According to the conservation plan, the area is important because it is representative of early-twentieth century society and its social conditions. Furthermore, many buildings are also of great architectonic significance (Kiruna Council, 1984). The historical environment analysis highlighted the area's well-preserved character (Kiruna Council, 2014).

The urban living lab found this area to be significant not only because of its official heritage value, but also because it is a calm area with pleasant historical buildings and ample green and open spaces. The buildings were recognized to be typical of Kiruna and, therefore, participants identified with them. Participants also noted that the open, green spaces would be beneficial for visitors to the area.

The area has a low building density and lacks enclosure. However, the original 95 × 95 m grid structure is still visible and a clear movement pattern (Figure 4, top right) provides legibility and permeability. The area can be perceived as both diverse and coherent: it consists of a mix of older and newer buildings and different typologies, yet buildings, blocks, and open spaces have shared similar characteristics over time.

The town centre

The selected part of the town centre (Figure 5, Table 2) includes a wider range of time layers than the other selected areas. The church is located within the area, along with other public amenities such as the Town Hall (demolished 2019), a former fire station, which has been converted into offices, a former cottage hospital, which has been converted into facilities for a music association, and public baths, which have been converted into a library. Several of these buildings were highlighted as significant in both the conservation plan (Kiruna Council, 1984) and the historical environment analysis (Kiruna Council, 2014). Both documents also pinpoint buildings from the early 1900s, the 1920s, and 1960s as having high architectonic values.

These public buildings were discussed more actively in the urban living lab than the area itself. Among others, the Town Hall, the church, the library and the Erskine-designed buildings were highlighted as being important for Kiruna and this area. A couple of participants had been on an architectural tour in Kiruna and identified buildings with Greek and Chinese references, details they had learned about and that they thought made these buildings interesting. In addition to buildings, participants highlighted informal meeting places such as a concrete stairway, which was recognized as a place to socialize, a fountain and part of a sidewalk.

The area has higher building density when compared to other parts of Kiruna. Blocks are open in character with passageways and semi-private places accessible for visitors.

