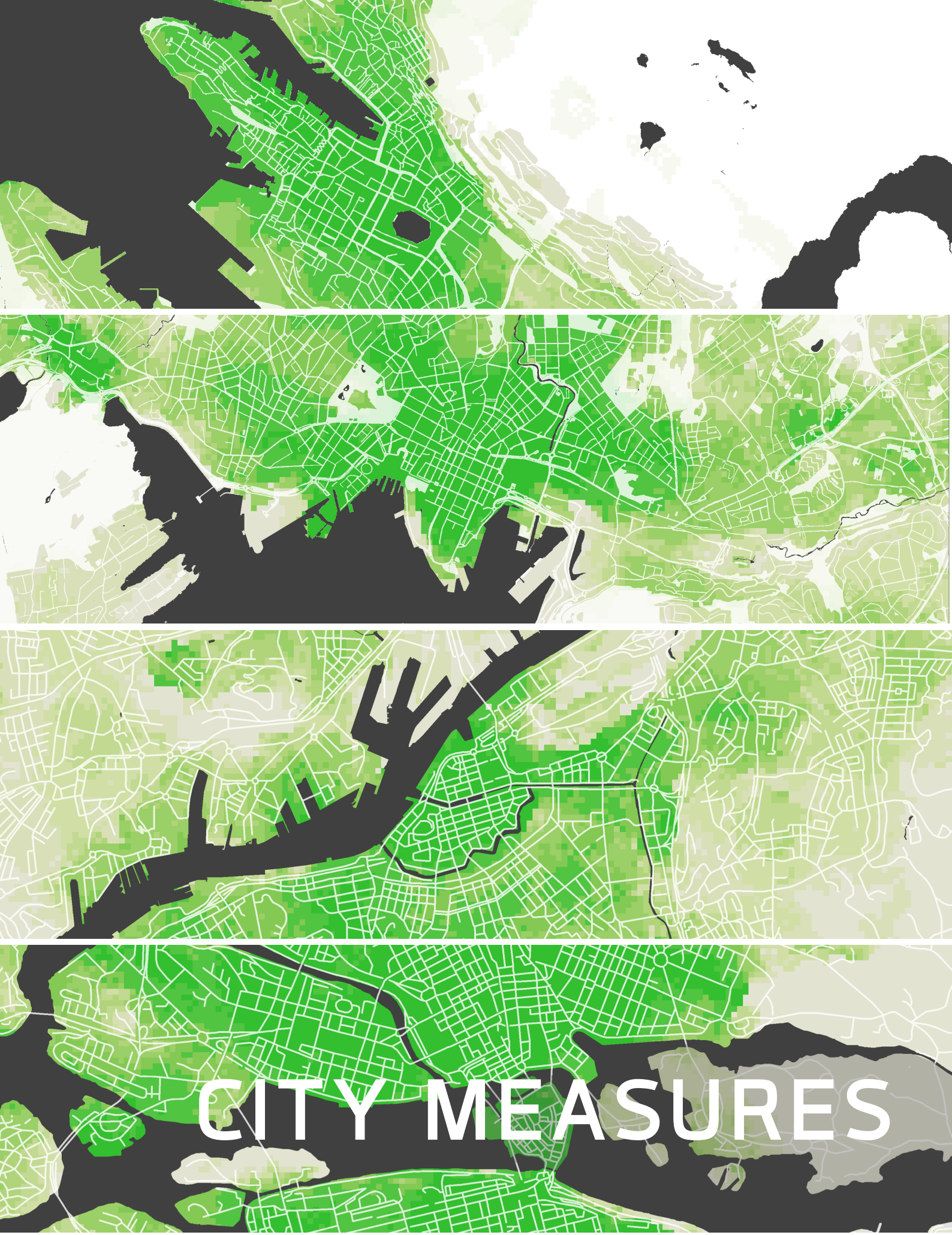
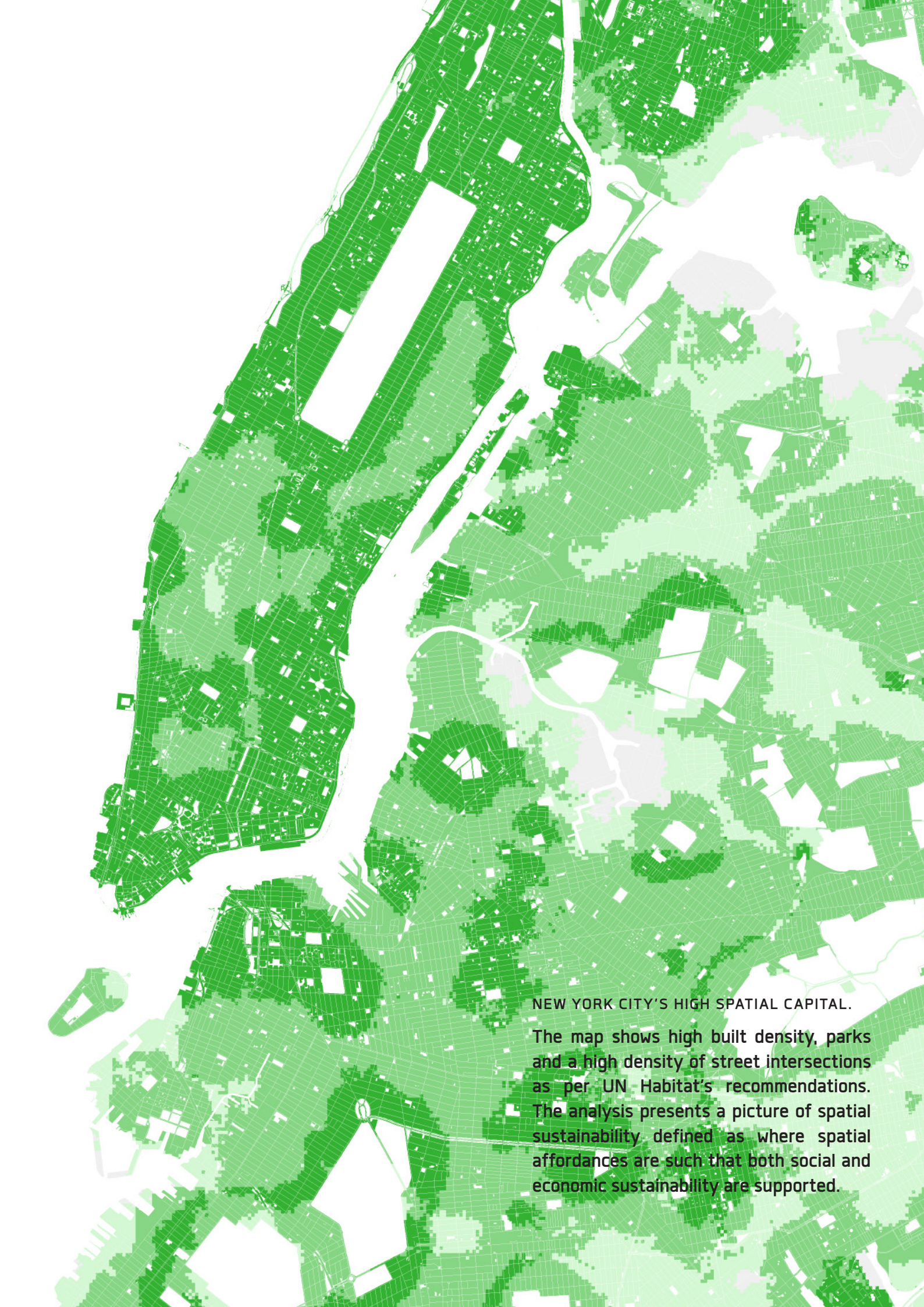


CITY MEASURES

SPACESCAPE

A Guide for Research Driven Urban Design



NEW YORK CITY'S HIGH SPATIAL CAPITAL.

The map shows high built density, parks and a high density of street intersections as per UN Habitat's recommendations. The analysis presents a picture of spatial sustainability defined as where spatial affordances are such that both social and economic sustainability are supported.

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AUTHORS

Alexander Ståhle
alexander.stahle@spacescape.se

Helena Lundin Kleberg
helena.lundin.kleberg@spacescape.se

Ida Wezelius
ida.wezelius@spacescape.se

Eva Minoura

Moa Rydell

Stina Gjertsen

STOCKHOLM OCTOBER 2018

SPACESCAPE

Östgötagatan 100 | Box 4700

SE-116 92 Stockholm | Sweden

www.spacescape.se

ABOUT THE REPORT

This report is a summary of the knowledge and models used by us at Spacescape. The focus is on the urban environment, encompassing both public and private space. Through our experiences working with urban development and design we have noticed that concrete tools and methods to ensure the quality of the urban environment are lacking in practice. By consolidating research-based measures and guidelines for urban space we hope to contribute to a more knowledge-based urban development and better urban design.

Many of the maps presented here come from a research project Spacescape executed for Bergen municipality in Norway in 2015. In the course of the project, we compared Bergen with other cities in Norway based on a number of variables which affect how we use and perceive our cities. These analyses are the basis of this report.

The report is made up of four parts: public space, street space, private outdoor space and built space. For each theme, a number of measures, thresholds and methods of analysis are presented. These have either been developed within research or are well-established within urbanism. The measures are then applied to analysis of one or several Scandinavian cities. With a basis in practice and research, the urban analyses are used to suggest recommendations for how the urban environment can be designed. All recommendations have to be set in the context of your location. Some recommendations are generally applicable, some have to be tuned to the place for planning.

Spacescape's methods are constantly being updated and revised in response to the latest urban design research and the urbanism we practice on a daily basis. We look forward to embarking on this knowledge-production with all who work within architecture, planning and city-building as well as readers of this report.

DICTIONARY

ACCESSIBILITY

Describes the degree to which it is possible for people to physically access and use an urban space.

BLOCK

A contiguous group of properties. May comprise one or several properties.

DENSITY

A concentration of people or built space. Measured as the number of people or the quantity of floor area within a defined area divided by the total ground space of the same area.

FAR (FLOOR AREA RATIO)

An expression of density. Measured as the gross floor area within a defined area divided by the ground space of the same area.

GFA (GROSS FLOOR AREA)

The sum of the floor are of each level within a defined area.

PUBLIC GREEN SPACE

Public space predominantly covered by vegetation. Examples are parks and nature.

OPEN SPACE

All outdoor space not dedicated to streets, roads or other infrastructure. Examples are parks, squares, nature, gardens and courtyards.

PRIVATE HOUSEHOLD OPEN SPACE

Outdoor space belonging to a household or a residence. Examples are a garden or a private patio.

PRIVATE OPEN SPACE

Outdoor space with limited accessibility and hence not understood to be public space. Private open space may be either household or shared space, depending on if the designated users are individuals or a group of residents.

PUBLIC SPACE

Urban space understood to be accessible to everyone. UN Habitat (2017) defines it as "Public spaces are all places publicly owned or of public use, accessible and enjoyable by all for free and without a profit motive." Examples are streets, parks, squares and natural recreation areas.

PRIVATE SHARED OPEN SPACE

Outdoor space belonging to a defined group of users, such as a residential yard/courtyard or school yard.

STREET SPACE

Publicly accessible space used mainly for circulation. Includes space dedicated to pedestrians and vehicles. May also include space for cycling and parking.

CURRENT DEMAND FOR KNOWLEDGE-BASED URBANISM

With a little hindsight it is already evident that the transition into a new millennium involved not just relearning how to count the passing of years, something bigger changed too. Through digitalization and globalization, the most minuscule is combined with the most expansive into a new constellation in which we as individuals find ourselves everywhere, all of the time. This is a fundamentally new world order which both creates amazing possibilities but also poses previously unforeseen hurdles.

With the current transformation follows a series of crises difficult to imagine only twenty years ago. Humanity's impact on the environment has reached a magnitude that has led geologists to now refer to he current era as the Anthropocene. Meanwhile, social upheaval appears to be on the rise once again and after the deepest financial crisis since the 1930's, it is not immediately evident how we can build a better future.

Global urbanization is a parallel process of upheaval in full force in Sweden as it is elsewhere. There are many ways to measure this phenomenon - one is the simple fact that the equivalent of two Vancouvers are built every week. Another is that globally, as much housing will be constructed in the next twenty years as there is at present in Europe.

All told, these factors point to an impending need for a more controlled and knowledge-based urban development to meet the challenges of such rapid growth. The reason is simple; since humanity is the predominant source of the extensive problems we face and cities are where we find humans, the best way to change people's behavior is by building better cities. Urbanism has suddenly become one of the most crucial toolkits for creating a more sustainable and just future.

The pressing question however, is whether we know how to do this. Siting housing merely by orienting buildings to natural light, providing schools within walking distance and following a specified parking norm is not enough. Today's challenges require creating the preconditions for social integration, meeting-places, sustainable markets and ecosystem services.

Do we understand how to do this?

Urbanism practice faces a challenge in terms of sharpening both it's knowledge-base and it's tools. We must reassess our procedures so that more may contribute their knowledge to urban development, which can better incorporate the experiences of residents and local actors. But we must also develop greater expertise and the requisite tools.

In recent decades, a scientific leap has strengthened the role of the traditional urban designer by way of more sophisticated analytical support. Among the important principles are first, that we must begin to see the city as a system - a phenomenon with many contributing parts. An urban space has characteristics given to it not only by it's own form, but also by where in the system we find it. The qualities of a place depend in large part on which flows pass through it and these in turn, result from the place's location in the city. Systems-thinking has been underdeveloped within urbanism, with consequences for the creation of vibrant meeting-places, urban life generally and the catchment needed to sustain basic services.

On the other hand, we must understand that beyond general knowledge about hos cities perform, there are factors which make each place unique. The design at the small scale; the width of a sidewalk, the interface of public and private land, the shape of parks are all elements which have been found to shape general social situations which produce the city's qualities. In short, we must consider both the unique and the general in place- and city-building.

When it comes to the overarching sustainability imperative, there is a third important principle to develop urban design and it's tools further. The form of complex systems we find in cities are made up of many distinct systems where some have a faster rhythm and some are slower. Typically the slower systems tend to be foregrounded to the faster ones, which is why they are especially significant when it comes to creating stability in the system, this is what is generally referred to as resilience. What urban design is about - namely shaping the city's spaces through built form, is an excellent example of a slow system which orders other systems, that is provides

stability and sustainability to other systems in the city.

In order to develop knowledge about these things, we need research that has time to go beyond the most apparent everyday hurdles. What we need to do, is to describe the urban form in a way that captures the importance of the form for various social phenomenon, such as flows of people, perceived accessibility or available services. This is a form which is not apparent to the naked eye; rather it is an effect of the urban structure. Therefore, we need specific techniques in order to decode it. You might say that this is a second form, encoded if you will into the first form. This second form is not something mysterious, but is simply a natural result of how a system is constructed. Urban design, like architecture operates in the domain of the structuring of space.

In the face of current challenges, we need to develop more precise knowledge about this second, lesser-understood form and how it affects and supports the various processes at play in the city in fundamental ways. In fact, it is quite strange how little recognition this second form has received throughout architecture- and urbanism history, given it's immense significance for urban life. Where the 'first form' says something by way of a visual and aesthetic expression, the 'second form,' manages instead, in spite of being invisible to do something. This is where Spacescape sees it's role, as a research-based urbanism practice - to ensure that what we say will happen actually does.

1. INTRODUCTION

1.1 CITY MEASURES

Analyzing urban structure using measurable factors has three aims from a planning perspective.

1) Understanding how an urban environment functions.
2) Understanding the consequences of a proposal.
3) Guiding the design of a planning proposal.

As for the first two aims, the measurable factors serve as an analytical tool and for the third, measures may serve as recommendations. Regardless of application, it is important to use measures that are both precise and able to capture the use and experience of the city. At the same time, the measures should lend themselves to use as tools for planning and design.

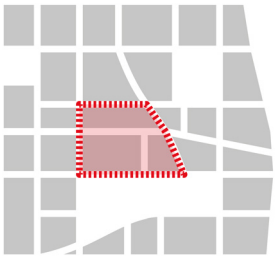
METRICS AND MEASURES

Many analyses of the city look at an area as a point of departure. Number of residents living in an area can be captured for the area, as can for instance the share of an area which is comprised of public space. Such analyses are inherently dependent on how the area being studied is defined and the results may vary depending on how the area has been delimited. This is a problem referred to as the Modified Area Unit Problem (MAUP).

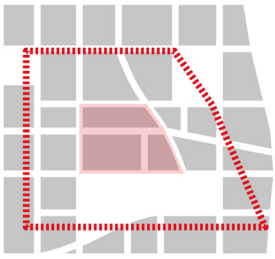
From the start, it is important to distinguish between areas defined for administrative reasons (ownership, construction, management) and those defined on the basis of perceptual or functional factors (urban life analysis, planning, urban design). Perceived area boundaries are more complex to discern and require knowledge and theories on how boundaries are experienced.

AREA

A common method is to perform measurements on an administrative area, for example a neighborhood district or planning area. This is the method of delimitation most adapted to administrative zones in the city and is thus commonly used within planning. One advantage of this way of defining an area is that the analysis tends to match the administrative responsibility for the same area, in the case of a redevelopment plan for instance. A drawback is that the area may not be defined in a way that matches the experience of the city. For instance, if we want to measure density in order to understand



AREA



AREA WITH BUFFER

LOCATION

the possibilities for a bustling urban life, measuring the population within the redevelopment or plan area will not account for those living and working adjacent to the area who are likely to use the streets within the plan area.

AREA WITH BUFFER

In order to assess what is just beyond the area being studied, a buffer can be included in the analysis, such as 500 meters. This is a delimitation procedure used in New York City's accessible green space model (New York City, 2014). The method gives a fair picture of how the area is experienced. It does not take into account barriers like roads or water; nor does it show variations within the area

LOCATION ANALYSIS

In order to capture variations within an area, one can also delimit an area by measuring how far one can reach from different starting points. Examples of starting points can be a building or the midpoint of a grid covering the area in question. This method delimitation-method gives a more accurate

representation of how the area is experienced. It also is better able to capture variations within the area of analysis. A location analysis can either be done from straight-line or walking distances. Using walking distances means that barriers like large roads and bodies of water are automatically accounted for.

DISTANCE

At times, instead of measuring quantities or shares of something, one wants to know the proximity to something, such as amenities, parks or public services. Proximity can be measured either using straight-line or walking distance. The latter better captures the experience on the ground since it considers barriers like differences in elevation or infrastructure.

RECOMMENDED MEASURES

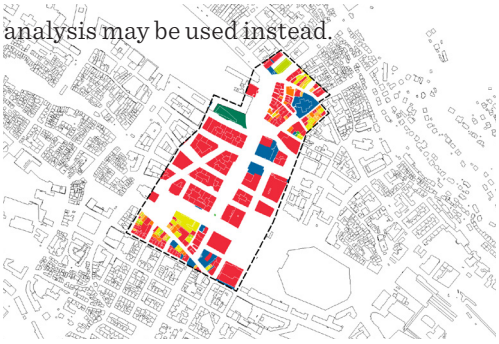
In order to guide the design of a proposal, it is common to set up measurable criteria or recommendations. A maximum proximity to green space is one such a criteria. Recommendations on the block- versus the neighborhood-level may differ. Recommendations on the block-level generally set constraints on private space, such as common yards or private gardens. Recommendations on the neighborhood-level set constraints on public space, that which is accessible to all.

BLOCK ANALYSIS

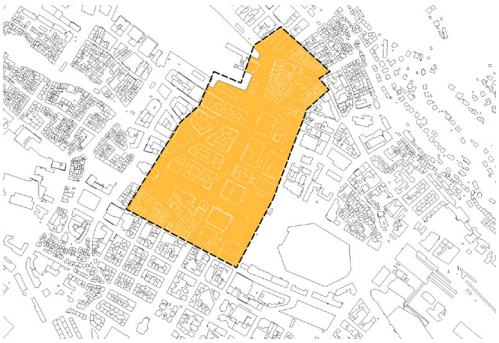
The purpose of analyzing the block is to understand block characteristics like the share of green- or playspace within the block. Here one is interested in finding out what areas are available to residents of the block, hence it is relevant to use an area analysis defined by the block itself.

DISTRICT ANALYSIS

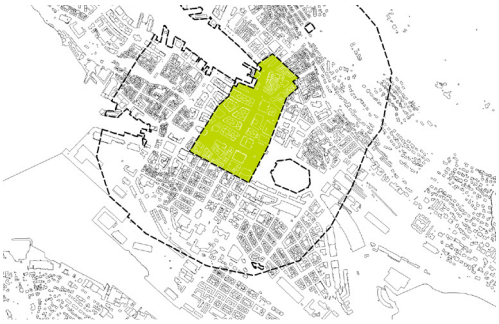
When analyzing districts or neighborhoods, understanding public space is key. Public space can be seen as a continuous space that continues beyond the neighborhood being analyzed. Hence, it is necessary to put the neighborhood in a larger context and use either a buffer- or location-analysis. Location analysis shows variations within an area which makes it a useful design tool. By analyzing variations within the area, it is possible to test alternative solutions. Since location analysis requires more sophisticated methods of analysis, it risks becoming complex. Therefore, as a basis for recommendations, a buffer analysis may be used instead.



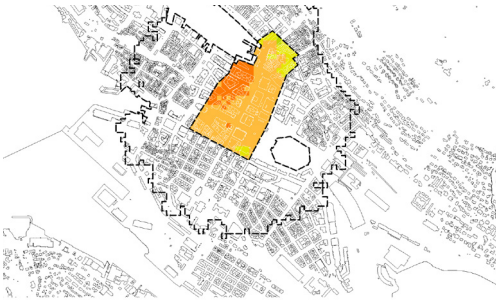
Density – area analysis, block



Density – area analysis, neighborhood



Density – area analysis, 500 m buffer



Density – location analysis, walking distance 500 m

Density measured as FAR (Gross floor area/area)

> 2,4	2,1–2,4	1,8–2,1	1,5–1,8	1,2–1,5
0,9–1,2	0,6–0,9	0,3–0,6	< 0	

DIFFERENT ANALYSES – SIMILAR MEASURES

The densification in Bergen city-center in Norway is here analyzed using four different analyses. Looking only at the block-level, they appear to be far denser than when a larger area is considered. Location analysis shows greater variation, for instance the southern part of the area is denser than the northern.

1.2 CITY BUILDING-BLOCKS

A city is comprised of different physical components, or building-blocks. Outdoor space, in effect the space between buildings (unbuilt space), is the building block that is most crucial for city-building. In our analytic model, we divide outdoor space into three main categories: public space, street space and private outdoor space.