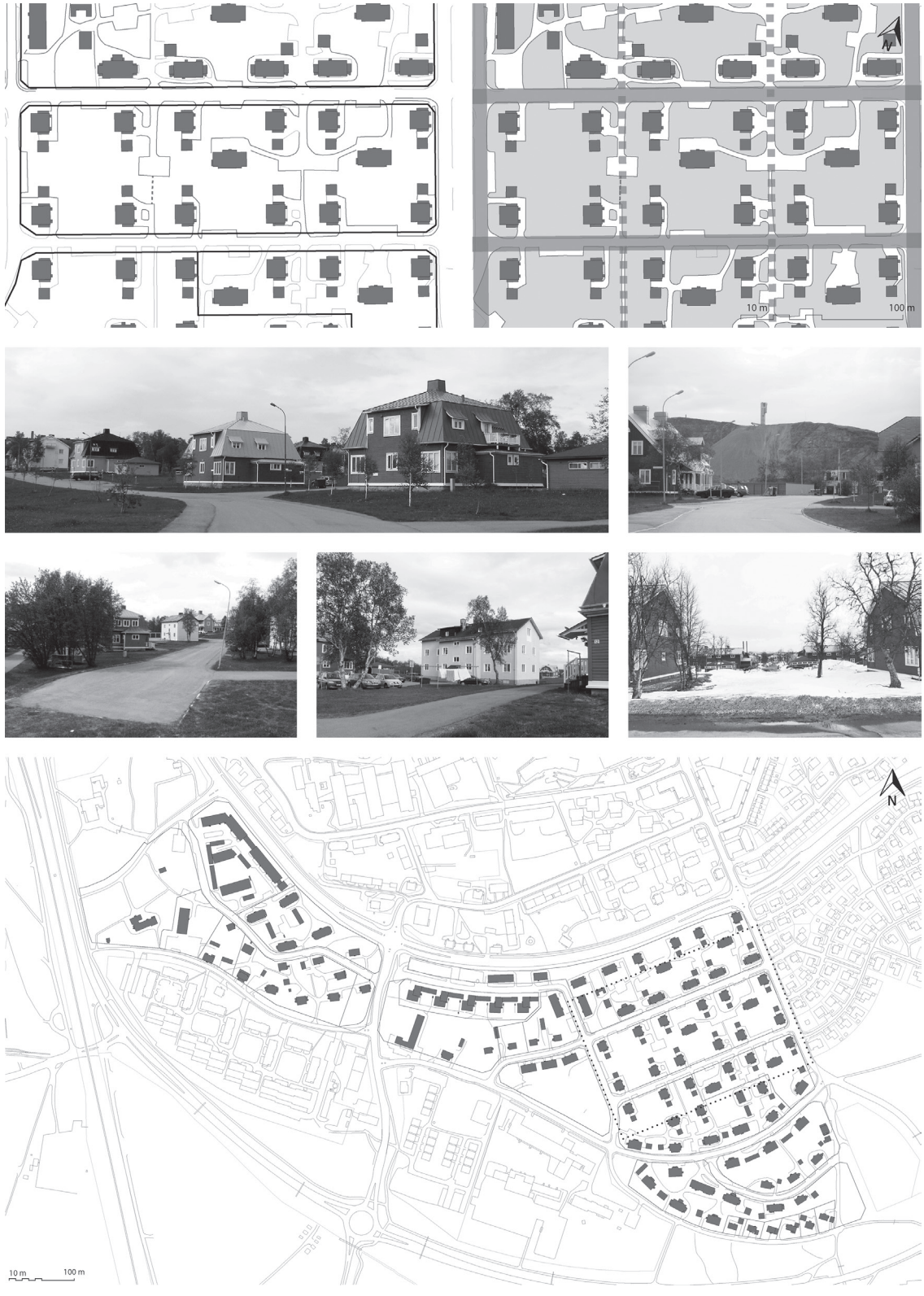

Figure 4. The company area. The upper maps are enlargements of a selected part of the area, that on the left showing buildings and plot boundaries, that on the right shows buildings, movement options and open green areas. The photographs show examples of workers' housing, streetscapes with view towards Kiirunavaara, and open spaces. The lower map shows the entire area with streets, plots and buildings.

Table 1. Form elements and their change over time in the selected parts of the company area

Period of origin	Early 1900s, density increased 1950s–1960s.
Position	South of the town centre, in the valley between the mine and the town.
Vegetation	Spacious green areas. To the west, the buildings sit amongst the greenery without any association with the streets.
Streets	
Types	The west part of the area has an organic cul-de-sac character. In the east the streets follow a grid system.
Connectivity	Poorly connected to the overall street network, only a few access points.
Change over time	Blocks have merged, transforming streets into paths. The placement of the buildings underscores the previous grid, giving a small block character to this part of the area.
Blocks	
Types	Regular designed, open block structure.
Shape	Impression of 95 × 95 m squares, but actually 285 × 95 m rectangles.
Change over time	In the east, the initial 95 × 95 m blocks have merged.
Plots	The blocks predominantly contain one plot.
Open spaces	Open, spacious green spaces surround the buildings.
Buildings	The housing is based on a rental stock that throughout has been built and maintained by LKAB.
Types	Multi-dwelling units, tenement houses, detached houses, hotel, school.
Height	1, 2, and 3 storeys.
Style	The older buildings are predominantly wooden, and have a co-ordinated colour scheme. The neighbourhood's density was increased in the 1950s, with rendered buildings adapted to the existing colour scheme.
Change over time	The joinery in the wooden buildings has been somewhat modified but is still typical for its time period.

The buildings are generally aligned along the streets, which provides some enclosure. The area is perceived as legible despite the winding nature of streets, and the passageways provide a high degree of permeability. The area is diverse in terms of building type and date, and types of public and private places, but the street layout and aligned buildings both contribute to coherence.

The Thule area

The Thule area (Figure 6, Table 3) was developed in the 1920s within the service and supply town. The conservation plan valued it as one of the finest examples of architecture within the region at the time (Kiruna Council, 1984). The historical environment analysis especially highlighted the former school, in which the national Sami parliament is currently located, as being a high-quality public building design (Kiruna Council, 2014).

In the urban living lab, the Thule area was described as a cosy, older area that looks inviting. Participants noted that the mix of colours gives the area a nice character, especially on a sunny day. The historical, small-scale, wooden house development was found to be an urban environment with which participants can identify. The former school, located in the south of the area, was highlighted for its typical architecture and for being a beautiful building.