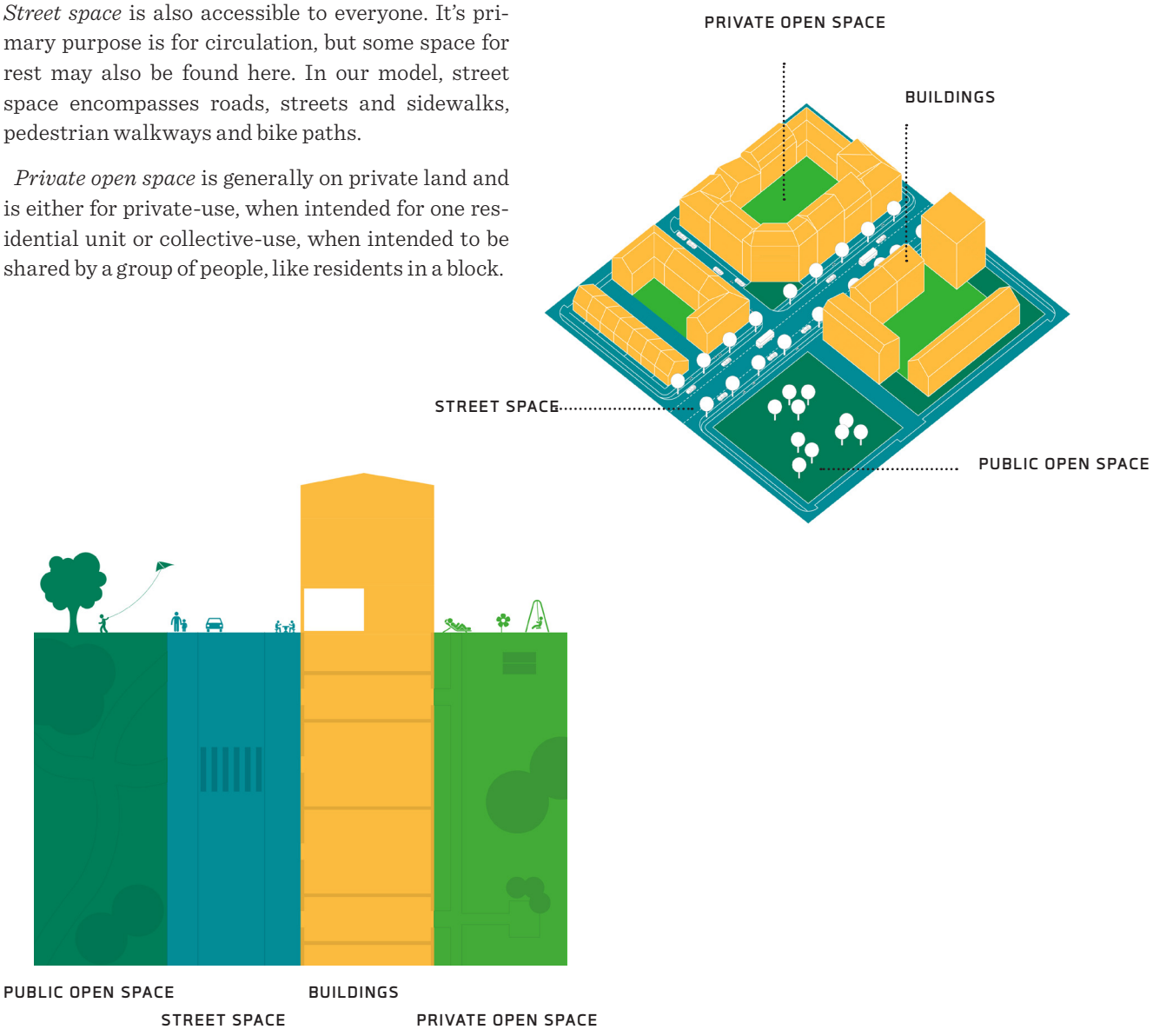
Public open space is space accessible to everyone. It is generally on publicly owned land and differs from street space in that it is primarily intended for rest and recreation. Examples of public open space are squares, parks and nature.

Street space is also accessible to everyone. It's primary purpose is for circulation, but some space for rest may also be found here. In our model, street space encompasses roads, streets and sidewalks, pedestrian walkways and bike paths.

Private open space is generally on private land and is either for private-use, when intended for one residential unit or collective-use, when intended to be shared by a group of people, like residents in a block.

Buildings are perhaps the most obvious building block and encompass buildings housing for instance residences, offices and commercial services. Buildings may also have a mix of functions, for instance businesses in the ground floor and residences above.

Urban design is about structuring and shaping these building blocks so that they contribute to a society's sustainable development.



Analytic model

PUBLIC OPEN SPACE

A city needs it's public open space for basic social affordances, such as social integration, gathering places, place identity, recreation, nature and children's play and development. These functions cannot depend on private land, rather they represent human rights which can only be protected in public open space. Examples of public open space are squares, parks and nature. These need a certain expanse in order to be functional and adequate space must therefore be reserved as part of the planning process.

2. PUBLIC OPEN SPACE

2.1 SHARE OF OPEN PUBLIC SPACE

BACKGROUND

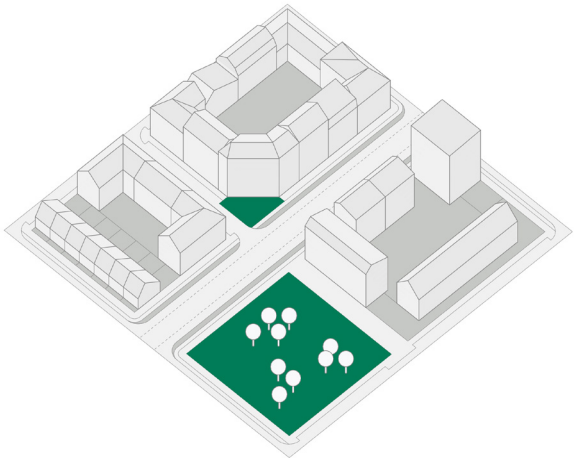
A simple way to capture how much ground space is reserved for public open space in an area is to study how large a share of the total open space that is comprised by public open space. This method of measuring land-use is standard within urbanism.

In cities like New York, London, Paris and Stockholm, which often are ranked highly in terms of livability, approximately 10–20 percent is public open space. The United Nations agency for human settlements and sustainable urban development (UN Habitat), has analyzed share of public open space and come to the recommendation that 15 percent public open space is a threshold that ensures that adequate space is set aside for the squares, parks and nature that people need (UN Habitat, 2014).

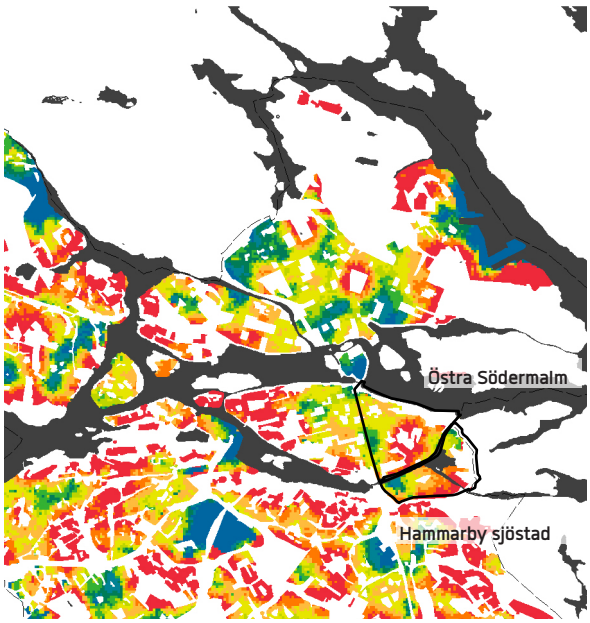
ANALYSIS

Analyses of Stockholm, Gothenburg, Oslo and Bergen reveal that large areas of all these cities have less than 10 percent public open space. This is too low, and particularly Oslo sticks out as having large neighborhoods where the share of public open space is much lower than the recommendation. In Gothenburg, centrally located industrial areas are particularly lacking in public open space. Neighborhoods like Grünerløkka and parts of Stockholm's inner city prove that it is possible to combine density with a share of public open space in the order of 15–20 percent.

$$\frac{\text{PUBLIC OPEN SPACE WITHIN THE AREA}}{\text{TOTAL AREA}}$$



>SHARE OF PUBLIC SPACE



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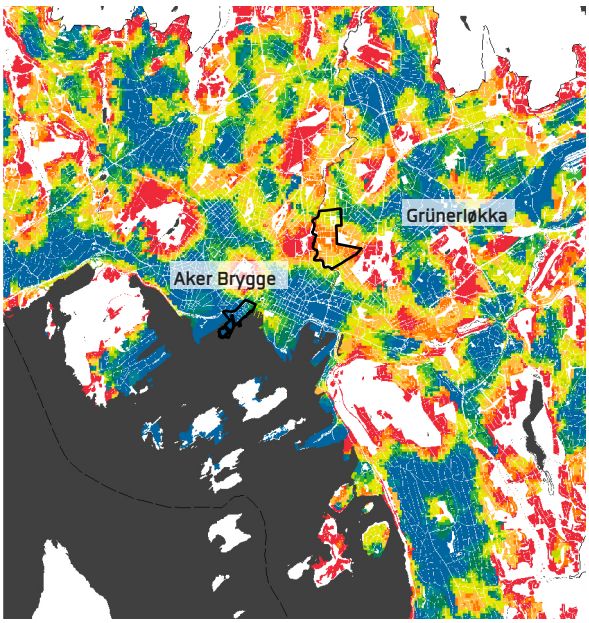
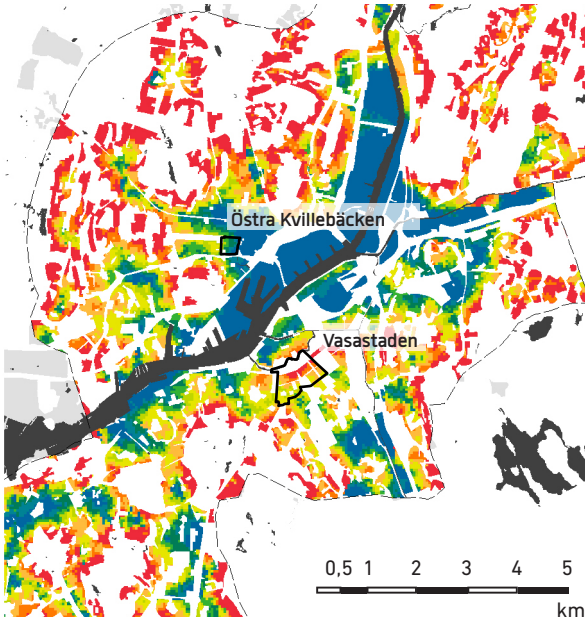
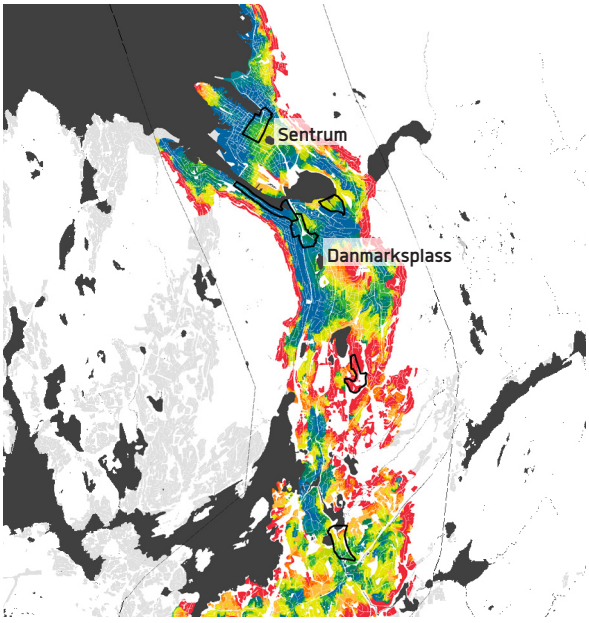


OSLO



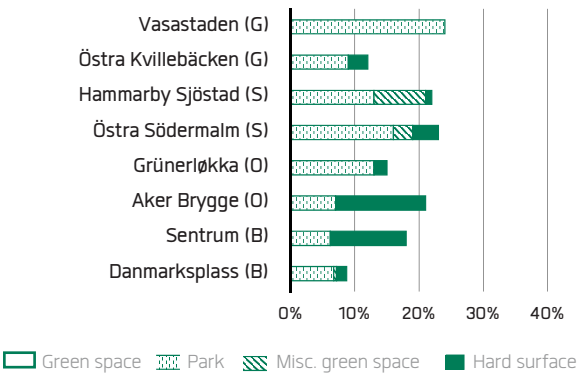
GOTHENBURG



BERGEN

Share of public open space within 500 m

> 25 (%) | 20–25 | 15–20 | 10–15 | 8–10 | 6–8 | 4–6 | 2–4 | < 2



Share of public open space in eight neighborhoods.

CONCLUSIONS

UN Habitat's recommendation that at least 15 percent of the total ground space be reserved for public open space appears to be attainable threshold based on analyses and research available. In order for these areas to be qualitative, 2/3 should be green and 1/3 of the area should be park-like. In effect, 10 percent of the total ground space should be comprised of public green space and 5 percent by public park space.

In the densest neighborhood in Gothenburg, Vasastaden, the share of public open space is 24%, mainly consisting of public parks.

In the dense neighborhood of Grünerløkka (Oslo) the share of public open space is 15%. Most of the spaces are public parks.

RECOMMENDATION

Minimum
15% public open space
10% public green space

5% public park space

OF THE TOTAL AREA

2.2 SPACIOUSNESS

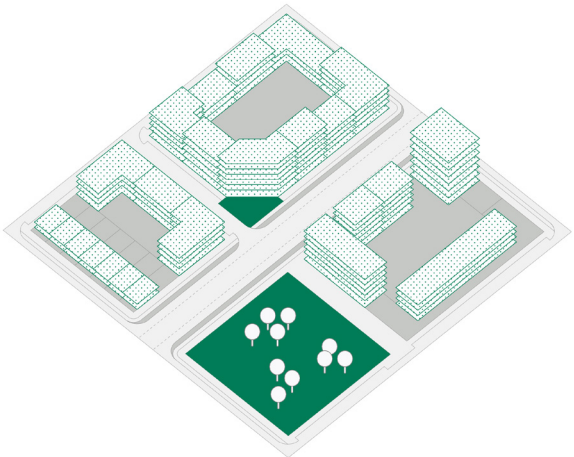
BACKGROUND

Urban density affects public space. A denser city translates to greater congestion and greater wear and tear on public space. In order to ensure that the share of public open space and green space is adequate relative to the population, a measure called spaciousness is used.

Spaciousness can be measured as the square meters of public open space per person (residential and working) or the square meter of public open space per gross floor area (GFA) within an area. In the City of Stockholm city, a threshold of 5-10 square meters per person is being discussed, which equates to 10–20 square meters of public open space per 100 square meters of GFA. 100 square meters GFA is used in Sweden as an average residential unit, including secondary space. New York City recommends at least 10 square meters public open space per resident on neighborhood level (New York City 2014).

PUBLIC OPEN SPACE

GROSS FLOOR AREA



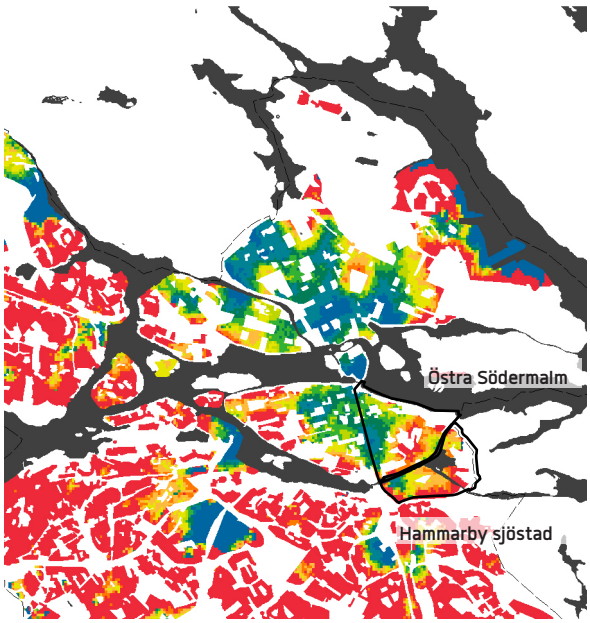
ANALYSIS

Analyses of Stockholm, Gothenburg, Oslo and Bergen show that the quantity of public open space per GFA is relatively similar in nearby neighborhoods for all cities studied. The lowest spaciousness of the studied neighborhoods was found in newly built areas Östra Kvillebäcken in Gothenburg and Aker Brygge in Oslo. They have less than 5 square meters of public open space per 100 square meters GFA. As a consequence, many people must share the inadequate public open space resulting in a higher wear and tear on the public green space. This tends to lead to green space being transformed over time to more impermeable surfaces. In fact, this challenge is shared in all the central city districts of the cities studied. Vasastaden and Hammarby Sjöstad have the highest spaciousness with more than 10 square meters of public open space per 100 square meters of GFA.

"As a planning goal, a ratio of 2.5 acres per 1,000 residents* represents an area well–served by open spaces"

* approx. 10 sqm per inhabitant

Excerpt New York City's CEQR TECHNICAL MANUAL 2014.



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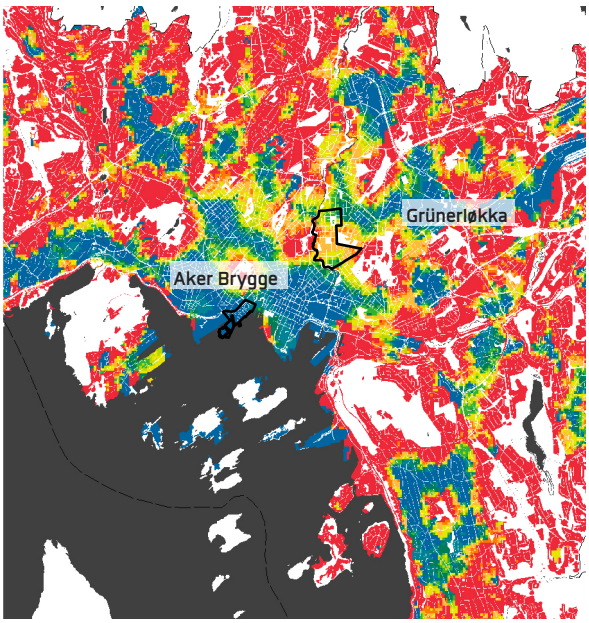

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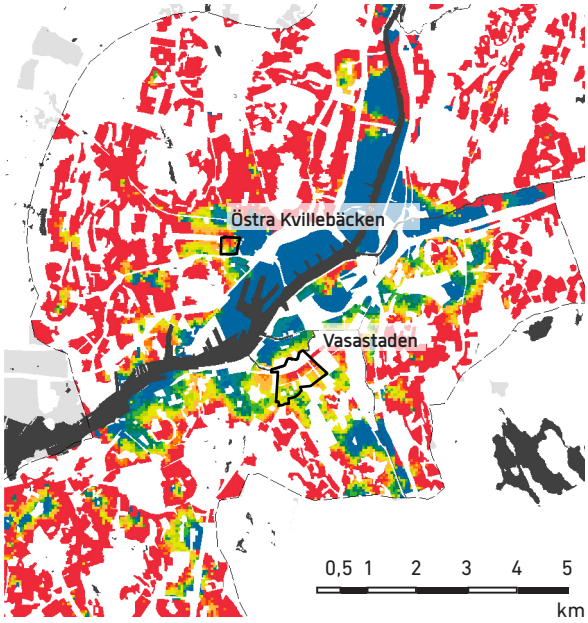
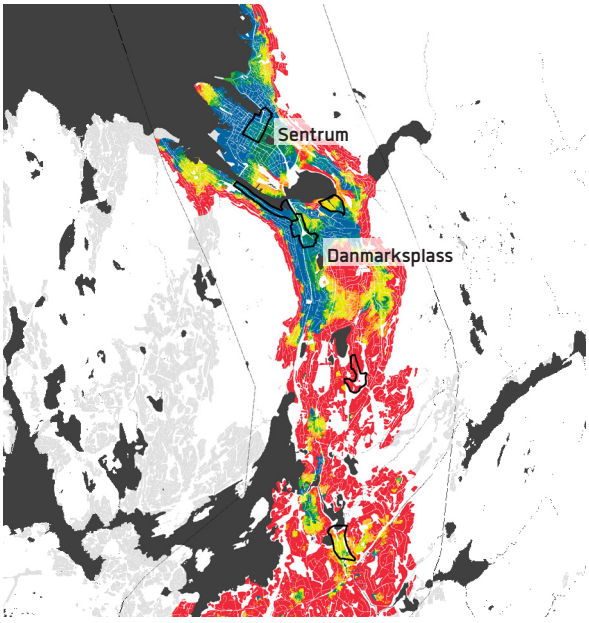


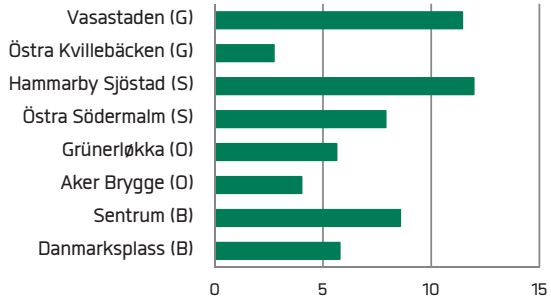
GOTHENBURG



BERGEN

Sqm public open space per 100 GFA

> 25 (m²)	20–25	15–20	10–15	8–10
6–8	4–6	2–4	< 2	



Sqm public open space per 100 GFA per district

CONCLUSIONS

Based on the research and our analyses, 10 square meters of public open space per inhabitant is deemed to be high. 10 square meters of public open space per 100 square meters GFA is possibly adequate from the standpoint of availability, congestion and wear and tear.

Hammarby sjöstad (Stockholm) is spacious and has over 10 sqm public open space per 100 sqm GFA.

In Östra Kvillebäcken (Gothenburg) many people have to share the public open spaces which leads to wear and tear.

RECOMMENDATION

Minimum 10 m^2 public open space per 100 m^2 GFA

2.3 SOCIOTOPE VALUES

BACKGROUND

Public spaces, such as squares, parks and nature contain varied functions and affordances. Affordances may be environmental (ecologic) or economic, but above all they provide social value for people in cities. Social value or use-value may comprise play, urban life or strolls for instance, which may be captured by way of so-called sociotope-mapping. (Stockholm stad, 2003). A sociotope describes a place's social affordances in the same way as a biotope describes the ecological value of a place. The American organization Project for Public Spaces emphasizes that public open space should have many different affordances or program functions. Another important concept raised is that of triangulation - when different affordances support one another. A playground located near a café, for instance increases the likelihood that both parents and children will stay in the space. The urbanism researcher Jan Gehl makes a similar point - namely that it is better to gather program elements than to spread them out (Gehl, 2008).

ANALYSIS

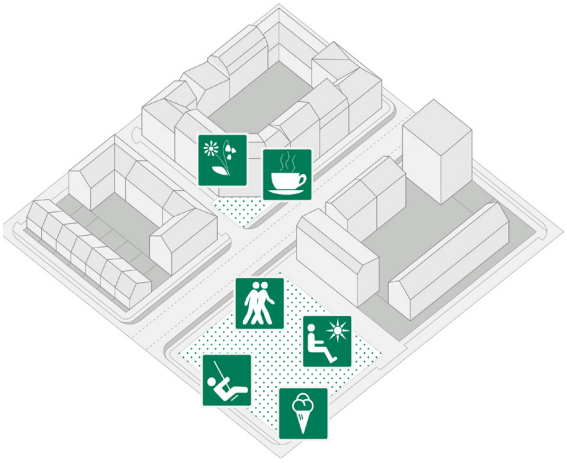
The analysis shows that a majority of Stockholm's sociotopes are green areas (the affordance called green oasis). It is also evident that peace and quiet are an important quality, as are the affordances supporting play, walks and picnics. All these qualities should be accessible within walking distance from home.

CONCLUSIONS

A diversity of functions and affordances in public space is important in order to attract people. The recommendation is to program public space in such a way that synergies are produced between different affordances. In order for this to be attainable, the public space must be adequately sized. Areas smaller than 0,25 hectares will not allow for more than one or a few affordances to be located there.

"The multiplier effect is tremendous"

William Whyte, urban anthropologist



RECOMMENDATION

A diversity of social affordances in public places

SOCIOTOPE MAP ÖSTRA SÖDERMALM (STOCKHOLM)

Social values per sociotope

G	Green oasis	**U**	View
Lp	Playground	**Dj**	Animals
Nl	Nature play	**V**	Water contact
Pr	Walks	**Ub**	Swimming
R	Peaceful	**Skr**	Ice skating
Bl	Flowers	**N**	Wild nature
Bs	Ballgames	**E**	Events
Bl	Ball play	**F**	Buzz
Pa	Play hous	**T**	Market
P	Picnic	**Us**	Outdoor cafe
Gr	Barbeque	**Bå**	Boats
Pu	Tobogganing	**Vl**	Water play
O	Gardening	**Ba**	Swimming pool
Lö	Jogging	**Sk**	Skate / BMX
S	Forest	**Ug**	Outdorr gym

2.4 PROXIMITY TO GREEN SPACE

BACKGROUND

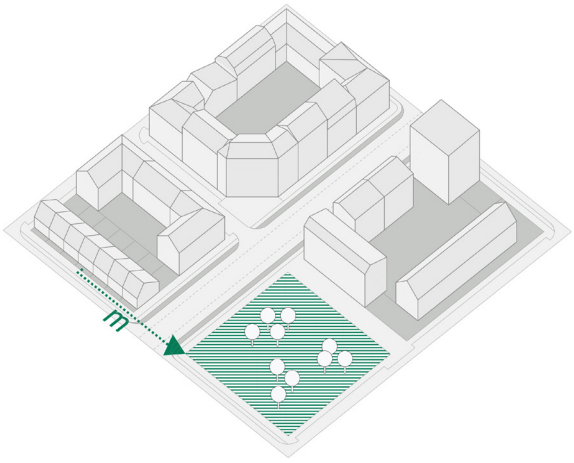
Green space in the city offers room for recreation, for repose and everyday exposure to nature. Research shows that proximity to green space promotes health and well-being (Grahn & Stigsdotter, 2003). Cities therefore need to provide green space in close proximity to residential areas especially.

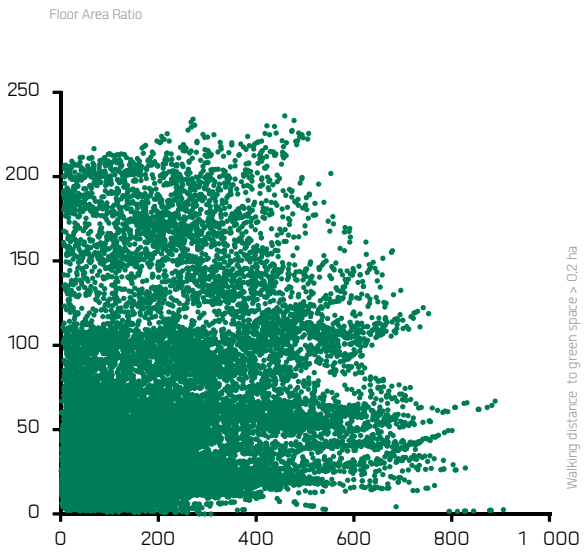
Research also shows one is unlikely to go farther than 200–300 meters in order to reach a green space, at least on a daily basis (Grahn & Stigsdotter, 2003). The Swedish National Board of Housing, Building and Planning (Boverket) recommends max 300 meters as a general threshold in terms of proximity to green space (Boverket, 2007), a figure which many Swedish cities have adopted as a recommendation. The European Union's European Common Indicators (2003) propose max 300 meters to the closest public space. In the City of Stockholm, the recommendation is max 200 meters to the nearest green space (Stockholms stad, 2004) and in Oslo it is max 250 meters to a 0,1 hectare green space. The Norwegian Environment Agency (Miljødirektoratet) recommends max 200 meters to a green space of at least 0,5 hectares (Miljødirektoratet, 2014).

Research shows that the ease of orientation to green areas is crucial (Ståhle, 2008). Ease of orientation to a park can be measured as the number of changes of direction, beginning with the home and ending with the destination in question.

ANALYSIS

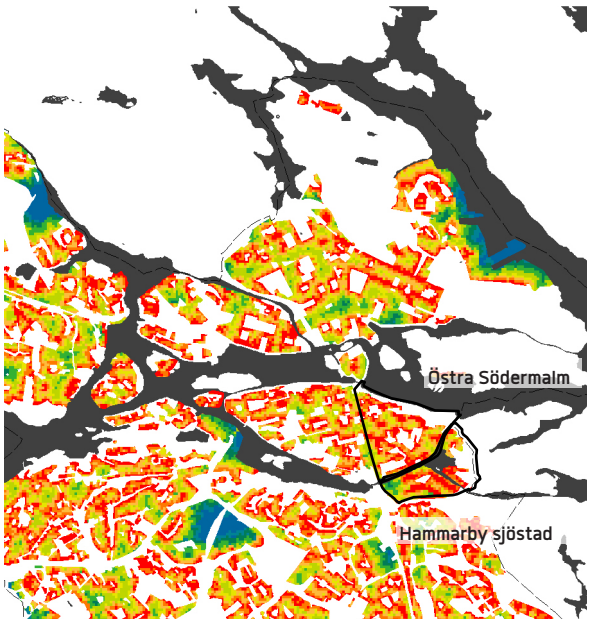
The analysis shows that the majority of the population of Bergen has public green space within 200 meters walk. Central Oslo on the other hand is more lacking in this respect, with farther than 500 meters to the nearest public green space. These inadequacies are not apparent to a similar extent in either Stockholm or in Gothenburg, where it is often less than 200 meters to the nearest public green space. A correlation analysis of the proximity to nearest public green space and area density in Bergen reveals that density does not matter to the proximity to green space. In other words, even dense areas can have ample proximity to public green space.



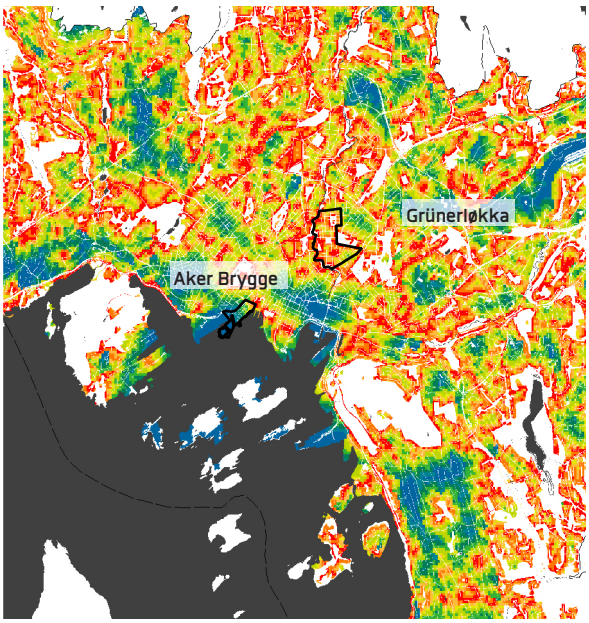


Correlation between area density and proximity to green space. Each point represents a surface within 800 meters from a train station in Bergen.

>PROXIMITY TO GREEN SPACE



STOCKHOLM



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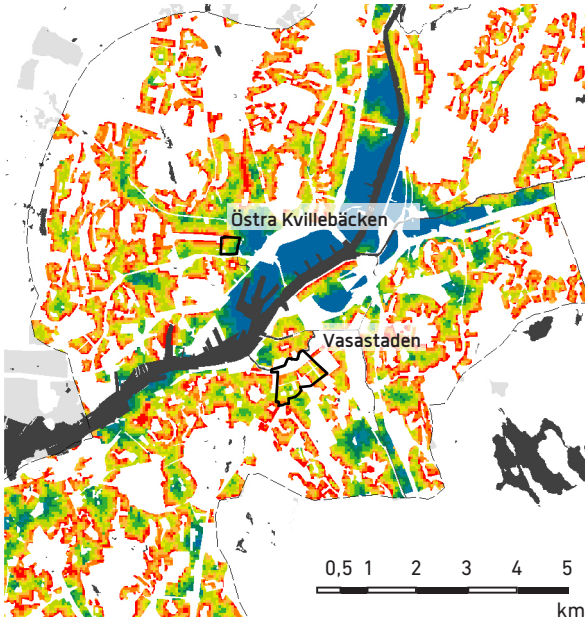
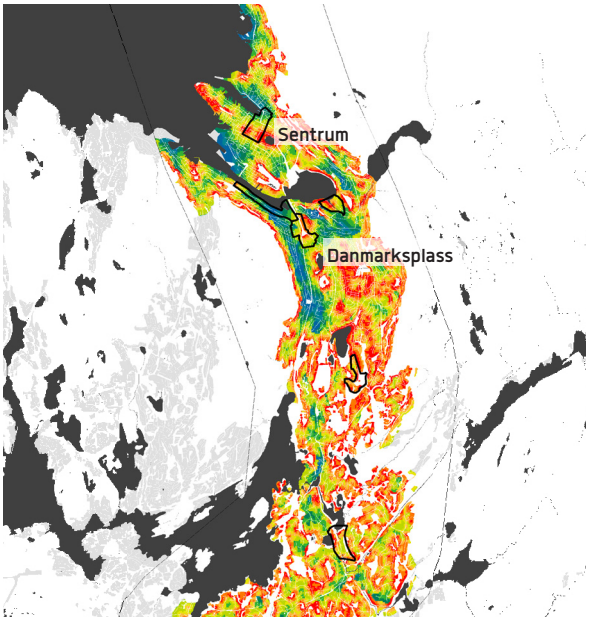


GOTHENBURG



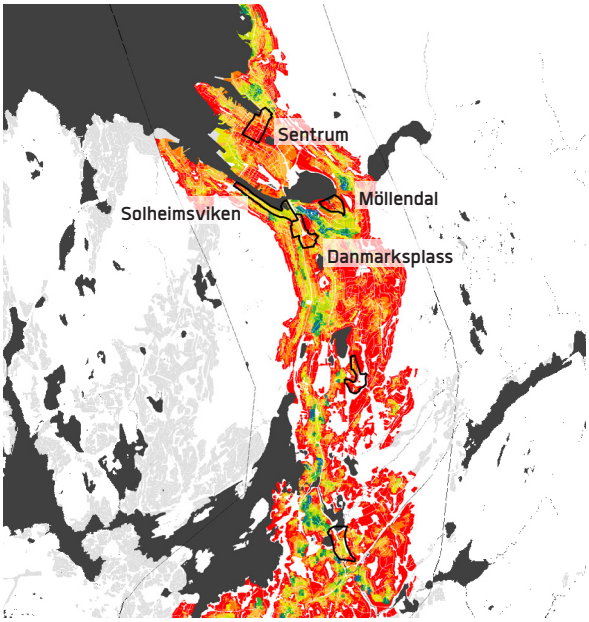
BERGEN

Walking distance to the nearest green space > 0,2 ha

< 50 (m) | 50–100 | 100–150 | 150–200 | 200–300 | 300–400 | 400–500 | 500–600 | > 600

ORIENTATION ANALYSIS

Parts of central Bergen are far from green space in terms of metric distance. Orientation analyses show that the central area has an even and adequate proximity to green space. This is attributable to the orthogonal street network in the center, which makes it easy to find the relatively speaking few green spaces. A similar trend is found in Solheimsviken where the long and straight streets make the public green spaces quite accessible.



BERGEN

Changes in direction to nearest green space > 0,2 ha

0 (step) 1 2 3 4
5 6 7 8

CONCLUSIONS

Based on the research and analyses performed, both Miljødirektoratet's and the City of Stockholm's recommendation that one should have a public green space within 300 meters of the home is deemed reasonable. Further, in consideration of the distance requirement, it is reasonable to lower Miljødirektoratet's size requirement of 0,5 hectares to Stockholm's 0,2 hectares. Oslo's 0,1 hectares is deemed to be too small, however.

Large parts of Aker Brygge (Oslo) has too far to walk to a public green space.

In dense Vasastaden (Gothenburg) many people live close to parks and green spaces.

RECOMMENDATION

Maximum 300 m walking distance to public green space > 0,2 hectares

2.5 PROXIMITY TO SQUARE

BACKGROUND

Squares are well-utilized public spaces with bustling urban life and as such an important component of the city. The possibility to be present in space and co-present with other people there is, in fact one of the most important functions of public space (Legeby, 2010). Squares are also important elements in terms of contributing identity to the city and neighborhood (Project for Public Spaces).

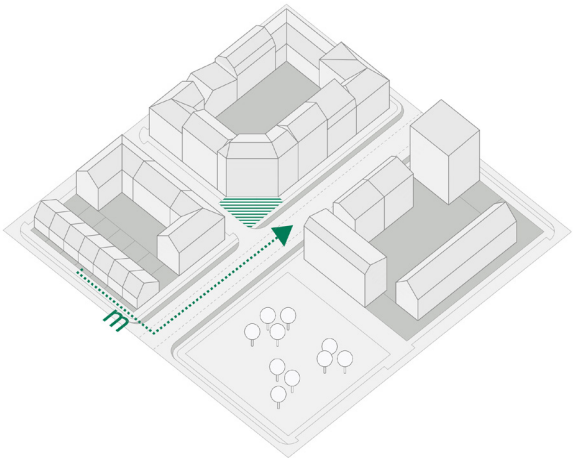
Research shows that squares must be placed strategically in order to become vibrant and well-utilized (Hillier, 1996). Open spaces located where many people tend to move, for instance at intersections of central streets or near public transit are more likely to be used. Naturally, the design of the square in terms of furniture, sunlight and wind matter also to people's willingness to stay in a place (Gehl, 2008).

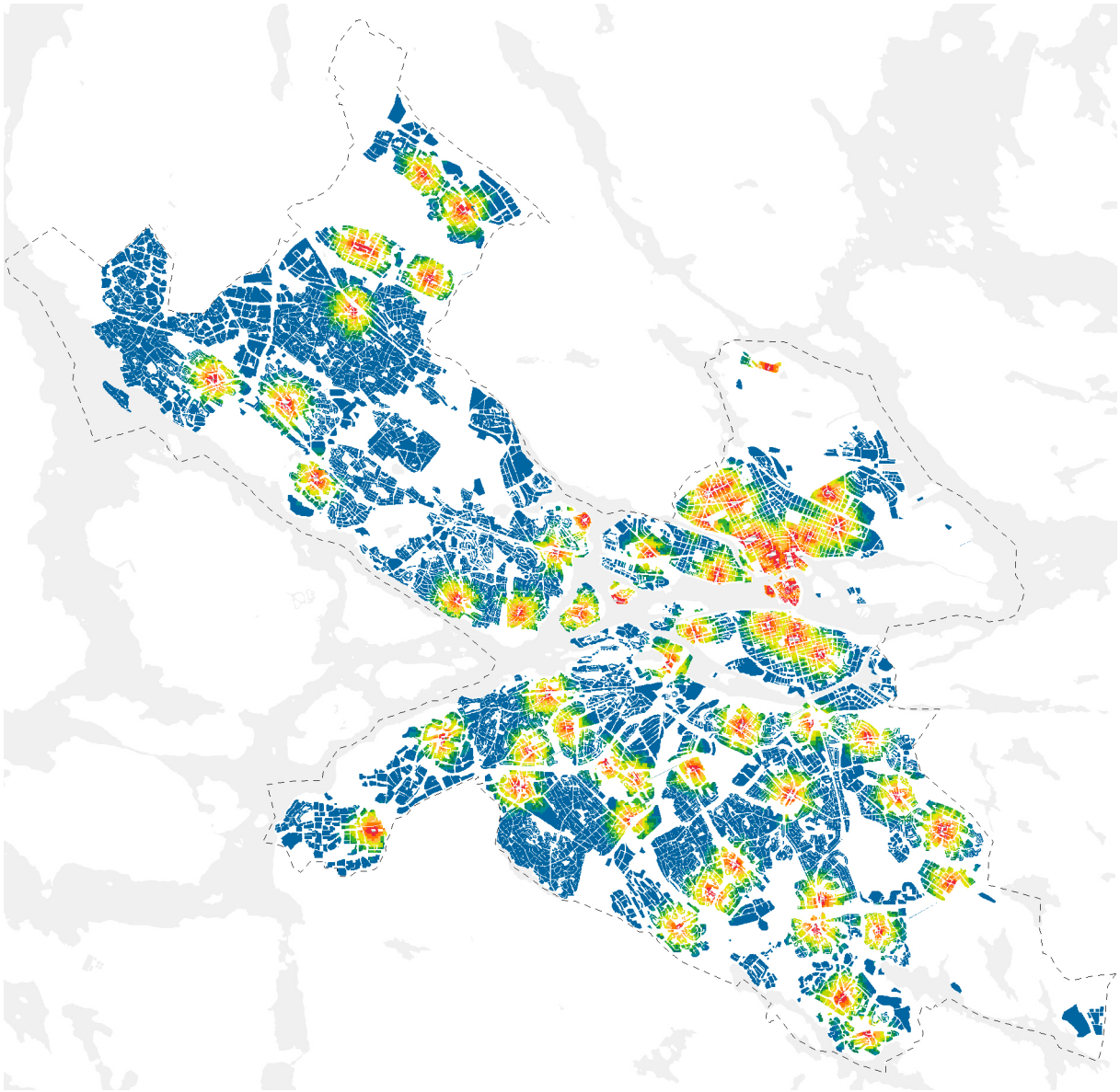
ANALYSIS

The analysis shows that proximity to squares is unevenly distributed in Stockholm. Predominantly in the inner city and outer suburbs are there squares to speak of, often located adjacent to public transit.

"What attracts people most, it would appear, is other people"

William Whyte, urban anthropologist





Walking distance to nearest square > 0,1 ha

< 100 (m) | 100–200 | 200–300 | 300–400 | 400–500

500–600 | 600–700 | 700–800 | > 800

CONCLUSIONS

Based on research, we recommend a maximum walking distance of 800 meters to a square of at least 1,000 square meters. The square is to be placed where many people move, advantageously adjacent to a public transit stop or a central crossing.

At Tjuvholmen in Aker Brygge (Oslo) the square is located on a busy route where many people move..

The square in Östra Kvillebäcken (Gothenburg) is not located in a central intersection and there is no public transport stop.

RECOMMENDATION

Max 800 m walking distance to a square > 0,1 hectare

SHOULD BE LOCATED NEAR PUBLIC TRANSIT OR A CENTRAL PEDESTRIAN ROUTE

"High quality public pedestrian space in general and parks in particular are evidence of a true democracy at work."

ENRIQUE PEÑALOSA, FORMER MAYOR OF BOGOTA

2.6 PROXIMITY TO PARK

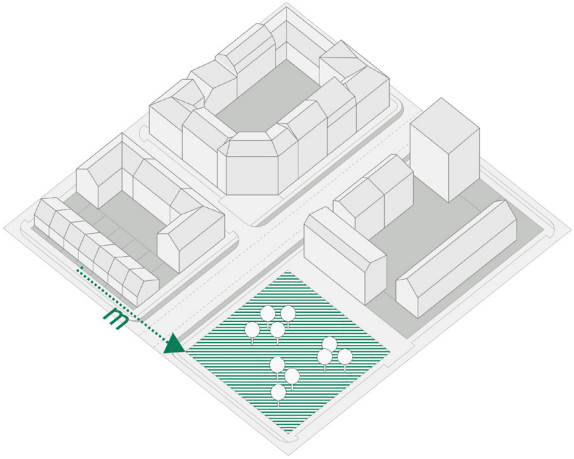
BACKGROUND

In order for green space to accommodate a diversity of qualities and recreational options, it must be of a sufficient size and design to be able to fit them. A green area's multifunctionality is an attractive feature in and of itself. Analyses performed on Stockholm city reveal that there is a certain minimum size required to fit certain larger functions, such as ball sports, sports generally in fact. Even providing space for walks and to enjoy peace and quiet require adequate space. Analyses show that at approximately 5 hectares parks are able to accommodate multifunctionality (Spacescape, 2015).

The Swedish National Board of Housing, Building and Planning (Boverket) recommend a distance of 500–800 meters to a park larger than 10–20 hectares (Ståhle, 2005), the municipality of Malmö recommends max 1 000 meters to a park larger than 5 hectares (Malmö stad 2003).

ANALYSIS

The analysis shows that in large parts of Stockholm a park area is reached greater than 1 hectare and wider than 50 meters within 500 meters.