The area is characterized by medium building density. It is legible because it follows the initial grid structure of the service and supply town. The open plots provide high

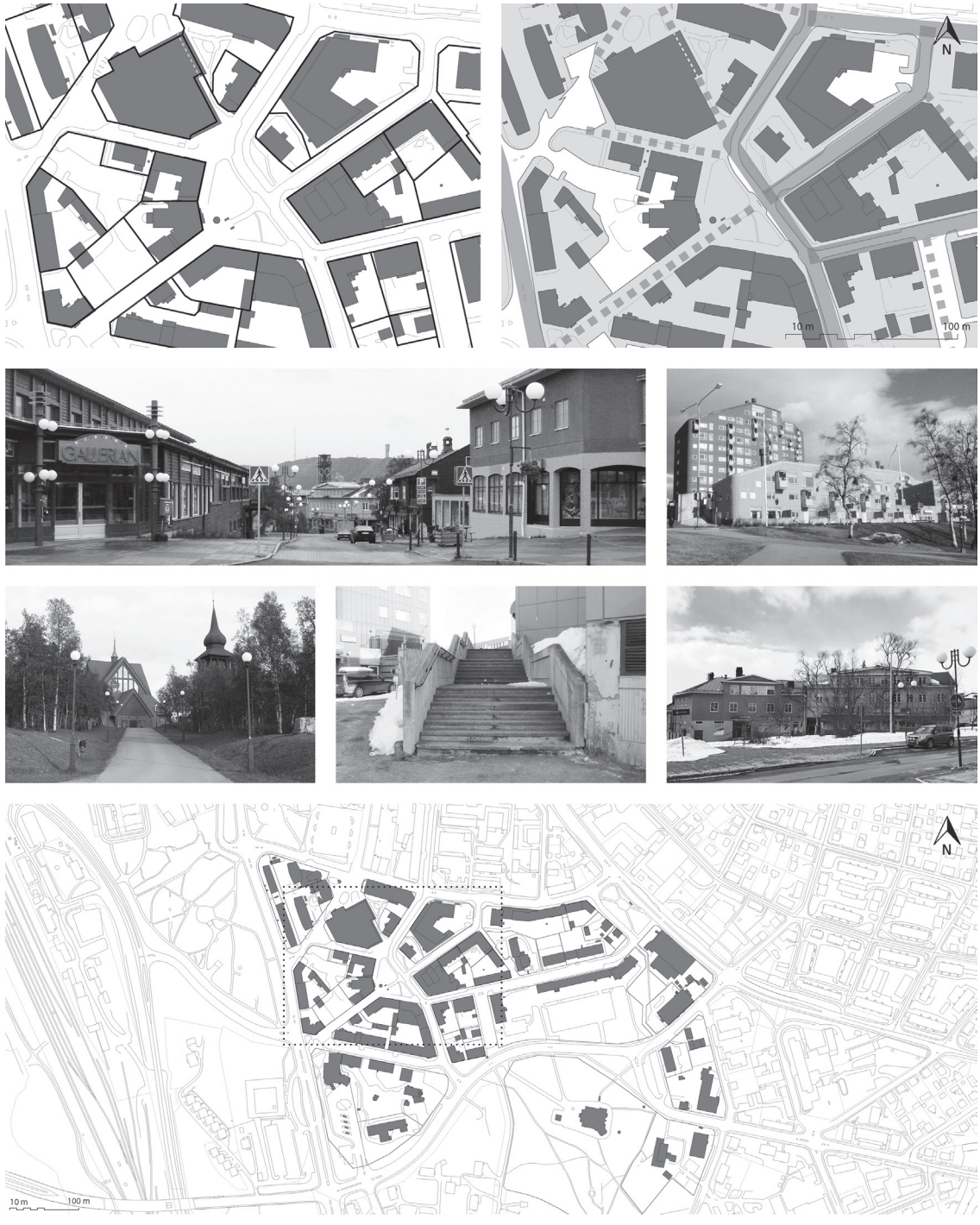

Figure 5. The town centre. The upper maps are enlargements of a selected part of the town centre, on the left showing buildings and plot boundaries, and on the right showing buildings, movement options and open areas. The photographs show the main shopping street Föreningsgatan with a view towards Kiirunavaara, the Erskine-designed buildings, the church designed by Wickman, a concrete stairway functioning as an informal meeting place, and Meschplan, one of the small areas created at crossroads in Hallman's town plan. The lower map shows the entire area with streets, plots and buildings.

Table 2. Form elements and their change over time in the selected parts of the town centre