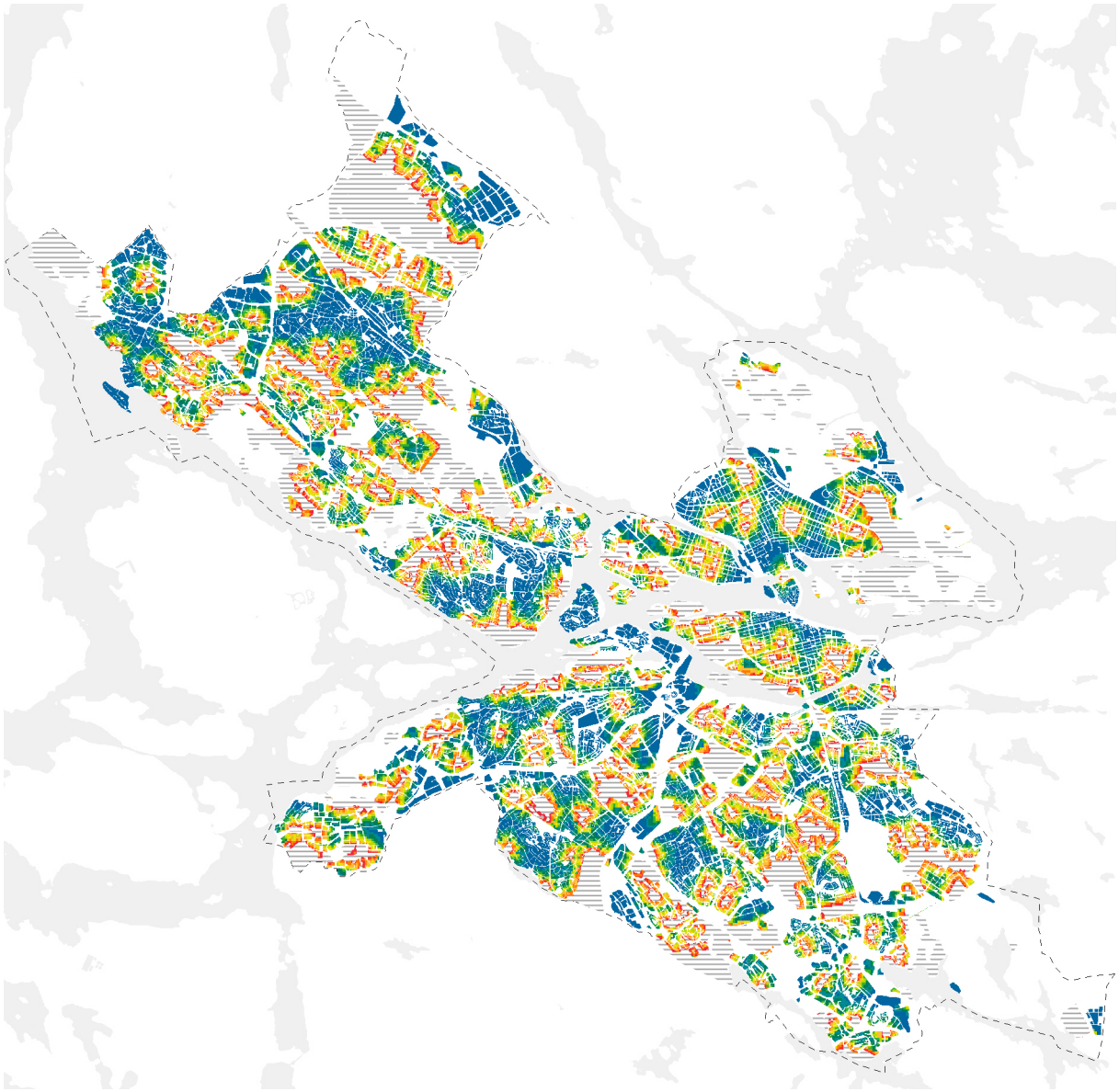


+10 000 EUR

APARTMENT VALUE FOR EVERY 10 HECTARE PARK IN THE NEIGHBORHOOD.

Source: Spacescape & Evidens, 2013, Värdering av stadskvaliteter

>PROXIMITY TO PARK



Walking distance to nearest park > 1 ha, 50 m bred

< 50 (m) | 50–100 | 100–150 | 150–200 | 200–250 | 250–300 | 300–400 | 400–500 | > 500

CONCLUSION

Based on analyses, the recommendations for large parks outlined by Miljødirektoratet, Boverket and Oslo municipality are difficult to attain. We suggest instead that there be a recommended max distance to a park area. A park area is defined as an area of at least 1 hectare and not narrower than 50 meters. It may be either freestanding or incorporated into a larger green area. The park area should contain a level grassy field of at least 0,5 hectares, a maximum of 55 decibels noise and be maintained in a park-like manner.

RECOMMENDATION

Maximum 500 m walking distance to a park > 1 hectare, 50 m wide

STREET SPACE

A city's network of streets, bike-lanes and pedestrian paths produce accessibility. In interacting, people, businesses and other activities connecting and interacting are the basis of city-life.

3. STREET SPACE

3.1 SHARE OF STREET SPACE

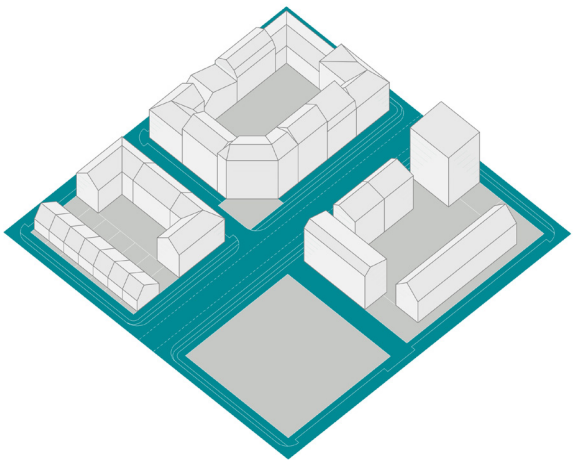
BACKGROUND

A straightforward way to measure street space is to look at the share of the total ground space that is made up of street space. Street space is a significant share of a city's total area so designing it effectively is key to making space for all the other city-functions, qualities and spaces.

Research presented by UN Habitat (UN Habitat, 2013) indicate that a certain quantity of street space is necessary in order to provide adequate capacity and connectivity in the street-network. If streets are too few, congestion or poor accessibility to businesses will result. UN Habitat therefore recommends the area of the city be comprised of 30 percent street space (UN Habitat, 2014, 2).

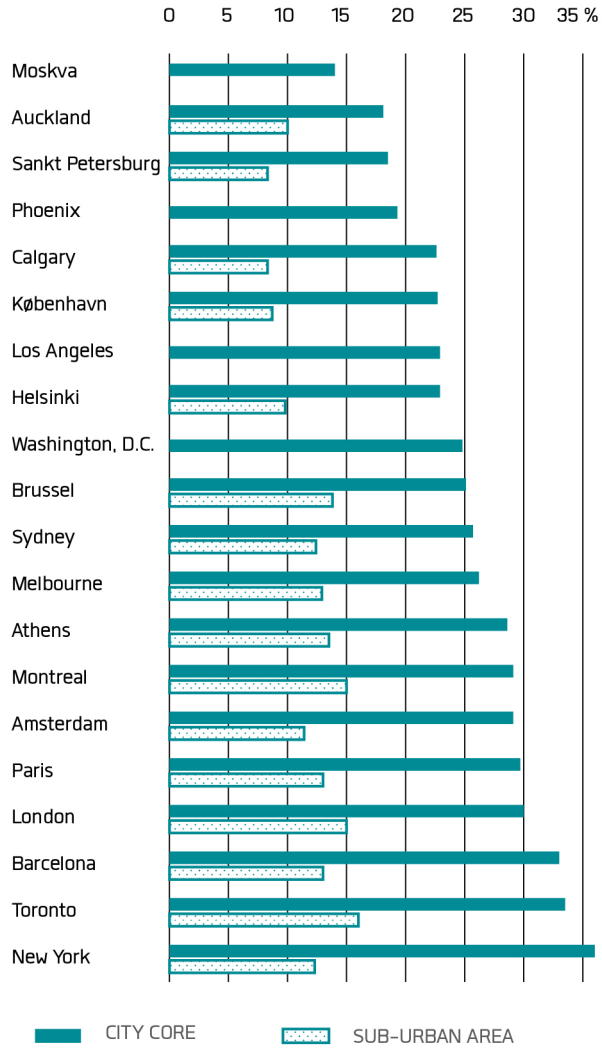
AREA STREET SPACE

TOTAL AREA



ANALYSIS

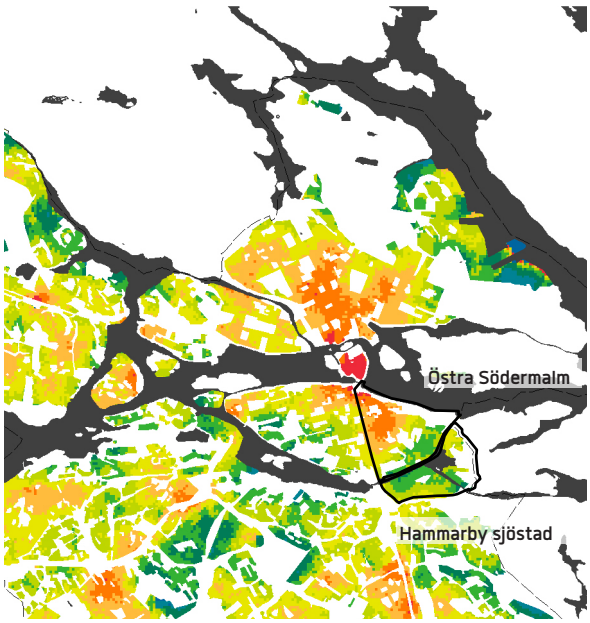
Analyses performed in Stockholm, Oslo, Gothenburg and Bergen indicate that the share of street space is high in the most central parts of these cities. This is partly due to the high degree of detail in the mapping of street space, which are not exactly comparable in the analyses due to different mapping methodologies. Bergen likely has the most detailed mapping, producing higher values than we might otherwise expect. Making comparisons with international references is likewise difficult, since variations in mapping make the analysis difficult to generalize.



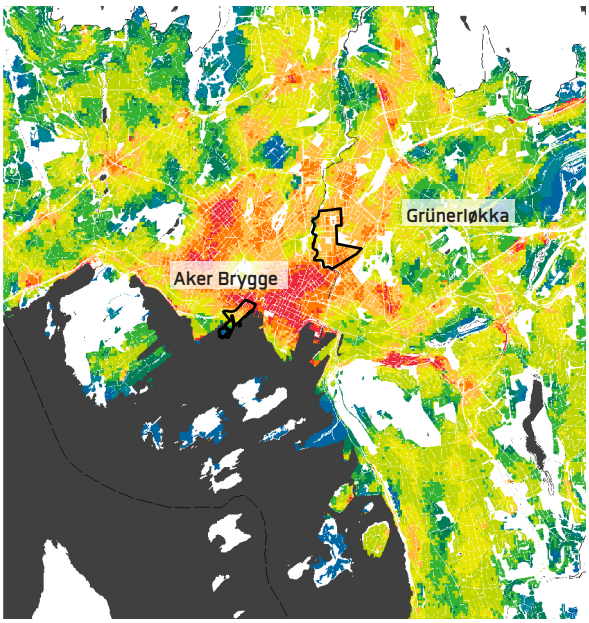
Share of street space in some cities in the world.

Source: UN Habitat, 2013.

>SHARE OF STREET SPACE



STOCKHOLM



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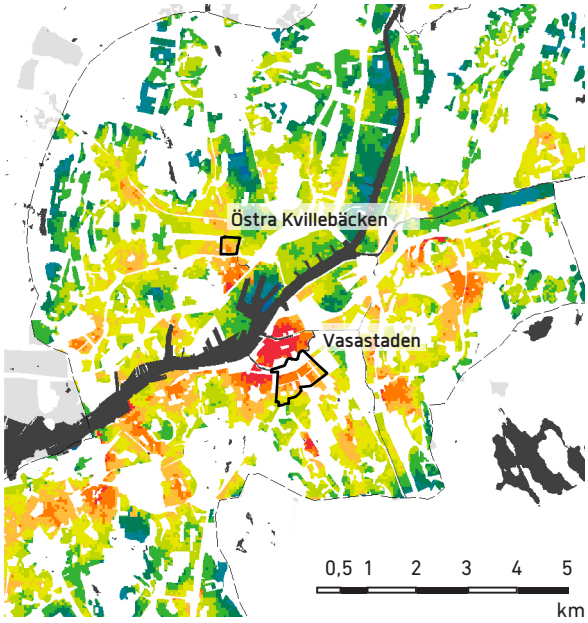
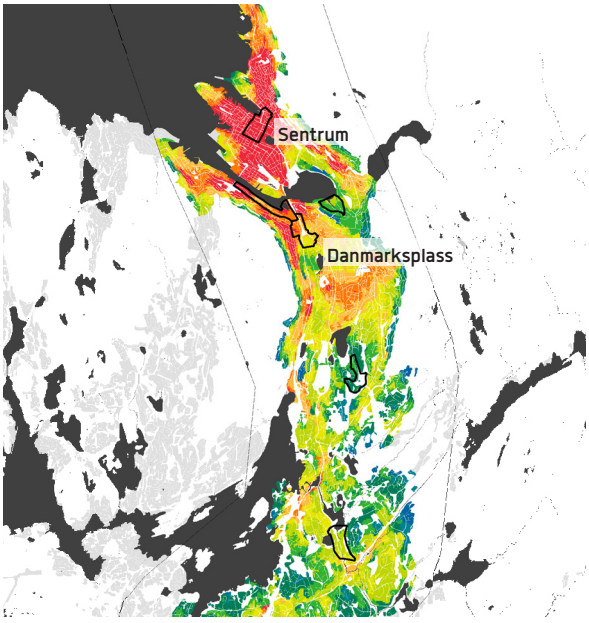


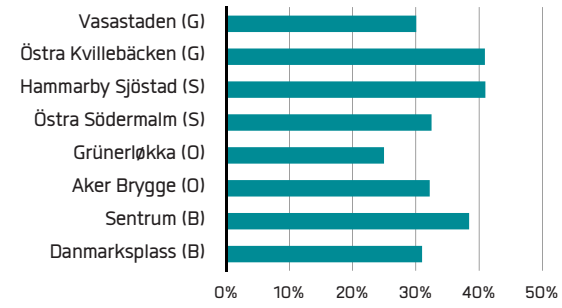
GOTHENBURG



BERGEN

Share of street space

> 40 (%)	35–40	30–45	25–30	20–25
15–20	10–15	5–10	< 5	



Share of street space in eight districts

CONCLUSIONS

Based on the research and on our analyses, the UN Habitat recommendation a 30 percent share of street space appears valid, however even areas with 20 percent may have excellent connectivity and an effective street-network. In contrast, areas with a higher share of street space tend to be too dominated by traffic. We therefore recommend that between 20 and 30 percent of the city's area be made up of street space.

RECOMMENDATION

20–30% street space

OF THE TOTAL AREA

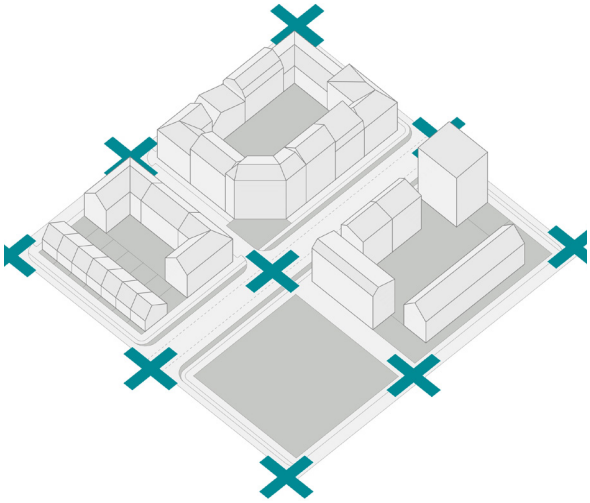
3.2 INTERSECTION DENSITY

BACKGROUND

Connectivity (the density of intersections) is a standard measure within transport-, public health- and urbanism-research. Connectivity is determined by measuring the number of intersections within a specific area as this indicates the ease of moving around in the system of streets and paths. Denser intersections translate to more direct route-options within the system. Research has established that connectivity is a factor which influences our transportation choices - higher connectivity means fewer trips by car and a greater share of trips made on foot or by bicycle or public transport (Ewing & Cervero, 2010).

Connectivity measures are used in several international policy documents. In LEED Neighborhood, an international certification-system for sustainable urban development, a connectivity of at least 150 intersections per square kilometer is recommended (LEED ND, 2009). UN Habitat recommends that connectivity be used as a benchmark to ensure a sustainable street-network (UN Habitat, 2013).

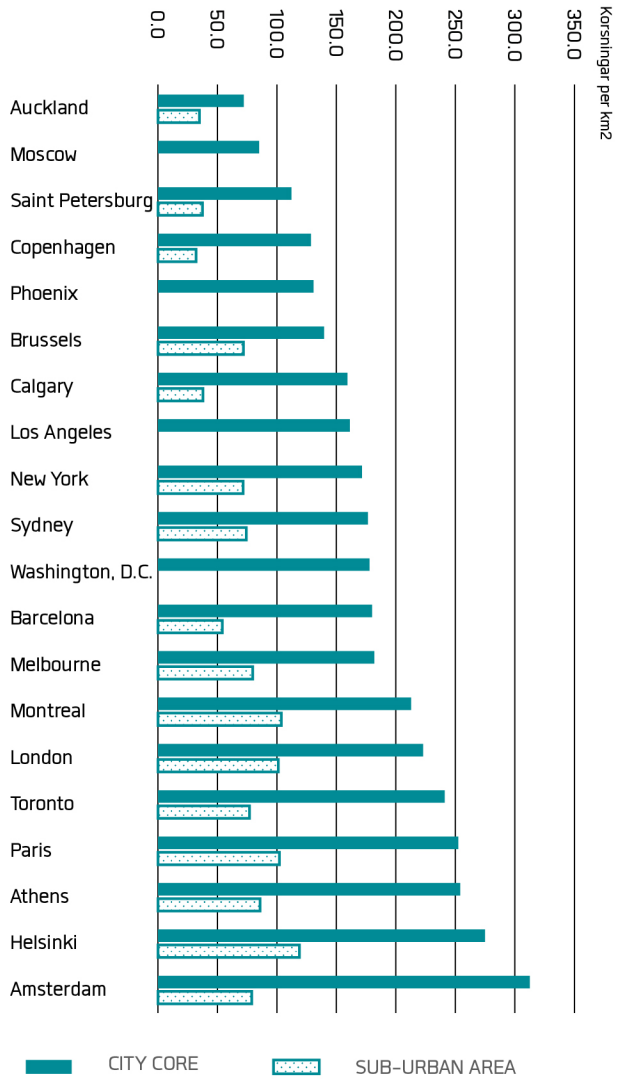
$$\frac{\text{\# OF INTERSECTIONS WITHIN AREA}}{\text{TOTAL AREA}}$$



ANALYSIS

Number of intersections per square kilometer vary greatly between different neighborhoods. In Hammarby Sjöstad the connectivity through the street-network is low, whereas the connectivity in Sentrum is quite high.

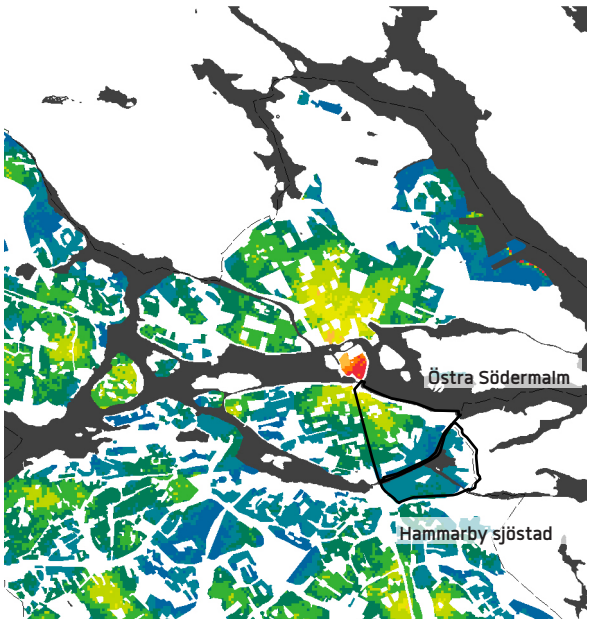
For purposes of analysis, an intersection was defined as an intersection of at least three streets. The base maps vary for the cities analyzed, making comparison difficult. Both Bergen and Oslo appear to have a higher resolution in the map data, producing higher values here than in Stockholm and Gothenburg. Comparison with international references is difficult to the base data not having a comparable level of resolution.



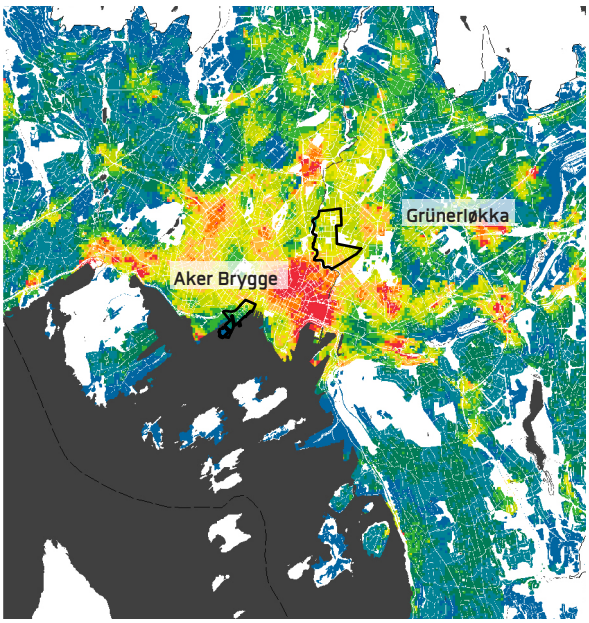
Intersection density in some cities in the world.

Source: UN Habitat, 2013.

>INTERSECTION DENSITY



STOCKHOLM



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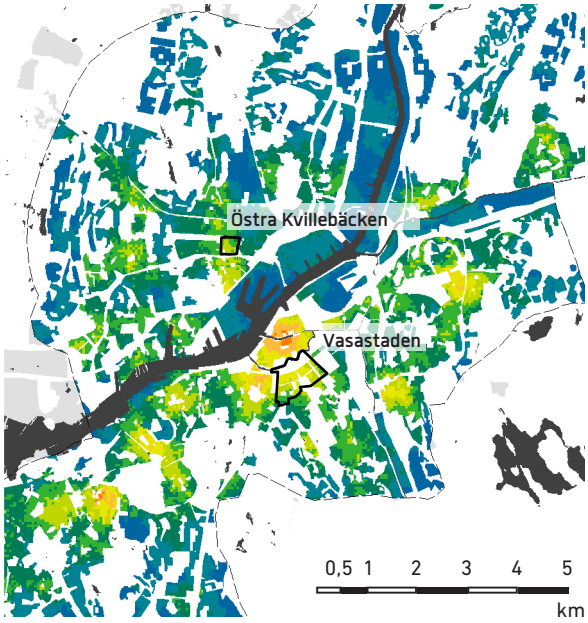
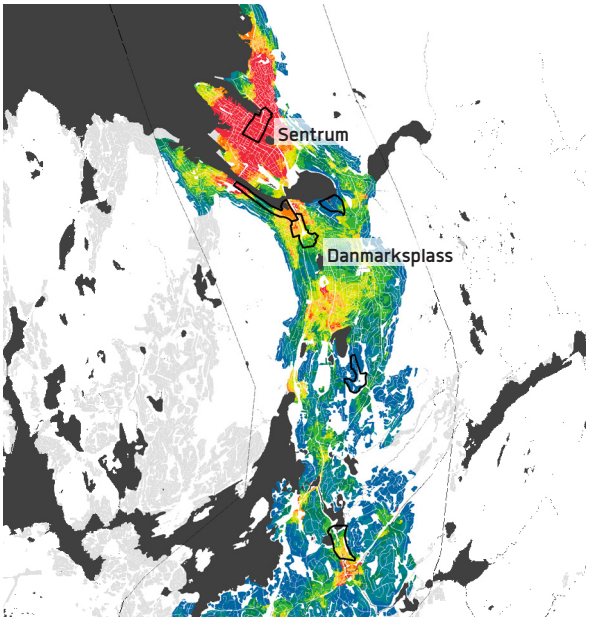


GOTHENBURG



BERGEN

Intersections per square kilometer

> 400 (pcs) | 350–400 | 300–350 | 250–300 | 200–250
150–200 | 100–150 | 50–100 | < 50

CONCLUSIONS

Based on the research and on our analyses, the LEED recommendation of at least 150 intersections per square kilometer is reasonable as it establishes an adequate connectivity in the street-network. The recommendation does impact the size of blocks in the network, which cannot be larger than 7 000 square meters, on average. This translates to blocks of approximately 84 x 84 meters or 50 x 140 meters to be precise.

In Sentrum (Bergen) the intersection density is high and easy to navigate.

In Auckland intersections density is low and streets long which decreases accessibility and way-finding.

RECOMMENDATION

Minimum
150 intersections per km^2

3.3 NETWORK INTEGRATION

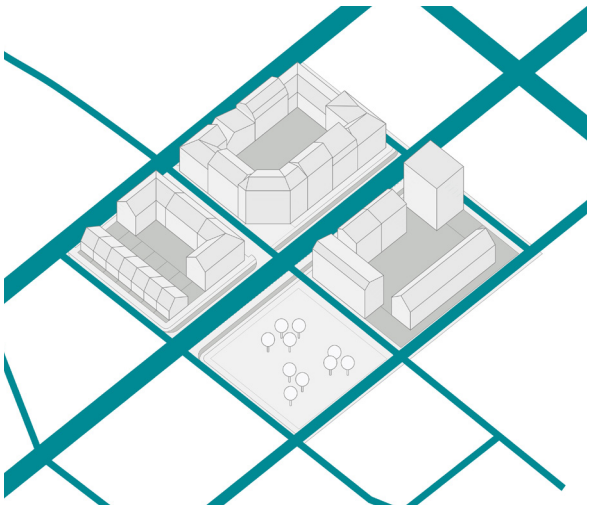
BACKGROUND

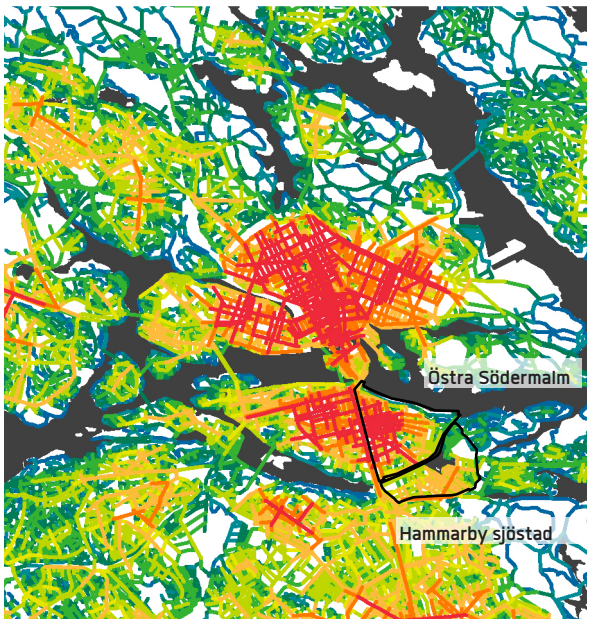
A city's street-network produces continuity in public space. How public space connects visually matters to how we orient ourselves in the city and which networks we choose. Routes which are located in such a way that they are easy to find and which visually connect to other routes tend to attract higher flows of people. These routes have higher centrality in the system since they are more spatially integrated with other routes in the system.

By mapping the street-network in terms of sight-lines (linear spaces) and then calculating their connectivity, a picture is produced of the street-network's spatial integration. This type of analysis is called 'space syntax' and has been found to approximate pedestrian flows, bike flows and car flows with relatively high precision (Hillier, 1996). A neighborhood needs to be connected with other neighborhoods by way of well-integrated streets or routes. Within the system as a whole, however a variety of both high-centrality and low-centrality routes produces a range of calmer and more bustling streets.

ANALYSIS

The analyses indicate that the street-network in the central parts of Oslo, Gothenburg, Stockholm and Bergen stand out as being more spatially integrated and connected vis-a-vis the less central parts of each city. In Bergen the integration decreases in the south where barriers such as water, roadways and differences in elevation prevent an otherwise integrated street-network from extending outward. The area around Danmarksplass has well-integrated streets which are possible to extend further, which is an opportunity that should not be missed when developing this area.





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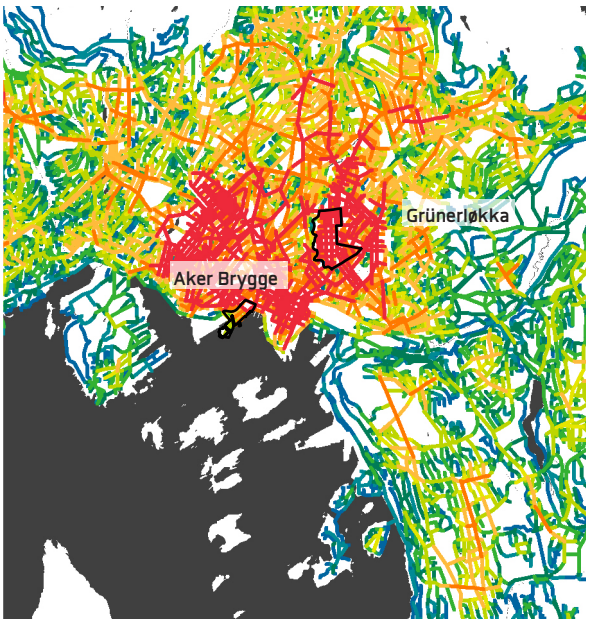

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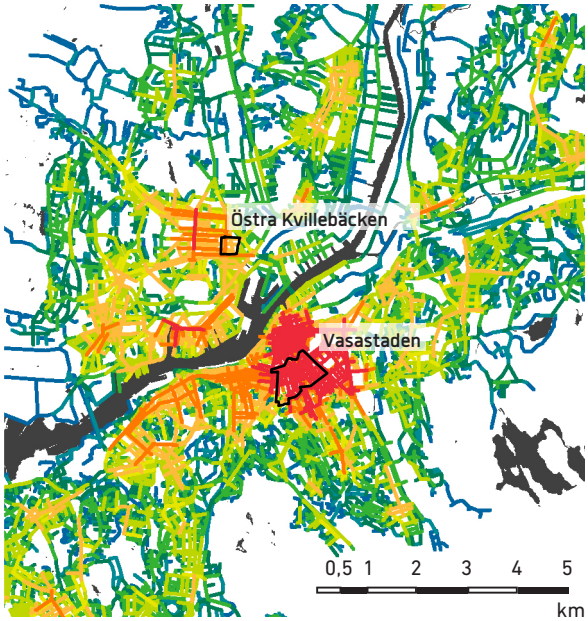
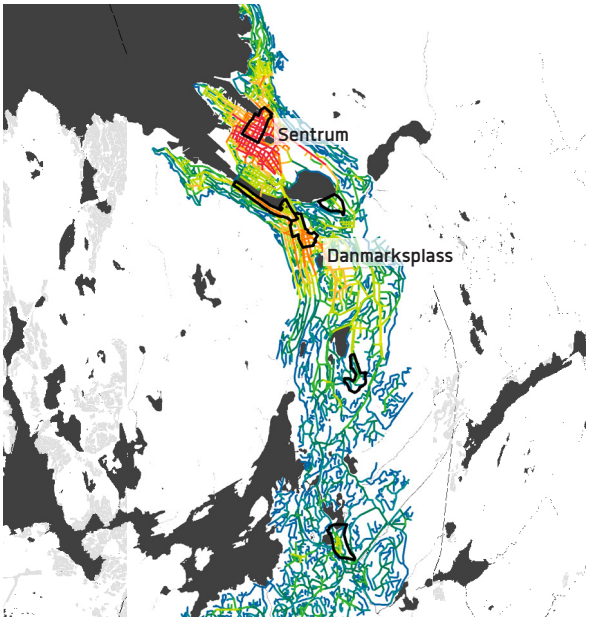


GOTHENBURG



BERGEN

Network integration (space syntax R6)

High integration Low integration

CONCLUSIONS

Based on space syntax research and on our analyses, a city's street network and public spaces should be connected with surrounding neighborhoods. A variation in street-life can be created by producing a variation of street space with differing degrees of integration - some streets will be livelier, others more tranquil.

The eco-district Hammarby sjöstad (Stockholm) has many low integrated streets.

A highly integrated street in Vasastaden (Gothenburg).

RECOMMENDATION

A variety of more and less integrated streets.

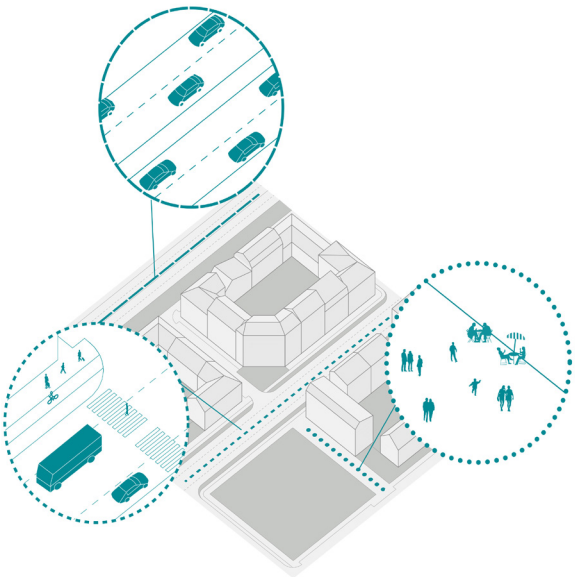
Connect new neighborhoods by way of well-integrated streets into surrounding neighborhoods.

3.4 TRAFFIC SPACE

BACKGROUND

By way of their design, different streets implicitly prioritize certain traffic-types over others. Some streets are intended mainly for cars and others primarily for pedestrians. The design of the traffic space, the width of lanes and sidewalks, speed restrictions and traffic quantities all contribute to the value of the traffic space as a space for circulation or for rest for different actors in traffic.

The Swedish Transport Administration (Trafikverket) has introduced a classification which translates to life-space model (livsrumsmodellen) that is comprised of five traffic spaces (Vägverket, 2008). The types are on a scale from entirely car-free traffic spaces to ones where cars dominate. In our model, we call these Pedestrian street, Pedestrian-priority, Urban corridor, Urban road and Motorway, respectively. The first three of these are traffic spaces which can contain urban life. LEED Neighborhood recommends that the traffic network be comprised of at least 75 percent of these three types. Or inversely, no more than 25 per cent pure motorways.



PEDESTRIAN STREET

Streets designed for cyclists, pedestrians and allowing children to play. On a pedestrian street, pedestrians should not have to worry about car-traffic, which is essentially nonexistent. The design of the pedestrian street should have the pedestrian- and bicycle-perspective as it's point of departure, meaning that a high level of detailing and materiality as well as supporting interactions between people. In our analyses, pedestrian streets also include designated pedestrian- and bike-paths.

SHARED STREET

Routes where pedestrians and cyclists are prioritized. Motor vehicles may use the traffic space in a limited capacity, such as for deliveries. When motor vehicles enter the space, it is intended that this be with the utmost respect for those not protected by a vehicular shell. Low speeds are a necessity and pedestrians and cyclists should have the right-of-way. Pedestrian streets are often lined by buildings with entrances to the street. Pedestrian priority streets tend to be found in the most attractive parts of the city's street-network, near squares and civic buildings, for instance.

URBAN STREET

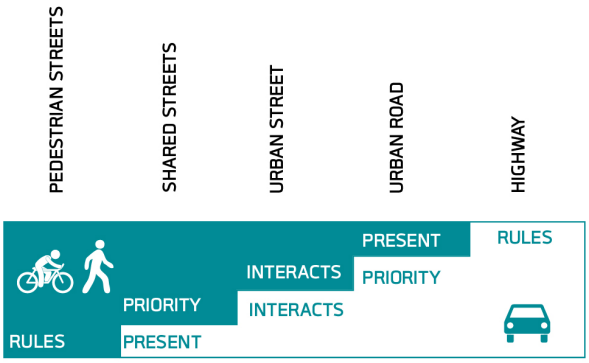
The traffic spaces which comprise the majority of a city's street space. Urban corridors tend to be lined by buildings with entrances to the street. It is easy to move both along and across the urban corridor. Vars and unprotected pedestrians and cyclists share the space on somewhat equal terms. The space dedicated to motor-vehicles is limited to the extent that this is possible with respect to the functionality of the streets.

URBAN ROAD

Pedestrians and cyclists can circulate along the traffic space but have few opportunities to cross it. There are also few opportunities to stop and rest while in the urban road. Buildings often line the urban road but may have few if any entrances to the road. Opportunities for interaction with other people are few except for sharing the space while circulating through it. The street space has a transport-emphasis in terms of it's functionality.

HIGHWAY

Traffic spaces, intended exclusively for motor-vehicles, where pedestrian and cycle-paths are distinct and protected. The motorway is rarely lined with buildings and if so, it is unlikely that entrances will face the motorway. The motorway has a distinct emphasis on transport.



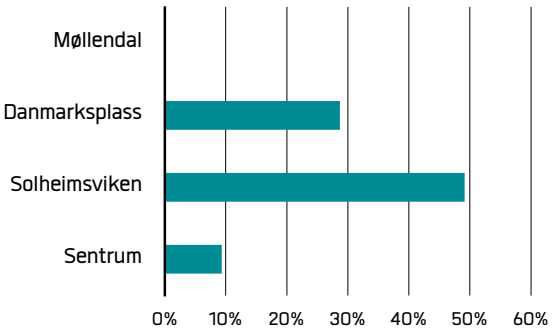
Fjösangerveien through Danmarksplass (Bergen) is defined as a motorway, where pedestrians and cyclists do not have the opportunity to move and stay.

ANALYSIS

The analysis done for various traffic spaces in Bergen indicates that shared and pedestrian streets dominate in most of the neighborhoods. Solheimsviken has a greater share of vehicle-dominated traffic spaces due to Michael Krohns gate which is designed for motor-vehicles. In Danmarksplass, Fjösangerveien is a vehicle-dominated traffic space which comprises a significant share of the total traffic space in this neighborhood.

At Torgallmeningen (Danmarksplass, Bergen), motor vehicle traffic is completely missing - a pedestrian street.

Damgårdsveien through Solheimsviken (Bergen) is a city street where pedestrian and car traffic interacts.



Share of space dedicated to urban roads and highways in four districts

CONCLUSIONS

Based on our analyses and planning experiences we can conclude that it is reasonable and possible to recommend that at least 50 percent of the transport network is set for shared streets and pedestrian streets only. This secures a good balance between traffic modes and good accessibility for active transportation such as walking and biking.

RECOMMENDATION

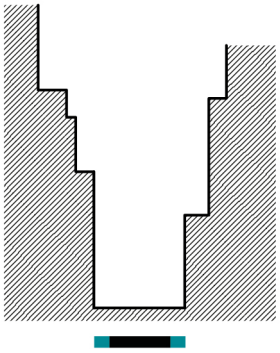
Traffic space should aim to have at least 50% shared or pedestrian only streets.

3.5 STREET SECTION

BACKGROUND

A street's width determines what there will be room for. If the street is too narrow, the space for multiple traffic types will be reduced, but if the street is too wide, it will be perceived as desolate and unappealing for street-life to play out. Sidewalks are perhaps the most important and democratic city-space. This is where city-life, pedestrian movements and rest co-exist. A sidewalk should be able to accommodate both pedestrian flows, furnishings, street-trees and spaces for rest such as outdoor-seating or benches. This requires both an adequate total area and street-width.

LEED Neighborhood Development recommends at least 3 meter wide sidewalks on streets with mixed functions. In traditional cities, wider sidewalks may be quite common, even as wide as 5-7 meters.



AVENUE

Total width 30 m
Sidewalk width 5 m
Height-to-width ratio (height determined at street-wall) 1,5

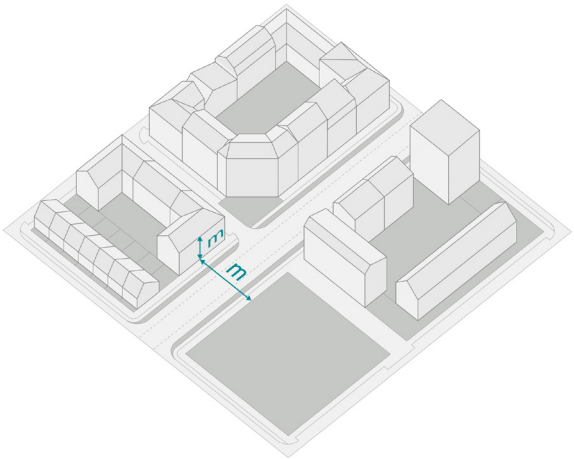
MAJOR CROSS STREET

Total width 30 m
Sidewalk width 6 m
Height-to-width ratio 1,2

STANDARD STREET

Total width 18 m
Sidewalk width 4 m
Height-to-width ratio 0,8

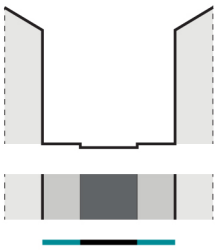
EXAMPLE OF STREET DISTRIBUTION ON MANHATTAN
Source: UN Habitat 2015



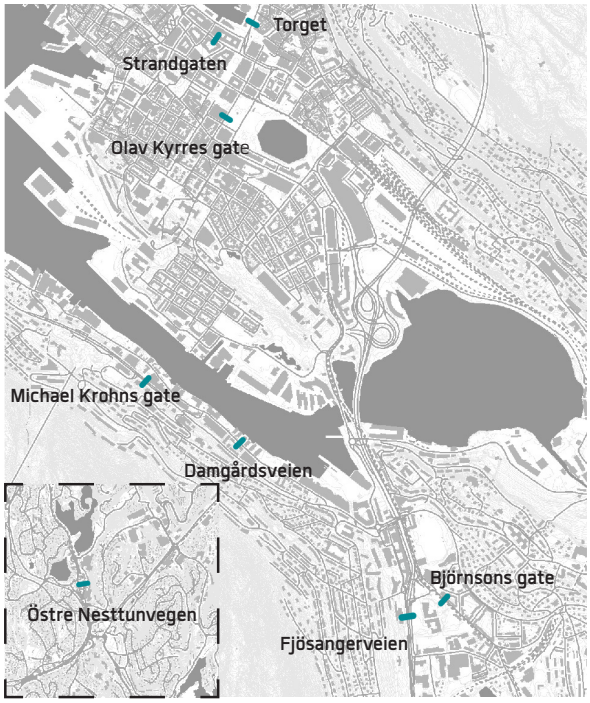
ANALYSIS

The street-sections shown here are streets that are characteristic for selected neighborhoods in Bergen. Strandgaten and Olav Kyrres gate are typical of streets in the city-center with total street-widths of approximately 17 m. The square is an example of a more trafficked street in the center. Here the roadway alone is as wide as Strandgaten. Fjösangerveien is a street space dominated by vehicular traffic - fully 3/4 is roadway. Östre Nesttunsvegen is almost as wide as Fjösangerveien but has a different design: approximately 1/3 is roadway and the sidewalk width is quite generous.

STRANDGATEN 17,5 M



7,5 m roadway
5 m sidewalk

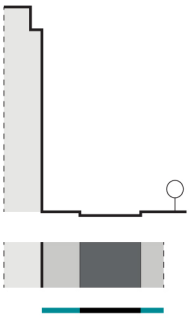


TORGET 30 M

17,5 m roadway
2,5 m sidewalk
10 m sidewalk

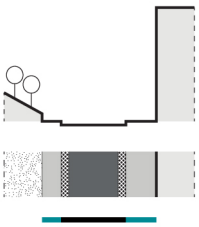
>STREET DISTRIBUTION

OLAV KYRRES GATE 16 M



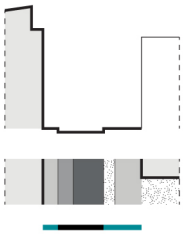
8 m roadway
5 m sidewalk
3 m sidewalk

MICHAEL KROHNS GATE 15 M



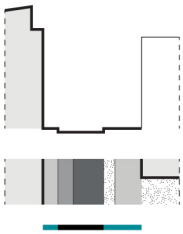
8,5 m roadway
2,5 m sidewalk
4 m sidewalk

DAMGÅRDSVEIEN 13 M



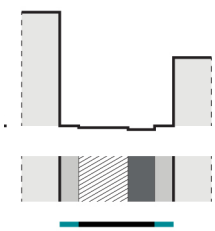
6 m roadway
2 m sidewalk
5 m sidewalk

FJÖSANGERVEIEN 24,5 M



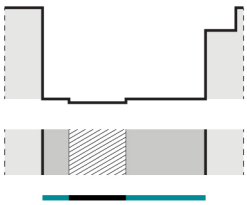
19 m roadway
3 m sidewalk
2,5 m sidewalk

BJÖRNSONS GATE 15 M



10 m roadway
2,5 m sidewalk
2,5 m sidewalk

ÖSTRE NESTTUNVEIEN 21,5 M



7,5 m roadway
3,5 m sidewalk
10,5 m sidewalk

CONCLUSIONS

Based on our analyses and other references, it is safe to recommend that street space in a city be between 8-30 meters. Too-narrow streets cannot fit all the necessary functions we associate with street-life; conversely, too-wide streets may feel unappealing and large-scale. Streets that are appealing to pedestrians should have wide sidewalks, these should be at least 3 meters wide. High numbers of pedestrians requires wider sidewalks, as do sidewalk cafes, benches, vendors, trees etcetera. An assymetric section, with wider sidewalks on one side of the street, for example the sunny side, can be an option. Not more than 50 percent of the street section should be dedicated to motor vehicle.

RECOMMENDATION

Maximum 50% of the street section to motor vehicles.

Sidewalk width a minimum of 3 m.

"Streets are the heart of a city. They mould the urban form and carry the public utilities that a city needs to function; they are the heart of the urban public area and are a key factor in the quality of life of a city."

UN Habitat, 2013

PRIVATE OPEN SPACE

A city is comprised not only of public spaces and buildings. For a rich and secure urban life, even private outdoor space plays an important role. It is here that city-residents may be more private and socialize with friends or neighbors. Private outdoor space may be either proprietary or so-called commons. Proprietary outdoor space benefits an individual or family, examples include the private yard, patio or balcony. Commons are intended for a defined group of users, such as neighbors within the same block or members of a club. Commons include central courtyards shared by residents as well as school-yards.

4. PRIVATE OPEN SPACE

4.1 PRIVATE OPEN SPACE

BACKGROUND

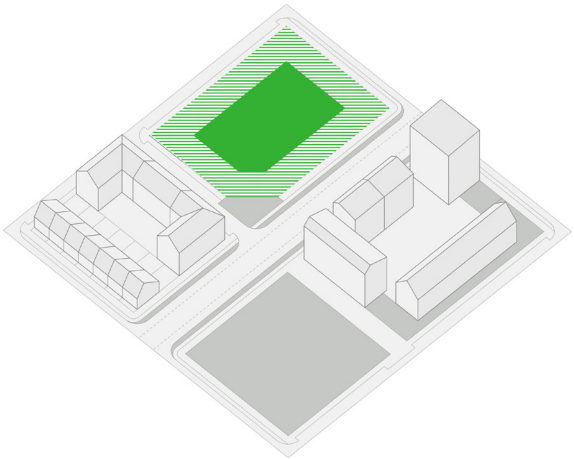
Just as a neighborhood needs ground space for public places, there also needs to be space set aside as private outdoor space. This space is especially valuable for immediate residents' recreational needs and play.