Period of origin	Early 1900s, 1920s, 1950s–1970s.
Position	On the south slope of the Haukivaara hill, between the iron ore mountains Luossavaara and Kiirunavaara.
Vegetation	Occasional small parks in the town centre consisting of lawns and deciduous trees. The church is surrounded by a park with the character of an arctic birch forest.
Streets	
Type	Grid pattern, organic due to the contours of the hill.
Connectivity	Well connected to the overall street network, a bypass road passes through the area.
Change over time	Rebuilt during the 1960s, implementation of pedestrian streets, one-way passages and culs-de-sac in the town centre.
Blocks	
Types	Predominantly buildings aligned with the streets to create open blocks.
Shape	Irregular, about 90 × 90 sq ms.
Change over time	–
Plots	Most blocks are divided into several plots, but some have merged over time so one block currently contains one single plot.
Open spaces	Open areas and passages between buildings.
Buildings	
Types	Housing, public buildings.
Height	Mainly 2–4 storeys. Some point-blocks of 8–10 storeys.
Style	Wooden buildings from the early-twentieth century, a block rebuilt with stone buildings in the 1920s after a fire, and apartment buildings from the town renewal in the 1960s.
Change over time	Most of the area originated as part of the service and supply town. Blocks were merged and old buildings were replaced by new apartment and commercial blocks during a rebuilding of the town centre in the 1960s.

permeability. The alignment of buildings with the streets provides some enclosure, while building design and a co-ordinated colour scheme provide coherency. The mix of building ages and colours adds some diversity.

Analysis of common features

Based on the descriptions presented above, a number of specific features contribute to the characteristics of Kiruna:

- Open, green, and collectively-used plots and areas rather than privately-owned detached housing areas.
- Areas that are visually integrated into the surrounding urban structure.
- Urban form that incorporates several time layers, for example new buildings blend in with the historical character.
- Town areas that are nationally renowned for good architectural qualities in design, materials and details.
- Wooden multi-dwelling, small-scale buildings with mixed but co-ordinated colour schemes.

Overall, the significant areas are characterized by a low level of containment relationships between form elements, as explained by Kropf (2014). Instead, the areas consist of interlocking forms where blocks, plots and streets are interwoven with no clear distinction between form elements.