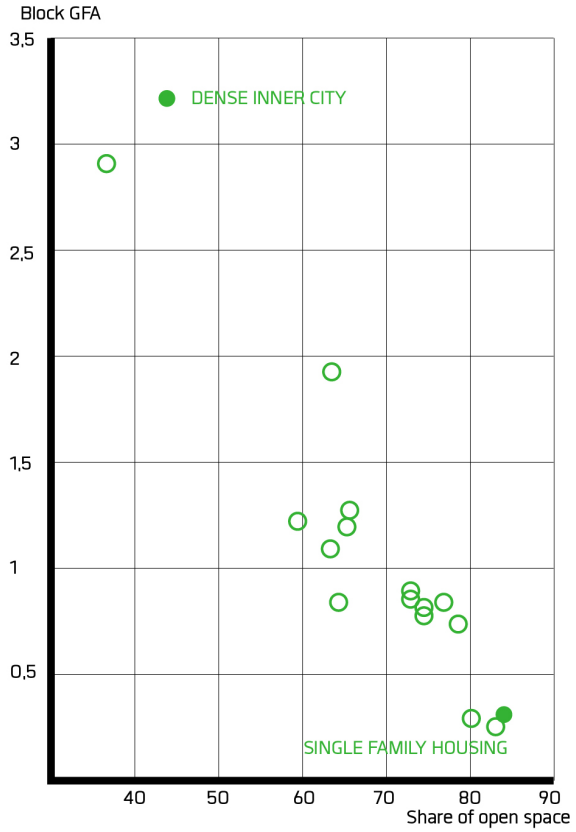
Open space on property is obtained by measuring the outdoor space within a block. Private outdoor space is obtained by measuring the area of open space within a block (on property) and dividing that by the total area of the block. There is no known research on this measure. Spacescape has however performed analyses for Stockholm with different block types (Spacescape, 2014,1). These analyses show that dense blocks may serve residents' needs for recreational and play area quite well, provided that approximately 50 percent of the block is private outdoor space.

ANALYSIS

The analyses shown on the following page are for selected neighborhoods in Bergen and indicate that the share of private open space with city-blocks for the most part is below 30 percent in Sentrum and in parts of Solheimsviken and Danmarksplass. Some blocks in Sentrum have less than 10 percent open space, which is a very small share. Other neighborhoods have over 50 percent open space within their blocks, which creates a potential both for sunlit yards and spaces to inhabit outside.

$$\frac{\text{OPEN SPACE WITHIN BLOCK}}{\text{TOTAL AREA OF THE BLOCK}}$$



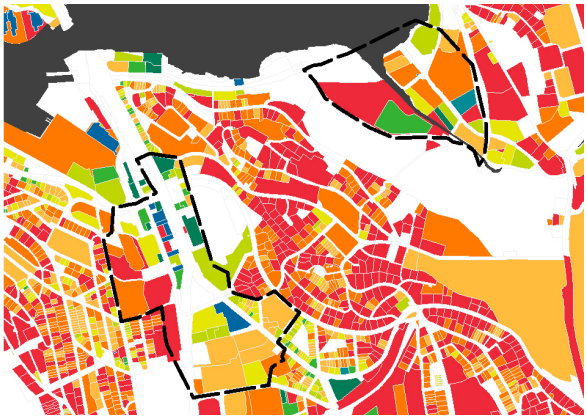


The relation between block density and the share of open space in the blocks are plotted for different urban types in Stockholm. Source: Spacescape (2014,1)

SENTRUM (BERGEN)

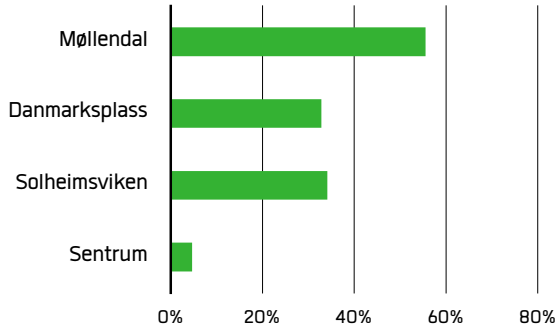
SÖDERMALM (STOCKHOLM)

This map differs in scale from the other cities



DANMARKSPLASS AND MÖLLENDAL (BERGEN)

SOLHEIMSVIKEN (BERGEN)



Share of blocks with more than 50% private open space.

Share of private open space within the block

> 70 (%) 60-70 50-60 40-50 30-40
20-30 10-20 5-10 < 5

CONCLUSIONS

According to the research and our analyses, 40 percent outdoor space within a block is a reasonable recommendation in order to produce adequate recreational outdoor space for residents in dense blocks. The open space should have at least 50 percent exposure to sunlight at noon during the spring solstice in order to ensure a good microclimate.

Private open space in Solheimsviken (Bergen).

RECOMMENDATION

Minimum 40% private open space

AS SHARE OF THE TOTAL BLOCK AREA

4.2 PRIVATE GREEN SPACE

BACKGROUND

Vegetation is essential for the experience of having accessible green-space as well as for various ecosystem services such as cleaner air, biological diversity and stormwater control.

The share of green space within a block may be assessed as a so-called *green area factor* (*grönytefaktor* in Swedish). This is a measure of the share of the total surface area within a block that has a permeable and green cover. In Malmö, green area factor has been further developed in which a point-system confers a rating on a block based on different greenery (Malmö stad 1999). A variant is to simply measure the green coverage. A green area factor of 0,5 (i.e. 50 percent) is considered an adequate share according to some reference studies (Stockholm stad 2013).

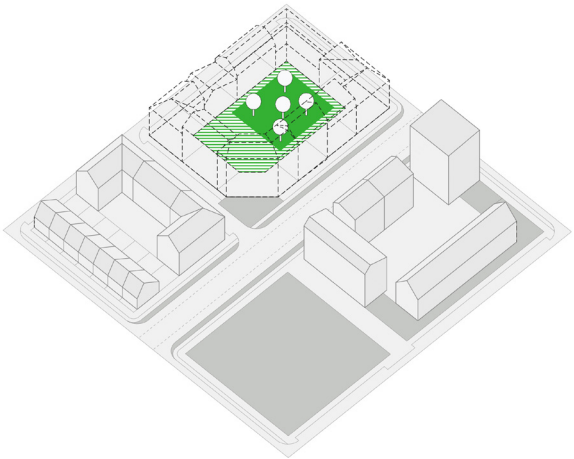
ANALYSIS

The analysis done on neighborhoods in Bergen show that all the recently constructed blocks in the sample have less than 25 percent green area factor. The sample is representative for a majority of recently constructed blocks in Bergen. Many of the newly constructed blocks in in Bergen have predominantly impermeable surfaces and a small share of greenery. In many cases the green area factor is below 10 percent, in some cases below 5 percent. Some exceptions show that it is quite possible to incorporate more vegetation within the block, even in new construction. A block in Møllendal has 55 procent private open space and 23 percent green space, while maintaining a high spaciousness and FAR. Even a block with older buildings located adjacent to Danmarksplass has a high share of outside space, green area and spaciousness overall. In this example, the density FAR is low however.

CONCLUSIONS

Based on our analyses, a recommendation of 25 percent green area of the total block area is a reasonable benchmark. This ensures that both ecosystem services and private open space with green qualities are made available as part of living environments.

$$\frac{\text{GREEN AREA WITHIN THE BLOCK}}{\text{TOTAL BLOCK AREA}}$$



BLOCK RECOMMENDATION

Minimum 25% green space of the total block area

>PRIVATE GREEN SPACE

HAMMARBY SJÖSTAD (STOCKHOLM)


Share of open space	42%
Share of green space	21%
Spaciousness	14 m^2 per 100 m^2 GFA
FAR	2,9

ÖSTRA KVILLEBÄCKEN (GOTHENBURG)


Share of open space	56%
Share of green space	16%
Spaciousness	16 m^2 per 100 m^2 GFA
FAR	3,6

ALLENDALE (BERGEN)


Share of open space	55%
Share of green space	23%
Spaciousness	22 m^2 per 100 m^2 GFA
FAR	2,5

DANMARKSPLASS (BERGEN)


Share of open space	58%
Share of green space	30%
Spaciousness	41 m^2 per 100 m^2 GFA
FAR	1,40

SOLHEIMSVIKEN 1 (BERGEN)


Share of open space	63%
Share of green space	3%
Spaciousness	18 m^2 per 100 m^2 GFA
FAR	3,6

SOLHEIMSVIKEN 2 (BERGEN)


Share of open space	40%
Share of green space	21%
Spaciousness	16 m^2 per 100 m^2 GFA
FAR	2,5

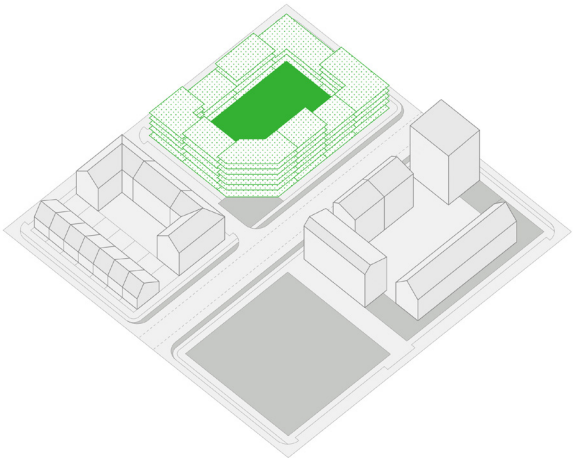
4.3 BLOCK SPACIOUSNESS

BACKGROUND

One qualitative aspect of the shared open space made available to residents in a block depends upon how many residents share that open space. A high density block with a small yard means that many residents must share what little open space there is. Measuring and regulating the ratio of open space and built density is thus an important aspect of quality-control. This measure is called spaciousness.

The spaciousness within blocks is measured as square meters of open space divided by the total gross floor area. This congestion measure reflects whether there is enough open space per person in the block. Modernist planning (in Sweden) recommended 100 square meters of open space per 100 square meters of gross floor area (approximately one residential unit). The Norwegian State Housing Bank (Husbanken) recommends 25 square meters of open space per apartment unit. Bergen municipality in turn, recommends 22 square meters per apartment unit (of which 7 percent private and 15 percent shared). New research suggests that 10 square meters per residential unit may be enough to ensure adequate spaciousness (Minoura, 2016). The open area norm for Oslo (Oslo kommun, 2012) recommends that the distance between buildings in a block be no less than 17 meters.

$$\frac{\text{AREA OF OPEN SPACE WITHIN BLOCK}}{\text{GROSS FLOOR AREA WITHIN BLOCK}}$$



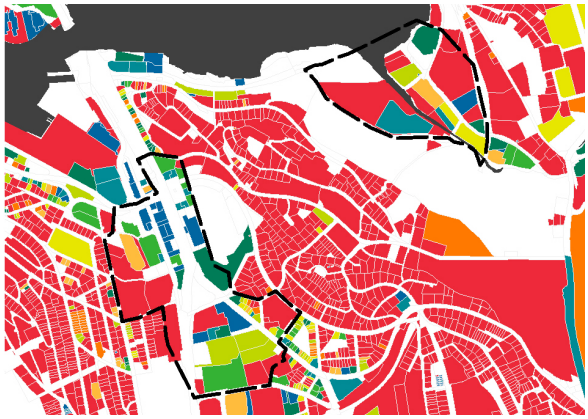
ANALYSIS

The analysis done on selected neighborhoods in Bergen indicates that the properties in Sentrum have a low spaciousness. Most blocks have less than 10 square meters of open space per residential unit (100 square meters of gross floor area). Some residential blocks in Danmarksplass have a spaciousness of below 10 square meters of open space per apartment unit. Even Södermalm in Stockholm has many residential blocks with low spaciousness. However, there are also many blocks with a relatively high spaciousness, indicating that it is possible to have a high spaciousness on block level even in quite central locations.

>BLOCK SPACIOUSNESS

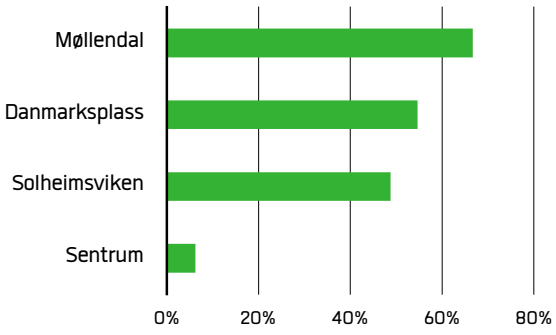
SENTRUM (BERGEN)

SÖDERMALM (STOCKHOLM)



DANMARKSPLASS AND MÖLLENDAL (BERGEN)

SOLHEIMSVIKEN (BERGEN)



Average spaciousness within blocks.

Sqm private open space per 100 GFA within blocks

> 40 (m²) 35-40 30-35 25-30 20-25

15-20 10-15 5-10 < 5

CONCLUSIONS

Bergen municipality's requirement of 22 square meters of open space and Husbanken's 25 square meters per apartment unit is high. Based on Minoura's research our recommendation is 10 square meters of open space per 100 square meters of gross floor area. We recommend that only the residential gross floor area is taken account for.

Block with 20 m^2 private open space per 100 m^2 GFA in Danmarksplass (Bergen).

Yard with high spaciousness in Jordbro outside Stockholm

RECOMMENDATION

Minimum 10 m^2 private open space per 100 m^2 GFA

4.4 BLOCK PLAYSPACE

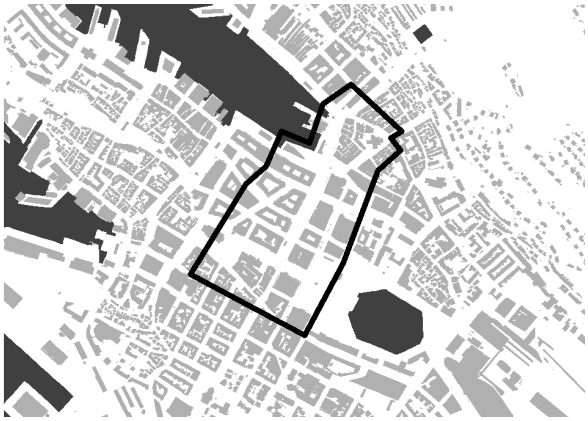
BACKGROUND

Small children (0–6 years old) need access to play areas near to the home and preferably within an enclosed area of the block's yard.

For a playground to be able to accommodate the necessary functions, like a swing, sand-box and jungle gym, a minimum size is required. The Norwegian State Housing Bank (Husbanken) recommends 50 square meters of playground per 25 residential units.

ANALYSIS

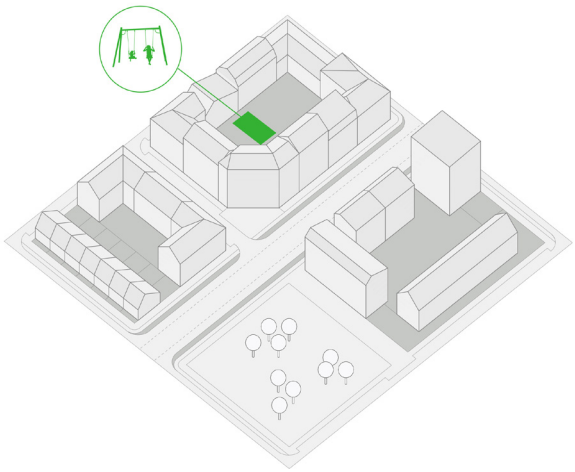
Many residential blocks in the studied neighborhoods in Bergen had no playgrounds at all. There are no blocks in Sentrum with adequate play areas. Solheimsviken and Danmarksplass have only a few playgrounds which are inadequate in terms of size. Historically speaking, planned playgrounds were unusual until well into the 1900's. Our analysis indicates that planning praxis is not that different even in blocks built in the 2000's.



SENTRUM (BERGEN)

DANMARKSPLASS AND MÖLLENDAL (BERGEN)

SOLHEIMSVIKEN (BERGEN)



Area play space per block

1000–1500 (m²) 500–1000 < 250

CONCLUSIONS

Based on analyses, Husbanken's recommended 50 square meters of playground per 25 residential units is difficult to ensure. Based on the planning conditions in dense urban blocks, we advocate instead for a minimum of 100 square meters of playground per 10 000 square meters of gross floor area (or 100 residential units) to be an adequate threshold.

Many new courtyards do not have playspaces. Here Solheimsviken (Bergen).

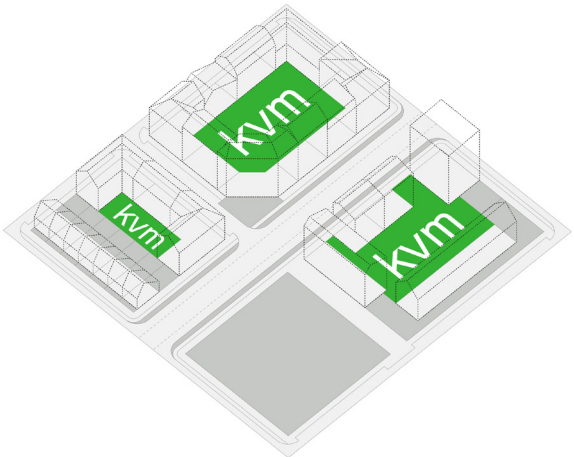
RECOMMENDATION

Minimum 100 m^2 playspace per 10 000 m^2 GFA

4.5 YARD SIZE

BACKGROUND

A yard is a type of shared open space within blocks that is shared by a distinct set of users, namely the residents. New research at KTH in Stockholm (Minoura, 2016) has shown that a yard should be made up of continuous open space rather than fragmented spaces in order to invite use by residents. The same research has also established that a yard should not be too small. A minimum of 1200 square meters and preferably 1500 square meters ensures that the yard is large enough to accommodate multiple and flexible uses while also providing more private zones within the open space of the yard.



1 920 m²
Seating, sandbox, bench

840 m²
4 tables, sandbox, 8 benches, playground, 2 waste bins

2 130 m²
2 sandboxes, 4 benches, 4 grills, 6 tables, 2 big trees

2 220 m²
2 sand boxes, 6 benches, playground, 2 swings, 2 waste bins

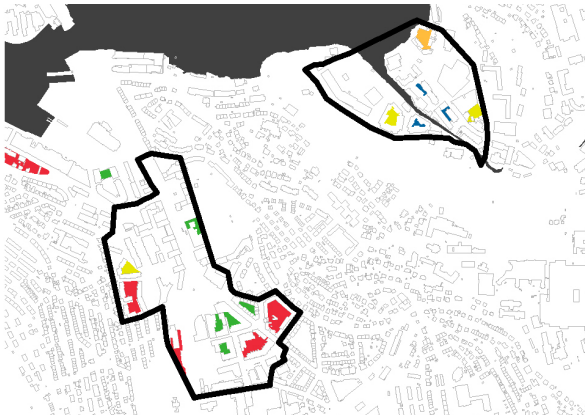
2 830 m²
2 large sandboxes, playground, climbing frame, pavilion, storage

2 840 m²
3 tables, laundry, 24 parking spots, 2 waste bins, lawn

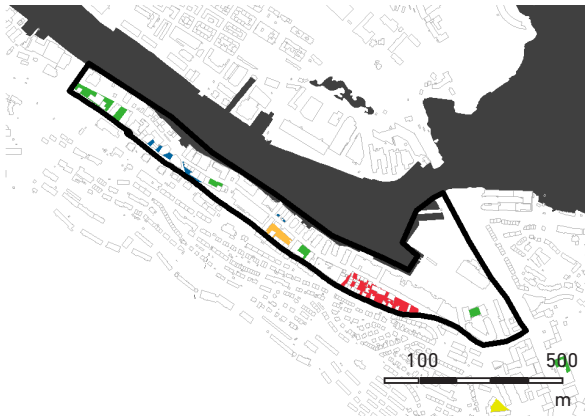
2 900 m²
8 benches, waste bins, storage, small stage, basket

4 050 m²
5 tables, sandbox, waste central, grill, 9 big trees,

SENTRUM



DANMARKSPLASS AND MÖLLENDAL



SOLHEIMSVIKEN

Yard size

> 2000 (m²) 1500–2000 1000–1500 500–1000 < 500

ANALYSIS

Yards in the selected neighborhoods are generally speaking small, only a few are 1500 square meters or larger in area. In Sentrum and Solheimsviken most yards are between 500–1 000 square meters. Danmarksplass has some yards over 2 000 square meters. The overall picture is that yards comprised of continuous rather than fragmented open spaces within the block are rare. The fragmented yards compromise use-value for residents since greater spaciousness both encourages use and allows for more possible uses, such as recreation and play.

CONCLUSIONS

Based on the research and our analyses, a yard should be at least 1 200 square meters in order to accommodate a diversity of functions and in order to be a meeting-place for residents of the block.

A larger yard in Möllendal (Bergen).

RECOMMENDATION

Minimum 1200 m² continuous yard

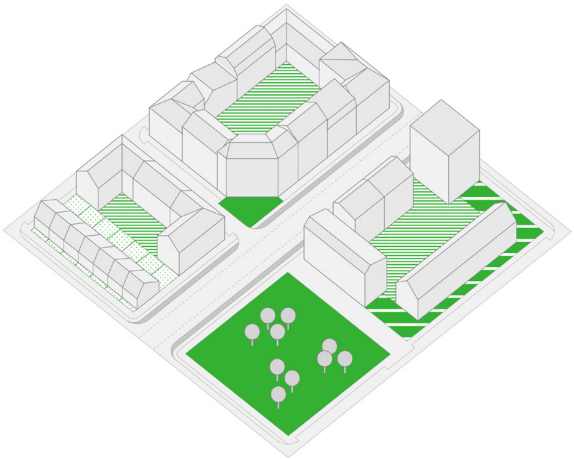
4.6 TERRITORIALITY

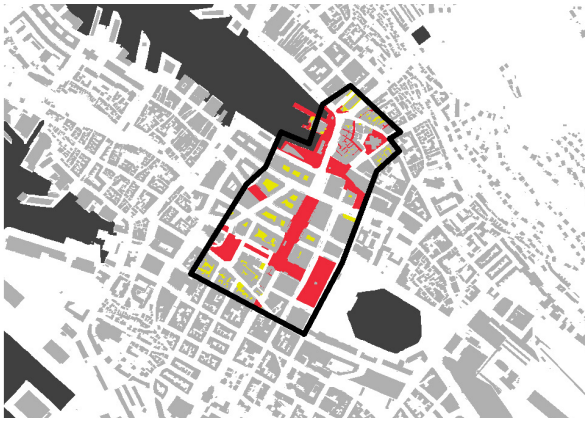
BACKGROUND

Social life in the city needs both different spaces and different degrees of separation. From the most intimate space of the bedroom to the most public urban square, the spaces we inhabit give us cues as to what behavior is expected of us. Open space within a block is different from publicly accessible open space. Private property may contain both private personal space and private shared space. The former category includes those spaces which serve only one residential unit, such as a balcony or single-family yard or patio. The latter category includes the yard belonging to a multifamily residence and the distinct set of residential units belonging to that block. We avoid the terms ”semi-private” and ”semi-public” since the terms are too imprecise and unclear in relation to social and legal space (Minoura, 2016). Open space which is neither private nor public create a diffuse ownership which is not always legible to people. Often these arise when a buffer is produced around buildings, common in residential typologies from the 1900’s when buildings are placed in a field of open space in a ”towers in a park” scheme. Studies show that these ambiguous zones are rarely used and should be avoided in cities where land is in limited supply (Ståhle, 2008).

ANALYSIS

In Sentrum, Solheimsviken and Danmarksplass that are more densely built, boundaries between private property and public space territories tend to be distinct. Yards are clearly defined and easily perceived to be shared by those who live in the blocks. Likewise, public space is clearly defined in relation to surrounding private property and nature.





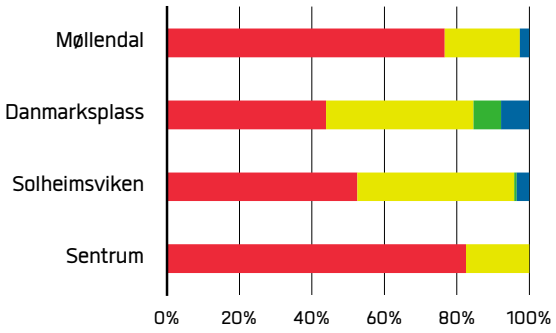
SENTRUM (BERGEN)

DANMARKSPLASS AND MÖLLENDAL (BERGEN)

SOLHEIMSVIKEN (BERGEN)

Territoriality

- Public
- Private shared
- Private household
- Unclear



Territoriality in four districts.

CONCLUSIONS

Research shows that areas with an unclear territoriality are used differently meaning that it is essential to design public space and shared or personal private space differently. The design should incorporate legible boundaries between personal, shared and public space.

In order to avoid confusing spatial situations, within residential blocks, i.e. on private property, there should only be private space - either of the personal private space or shared private space variety. The share should be a minimum of 80 percent shared private open space and a maximum of 20 percent personal private open space. This ensures that the residents' needs of private open space as well as space for collective socialization are accommodated. In other words, different categories of private open space are supported.

PUBLIC

PRIVATE SHARED

PRIVATE HOUSEHOLD

UNCLEAR (AMBIGUOUS)

RECOMMENDATION

Minimum 80% shared
OF PRIVATE OPEN SPACE IN BLOCK

4.7 SCHOOL AND PRESCHOOL YARDS

BACKGROUND

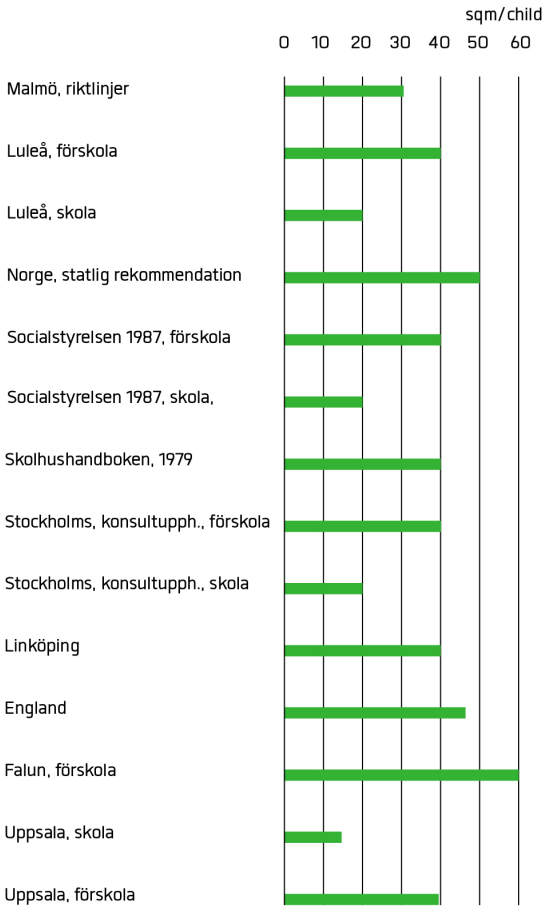
Children are prevalent in a dense and attractive city. Hence both preschools and schools are needed and along with them schoolyards are a must.

A Swedish recommendation for preschool yards is 40 square meters of outdoor space per child, and for school yards 30 square meters of outdoor space per child (Boverket 2015). More recent studies in Stockholm suggest that preschools with 15–20 square meters per child may also function quite well. The Norwegian Ministry of Education and Research (Kunnskapsdepartementet) and Norwegian Horticulture Society recommend 24–33 square meters per child (Kunnskapsdepartementet, 2006).

In order for education in schools to be effective, adequate school yards for children to move around, run and play are essential. Research has shown that this even impacts student performance (Sosial- og helsedirektoratet, 2003). A schoolyard should also be able to be used in the curriculum, such as in physical education and science classes, for instance. Research has shown that a minimum of 25–60 square meters per child guarantees adequate spaciousness (Ibid.)

CONCLUSIONS

Based on the available research and our own analyses, the previous recommendations is quite space-consuming for a dense city to provide. Different types of compensation models and balancing have been practiced because of these high spatial demands. A firm yet reasonable recommendation would rather be 20 square meters per child for yards in schools and pre-schools.



Comparison of guidelines for school and preschool yards. Source: Lund, 2009

4.8 PARKING LOTS

BACKGROUND

A city requires that cars and other vehicles be stored periodically. This may encompass parking for residents or workers as well as for visitors. Parking lots is an extremely ineffective use of space. Within urbanism today, parking lots for residents and workers in a given block to store their vehicles is generally avoided. Most parking is accommodated in parking garages instead.

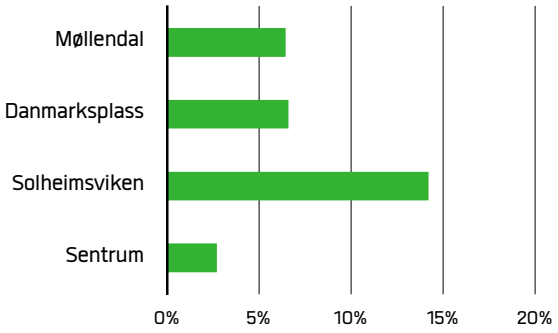
ANALYSIS

The map show all parking lots in selected neighborhoods in Bergen, street-parking excluded. In Sentrum, parking lots can be found in the courtyards of certain blocks, but in other parts of the city parking is often more visible from the public realm. Share of parking supplied in the form of lots is lowest in Sentrum. Solheimsviken in turn has the highest share of parking supplied in parking lots. Bergen stands out in terms of allocating a substantial amount of space to cars as opposed to space for play or recreation. This is true both in public space and on private properties.

CONCLUSIONS

Parking lots within the blocks is not recommended in Bergen's planning code. Such a policy is reasonable in dense city fabrics, but may be acceptable here and there in less dense neighborhoods. We recommend that no parking lots be reserved in blocks with an FAR of 0,5 or higher.

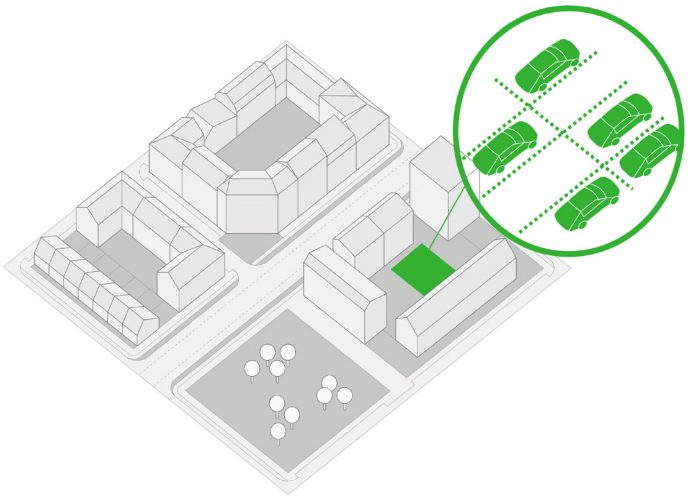
DANMARKSPLASS AND MÖLLENDAL (BERGEN)



Surface parking as share of the total area in four districts in Bergen,

BLOCK RECOMMENDATION

No parking lots on ground where FAR is higher than 0,5



BUILT FORM

A city's housing, businesses and blocks may be shaped in many different ways. Basic characteristics of the built form are captured in the terms density and mixed-use. These factors matter greatly to how vibrant and attractive a city's outdoor space will be. Good locations for businesses along the street also predetermine what qualities and street-life and vibrant shops and services will prevail.

5. BUILT FORM

5.1 BUILDING COVERAGE

BACKGROUND

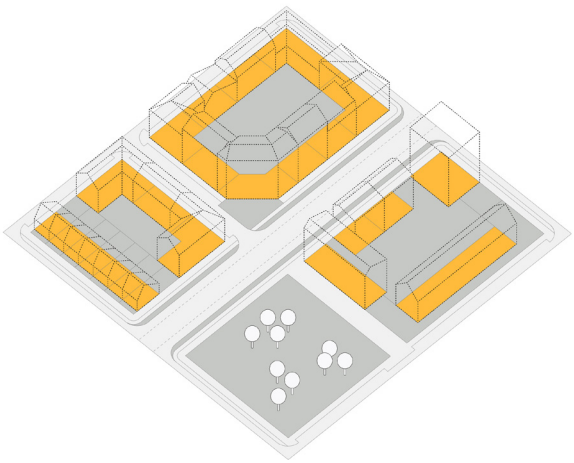
Building coverage is a measure of the ground surface taken up by buildings divided by the total ground surface in a particular area. You might call it all the ground that is not outdoor space. This surface area should be looked at in relation to the ground needed to supply private and public outdoor space, streets, parks, squares and so forth. If the share of building coverage is too high, a lack of outdoor space with naturally follow.

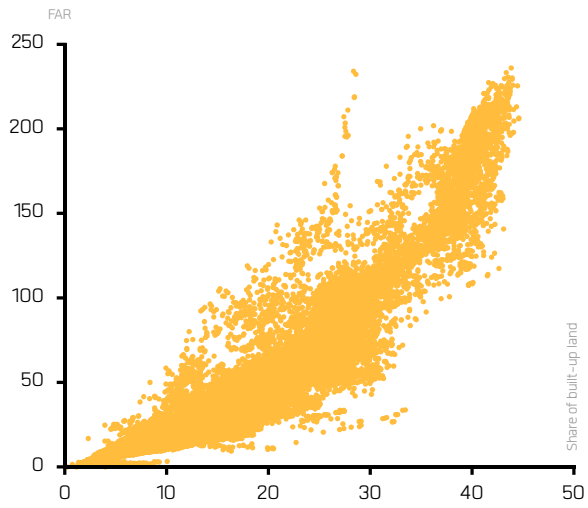
ANALYSIS

In most of the analyzed neighborhoods, 30-40 percent of the ground is built. There is a clear correlation between the area FAR and building coverage in Bergen. Reference areas in Stockholm and Gothenburg are just below 30 percent building coverage, while Grünerløkka and Aker Brygge have approximately 40 percent building coverage.

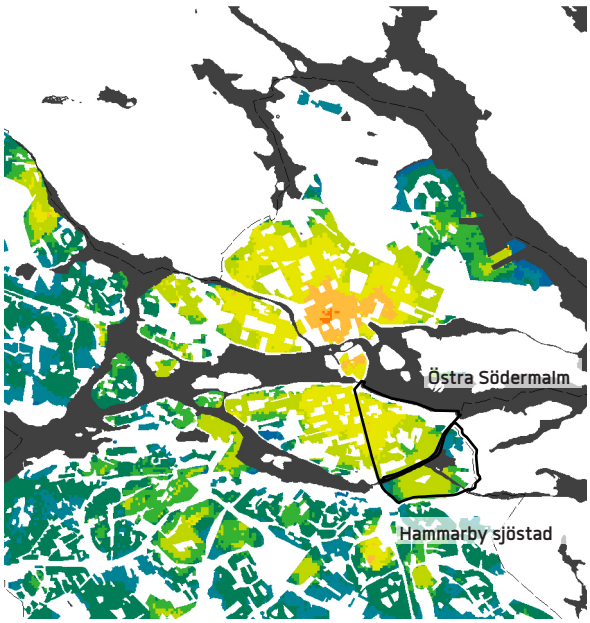
BUILT-UPON SURFACE AREA

TOTAL AREA

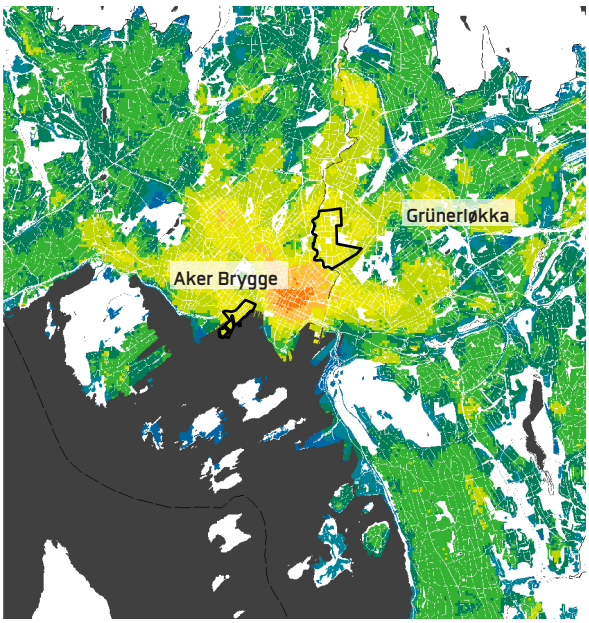




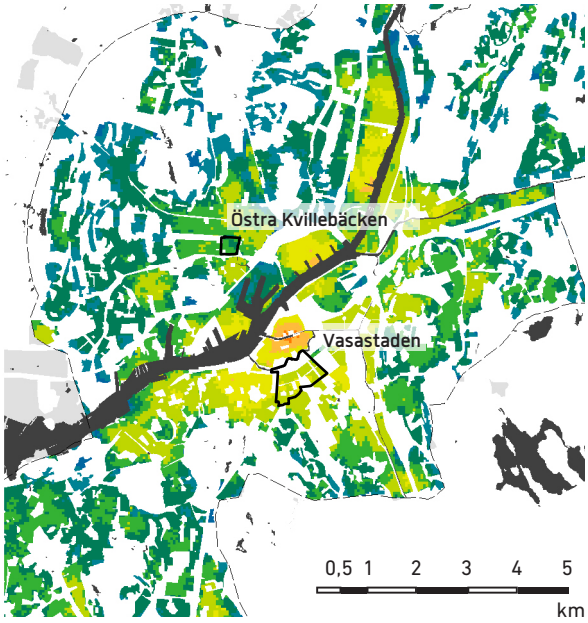
Building coverage and floor Area Ratio on district level



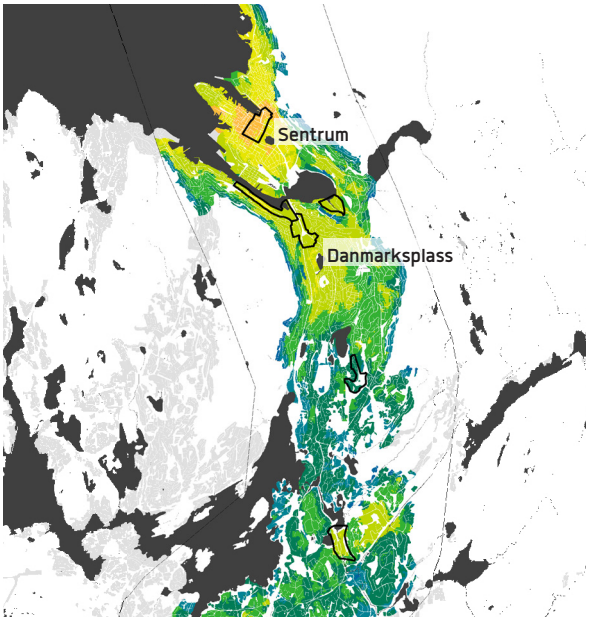
STOCKHOLM



OSLO



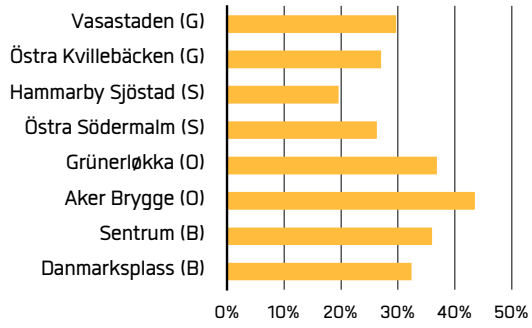
GOTHENBURG



BERGEN

Building coverage

> 60 (%)	50–60	40–50	30–40	20–30
15–20	10–15	5–10	< 5	



Building coverage in eight districts

CONCLUSIONS

Based on our analyses and the recommendations for public space, street space and private open space lead to the consequence that a neighborhood should have a maximum of 40 percent building coverage.

Hammarby sjöstad (Stockholm) has a building coverage of approx 20%.

Sentrum (Bergen) has a building coverage of approx 40%.

RECOMMENDATION

Maximum 40% building coverage

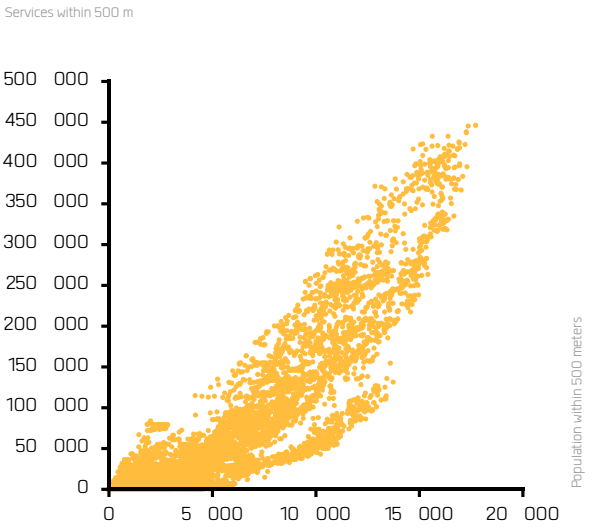
OF TOTAL AREA

5.2 DENSITY

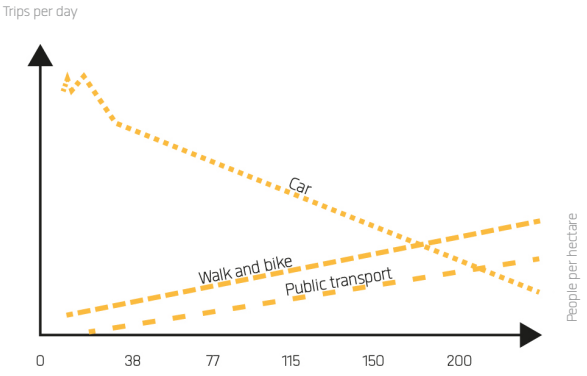
BACKGROUND

”Cities are density and proximity” according to urban economist and Harvard professor Edward Glaeser (2012). Concentrating people together is the primary function of cities after all. This is what sets the stage for people to meet and exchange ideas and services, which in turn create growth and welfare. A high density translates to a more robust base for services and hence more sustainable transportation.

Density can be measured either as population density or spatial density. Population density is measured as the number of people within a defined area or within a specific radius from a certain point. The analyses may include either the resident population or working population, or both. Population density within walking distance correlates strongly with the diversity of services within walking distance, evident in Bergen, for instance. UN Habitat recommends 150 people per hectare as a sustainable population density based on car-dependency and availability of services (UN Habitat, 2014, 2).



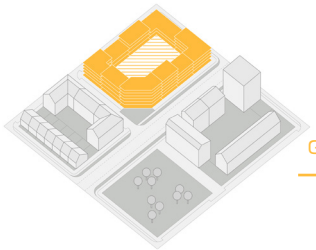
Correlation between population density and number of services within 500 meters



Correlation between population density and travel behavior. Source: UN Habitat (2014)

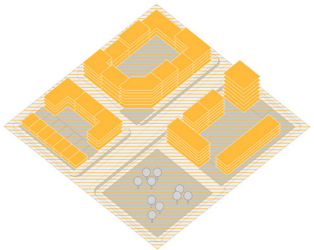
GROSS FLOOR AREA IN BLOCK

BLOCK AREA



GROSS FLOOR AREA IN DISTRICT

DISTRICT AREA



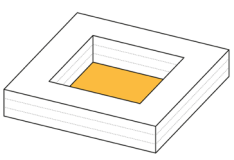
Spatial density is measured as the total floor area (GFA) divided by the ground area. This is called Floor Area Ratio (FAR). Separation is explored in district density and block density, where the first is measured in a larger area containing, for example, streets and public places. If you want to understand the significance of the density for, for example, service substrates or transport choices, look at the district density. An individual, high-density block in an otherwise sparsely populated district is not able to increase service offerings or reduce car dependency.

>DENSITY

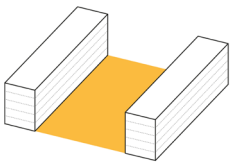
It is important to understand that a certain FAR can be expressed with a range of building types. A block with an FAR of 2,0 may contain a 24-storey high-rise or a perimeter block of 3 storys.

The building density or FAR is strongly correlated to population density. In planning, FAR is generally more useful since it more closely approximates the surface intended to be built. 150 people per hectare, UN Habitat's recommendation for sustainable density, translates to an area FAR of approximately 0,75. In an urban context with public spaces and a fine-grained street-network, this is a block FAR of about 2,0.

Density can also be measured within a certain radius from a public transportation node. This method is used to examine whether there is enough population to warrant new public transportation. In Stockholm a threshold of 10 000 people within 800 meters is considered adequate for a new subway station.