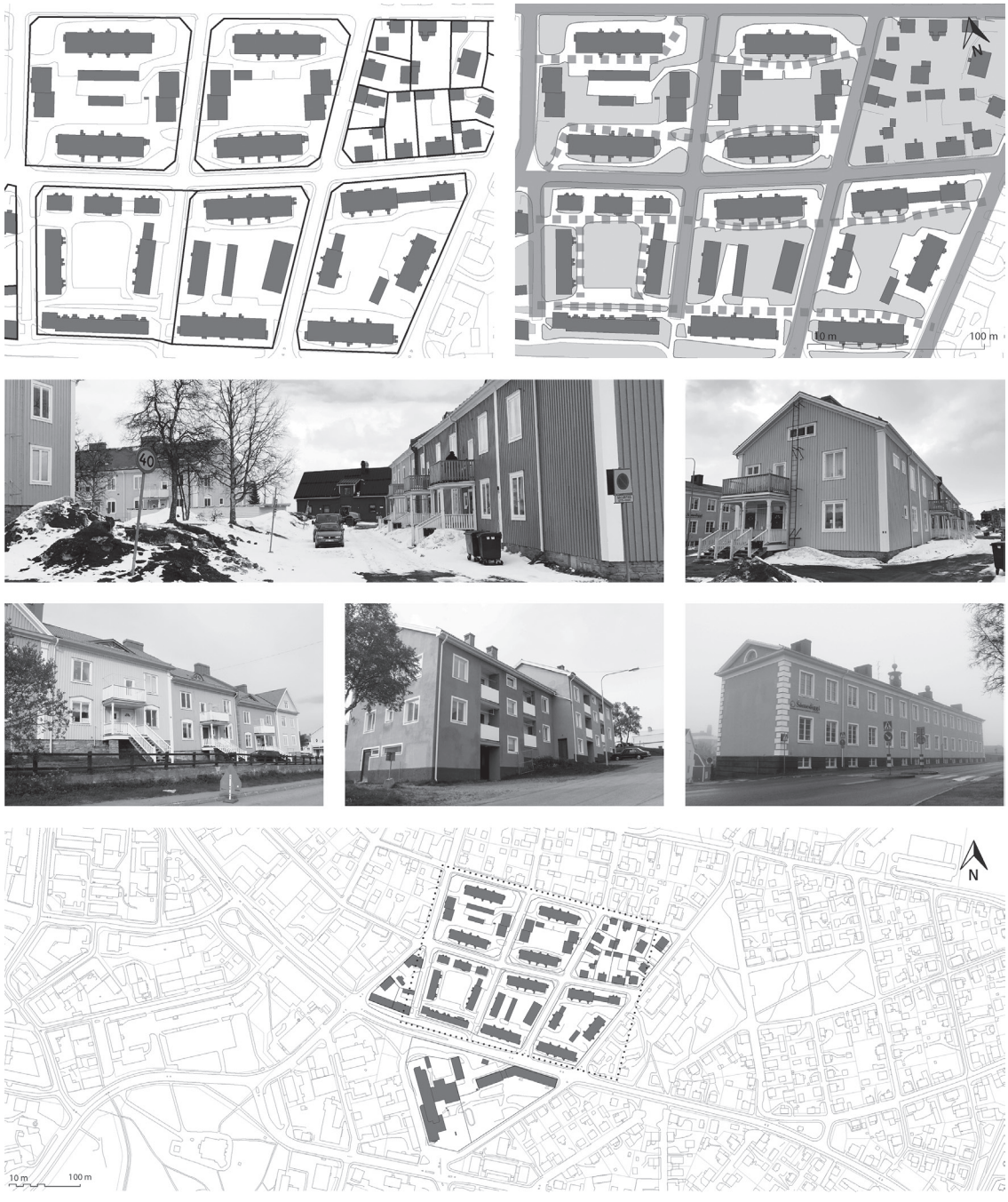

Figure 6. The Thule area. The upper maps are enlargements of a selected part of the area, that on the left showing buildings and plot boundaries and on the right showing buildings, movement options and open green areas. The photographs show streetscapes, housing from the 1920s and 1950s, and the Swedish Sami parliament located in a former school. The lower map shows the entire area with streets, plots and buildings.

The empirical data stress part-to-whole relationships rather than containment relationships. The domination of part-to-whole relationships could support an impression of physical coherence and legibility.

All of the areas are characterized by interventions that have changed their appearance over time. Generally, any infill and regeneration projects have followed the key characteristics of an area, such as scale and colour

Table 3. Form elements and their change over time in the Thule area

Period of origin	1920s, density increased 1950s.
Position	Developed within the service and supply town, and well integrated with the surrounding areas. Borders the town centre to the west and is located on the eastward slope of the Haukkivaara hill, giving it some views to the east.
Vegetation	Plain lawns with occasional deciduous trees.
Streets	
Type	Grid system.
Connectivity	Connected with surrounding areas, but only a few connections provide vehicular access to the main road, which runs through the area.
Change over time	Some junctions to the bypass road have been closed, leaving some culs-de-sac in the area.
Blocks	
Types	Predominantly open blocks with buildings aligned along streets, entrances towards the inner yard.
Shape	Rectangular, slightly skewed blocks. In general about 90–120 m between framing junctions.
Change over time	–
Plots	One block equals one plot.
Open spaces	Passages between buildings and some open areas.
Buildings	The housing is based on a rental stock that throughout has been built and maintained by LKAB.
Types	Five blocks of wooden apartment buildings give the area its character. Across the street, south of these building blocks, there is a former school building, currently the home of the Sami parliament.
Height	2 storeys.
Style	Wooden panel architecture from the 1920s. Rendered buildings, adapted to the existing colour scheme of surrounding buildings, from 1950s.
Change over time	Addition of garages.

schemes. Street patterns and block structures essentially follow the original town plan, and buildings added later have blended into these structures. The residential areas have been strengthened over time with the addition of housing provided by the mining company, whereas the town centre has followed the typical Swedish post-war pattern of increasing density with apartment buildings and ambitions to provide more efficient shopping facilities. This could again be related to the importance of coherence, but can also represent the wish for diversity stressed by the urban living lab group.

Many of the buildings and areas both highlighted in the urban living lab as significant for the character of Kiruna and included in conservation plans were either designed by renowned architects or have other acknowledged qualities. An architectural tour that explains the characteristics of different buildings and widely-available literature about the town have provided both planners and inhabitants with ample knowledge about the town and its history. This suggests that knowledge about architecture and urban design develops an understanding of these concepts and facilitates interactions between planning practice and user experience.

Conclusion

This study shows that an urban morphological approach could be useful for the description, identification and classification of features

that are important for the character of urban environments. Analyses that include the basic components of resolution, form and time can provide urban planners interested in conserving historical landscapes with information that goes beyond the recognition of historical buildings.

A particularly interesting finding from an urban morphological analysis of the town of Kiruna is that traditional containment relationships between form elements are not necessarily relevant. This goes against international ideas of desirable urban form, which generally advocate dense neighbourhoods and clear spatial definitions (for example Çalışkan and Mashhoodi, 2017). Contemporary urban planning and design ideas of enclosure must therefore be adapted to the local context, and not only based on the understanding of prevailing qualities of urban forms.

In an urban transformation, such as the relocation of Kiruna, it would be interesting to further investigate how these components – resolution, form and time – can be integrated into the management process underlying the transformation. In other words, would an urban transformation be considered more successful if variations in the complexity of physical features constituting town character – a result of the town evolving and developing – were at the forefront of the transformation process?

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