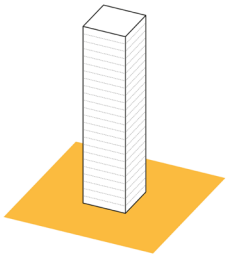


3 floors



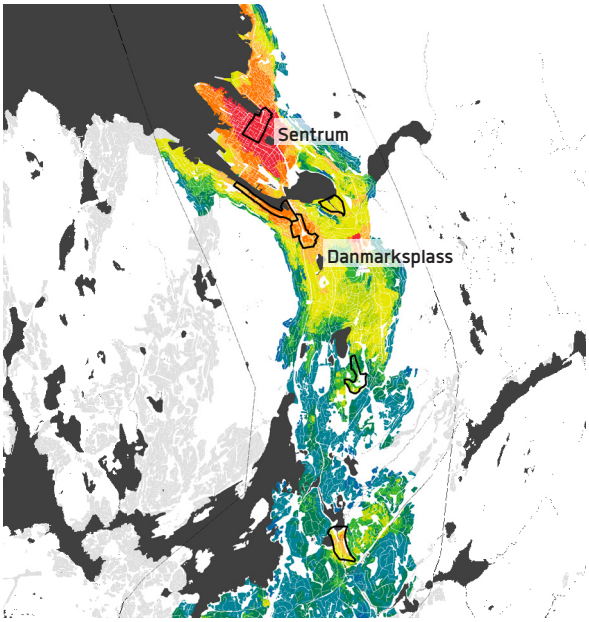
5 floors

6 floors

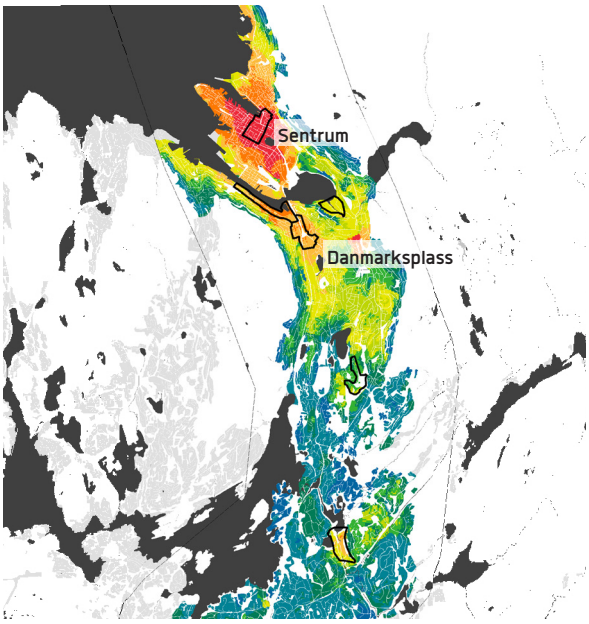


24 floors

FAR 2,0 in four different built forms



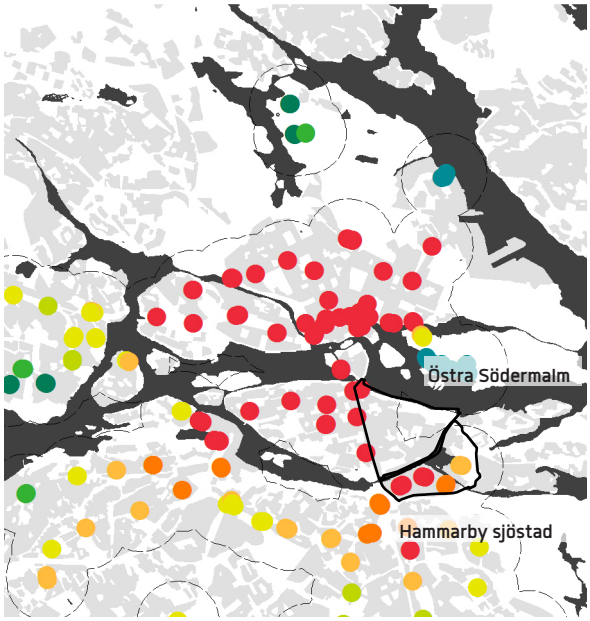
SPATIAL DENSITY BERGEN



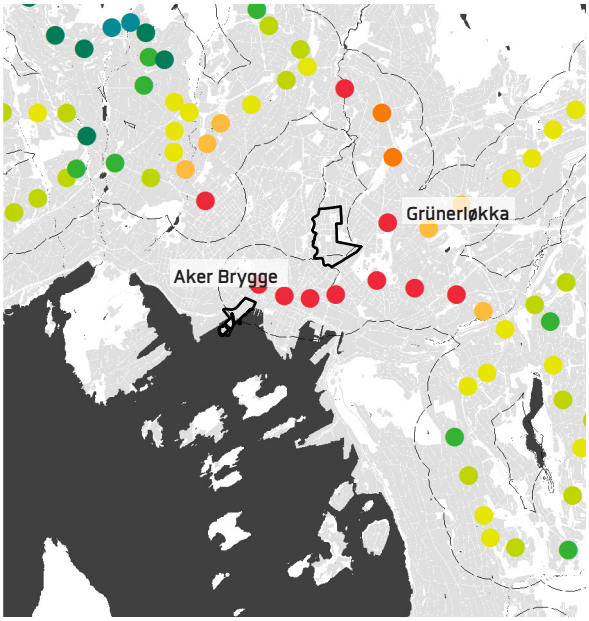
POPULATION DENSITY BERGEN

Spatial density and population density

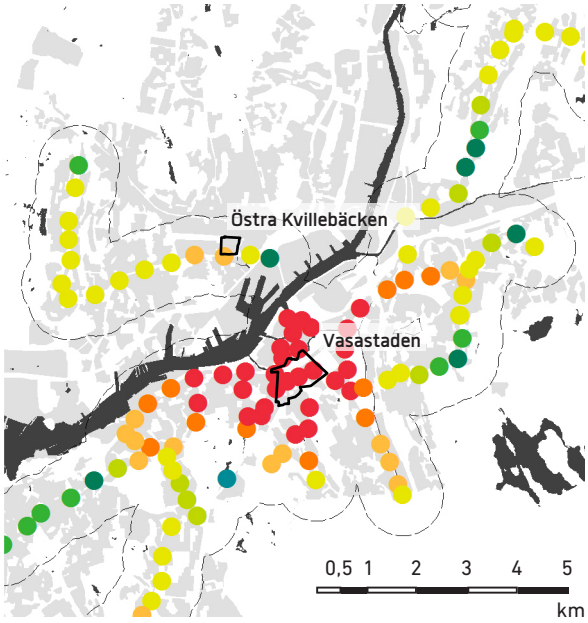
>1,5 > 300 pers	1,0–1,5 200–300 pers	0,75–1,0 150–200 pers
0,5–0,75 100–150 pers	0,4–0,5 80–100 pers	0,3–0,4 60–80 pers
0,2–0,3 40–60 pers	0,1–0,2 20–60 pers	< 0,1 < 20 pers



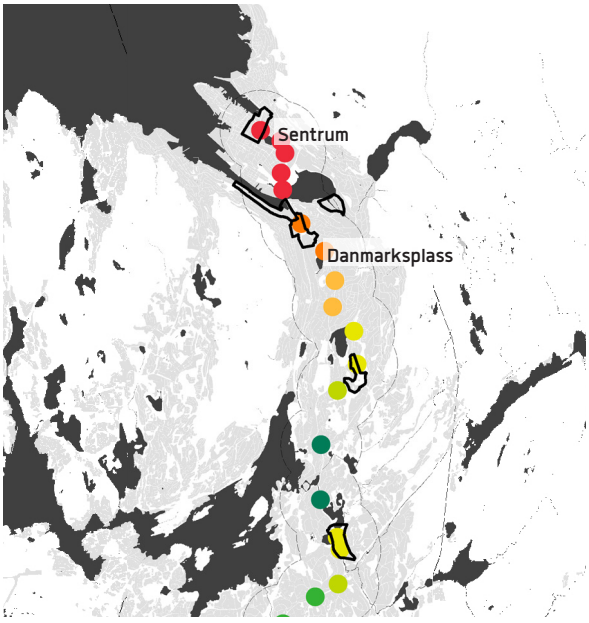
STOCKHOLM



OSLO



GOTHENBURG

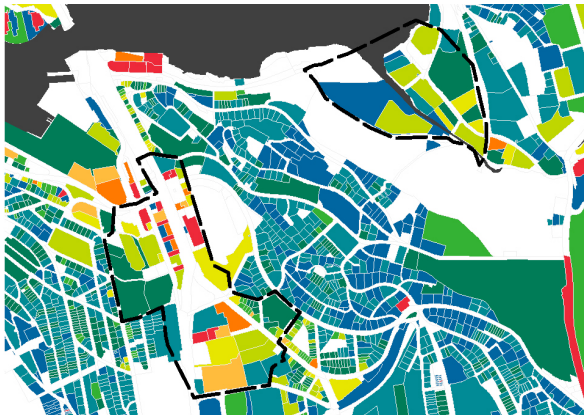


BERGEN

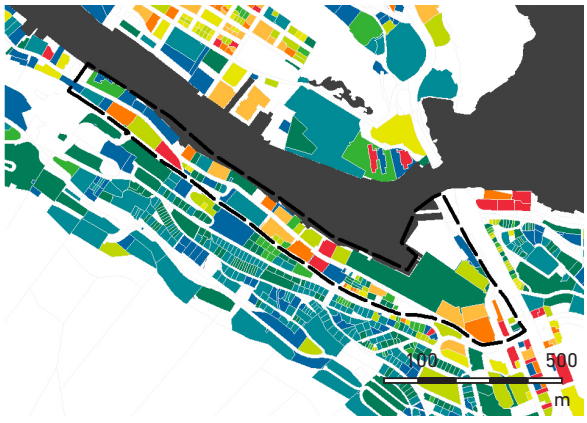
Population within 800 meters from transit station

- > 25 000 (pers)
- 20–25 000
- 15–20 000
- 10–15 000
- 8–10 000
- 6–8 000
- 4–6 000
- 800 m from station

SENTRUM (BERGEN)



DANMARKSPLASS AND MÖLLENDAL (BERGEN)



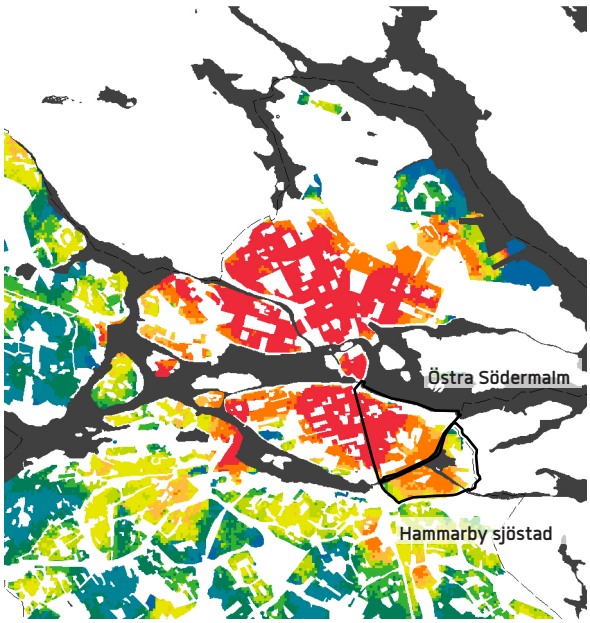
SOLHEIMSVIKEN (BERGEN)

Gross floor area in block

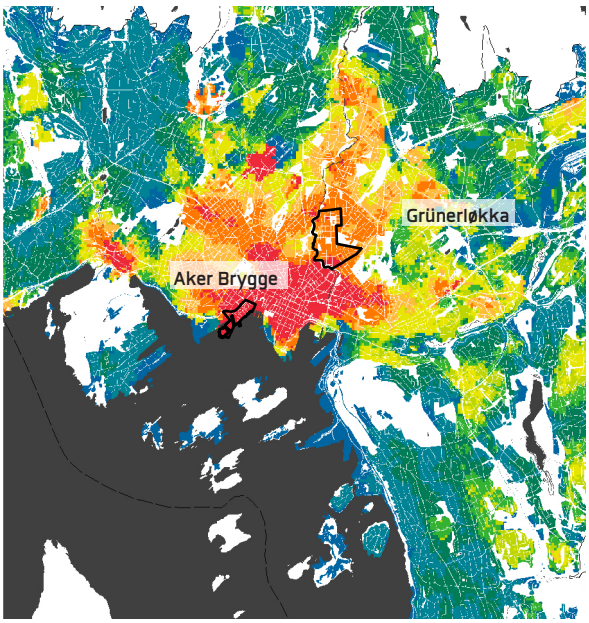
> 4,0	3,5–4,0	3,0–3,5	2,5–3,0	2,0–2,5
1,5–2,0	1,0–1,5	0,5–1,0	< 0,5	

ANALYSIS

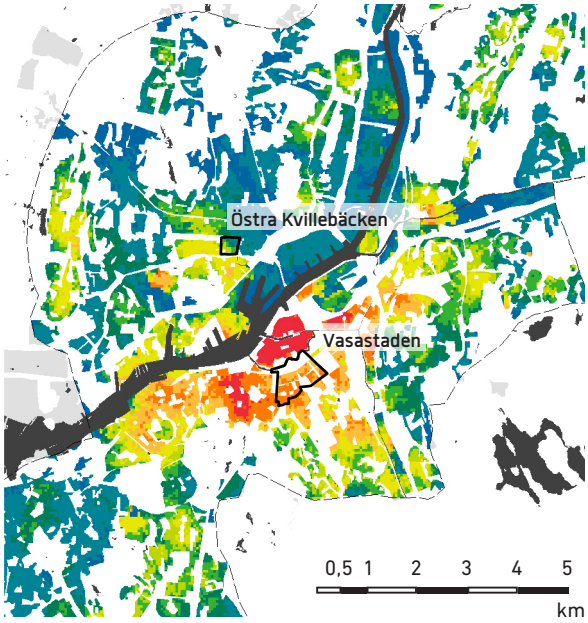
The analysis shows that the block density in Sentrum is high, with a majority of properties having an FAR of over 0,3. In Solheimsviken, Danmarksplass, Möllendal and Nesttun building density is high. In Slettebakken and Råstøl the building density is low. Locational analyses area-by-area show that Bergen's dense core is in Sentrum and reaches across the water to Solheimsviken and Danmarksplass. Nesttun sticks out having a small concentration of density in the southern, otherwise low-density parts.



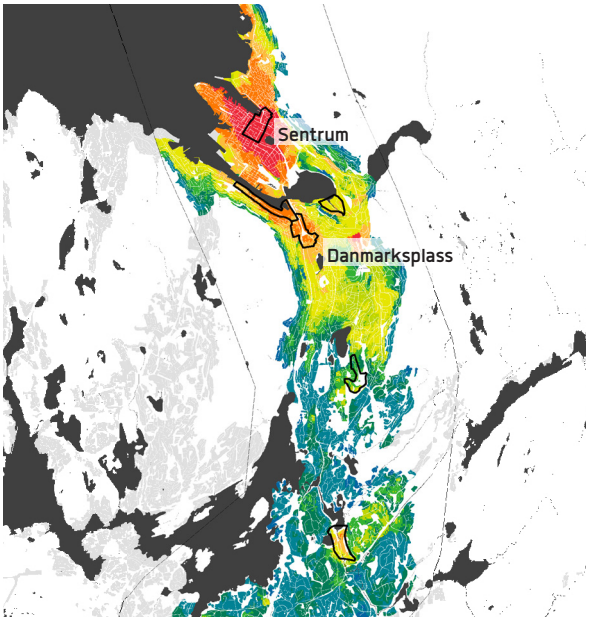
STOCKHOLM



OSLO



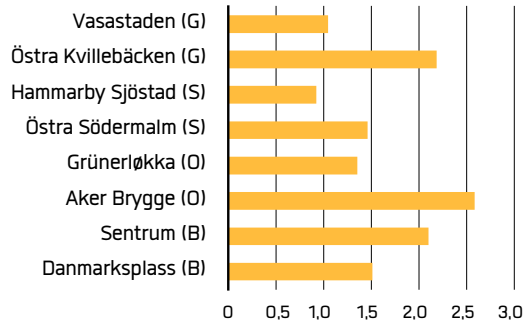
GOTHENBURG



BERGEN

District FAR within 500 m straight-line distance

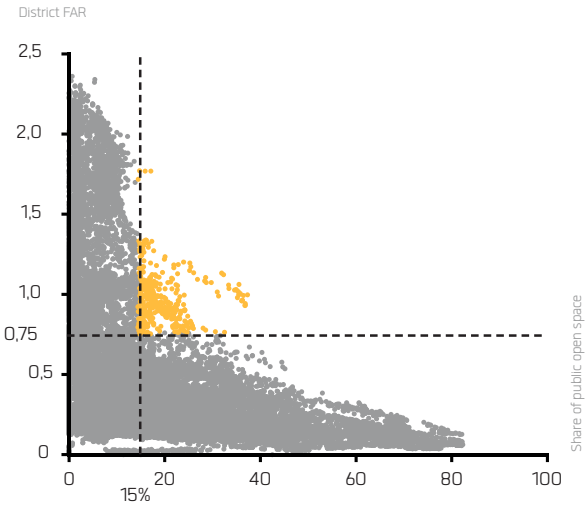
> 1,5	1,0–1,5	0,75–1,0	0,5–0,75	0,4–0,5
0,3–0,4	0,2–0,3	0,1–0,2	< 0,1	



District FAR in eight districts

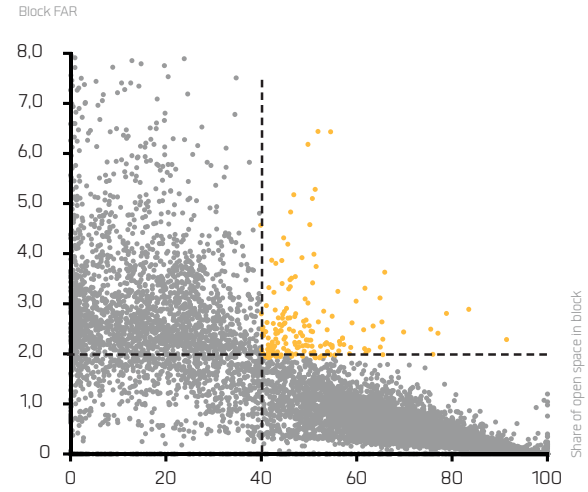
CONCLUSIONS

Based on the research and our analyses, UN Habitat's recommendation of a minimum of 150 people per hectare is attainable in locations with good public transportation. Translated to building density, this means a minimum of 0,75 FAR on district-level and 2,0 FAR on block-level. A location within 800 meters to public transportation is considered close.



DISTRICT FAR AND SHARE OF PUBLIC OPEN SPACE

The diagram shows the situation in the existing Bergen. The yellow-marked points are areas that today meet the recommendations of both at least 15 percent public places and district FAR of at least 0.75.



BLOCK FAR AND SHARE OF PRIVATE OPEN SPACE

The diagram shows the situation in the existing Bergen. The yellow-colored points are blocks that today meet the recommendations on both at least 40 percent open space within a quarter and a quarter-farmer of at least 2.0.

RECOMMENDATION

Minimum of 0,75 FAR on district level

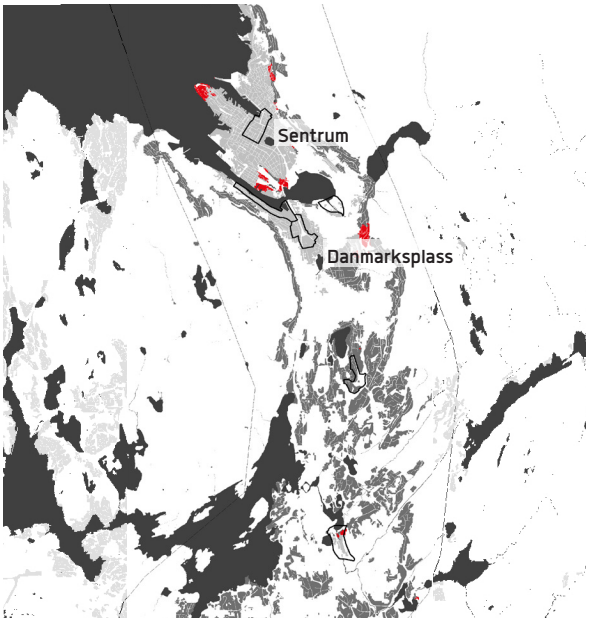
Minimum of 2,0 FAR on block level

IN LOCATIONS WITHIN 800 METERS OF PUBLIC TRANSPORTATION

DENSE AND SPACIOUS

Density needs to be considered with regard to open space. The recommendation for minimum area density has been examined in comparison with a 15 percent minimum share of public space. The map shows in red which areas satisfy both requirements, which are both dense and spacious. In Bergen, very few areas manage to have both a 0,75 FAR and 15 percent share of public space. Proof that such a benchmark is possible exist in Stockholm, where several parts of the inner city satisfy the criteria.

STOCKHOLM



BERGEN

Dense and spacious

- More than 0,75 FAR and 15% public open space
- More than 0,75 FAR and less than 15% public open space
- Less than 0,75 FAR and more than 15% public open space

5.3 MIXED-USE

BACKGROUND

An effect of having a mix of different uses is that people will be more likely to be present in public space at different times of the day and night. A neighborhood with a higher mix of functions is more dynamic and lively than one with a low mix. Research has shown that a diversity of functions in the city will affect transportation choices. The higher the diversity, the more likely that people will walk, bike and use public transportation (Ewing & Cervero, 2010).

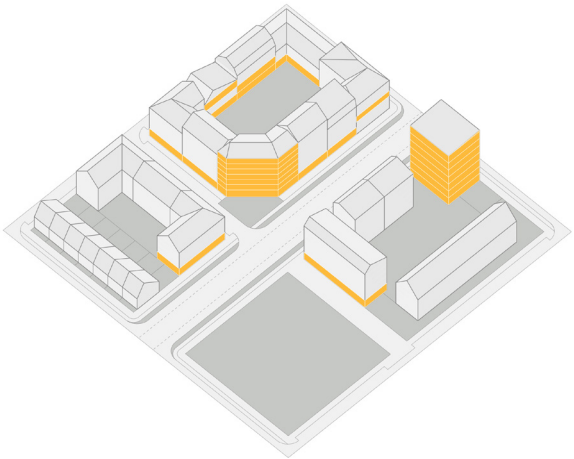
Mixed-use can be measured as the share of the total commercial floor area of the total gross floor area (including residential floor area). Both UN Habitat and the available research (Ibid.) emphasize that a mixed-use city provides advantages in terms of the use of city space and commercial spaces. UN Habitat (2014, 2) includes among it's guidelines for sustainable city-building that 40-60 percent of the gross floor area should be commercial spaces, 30-50 percent residential and approximately 10 percent public services.

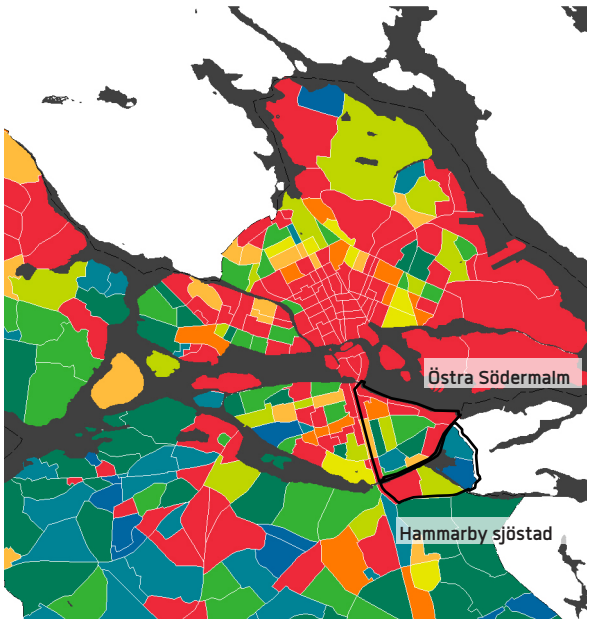
ANALYSIS

Danmarksplass and Møllendal are mixed at area level while Solheimsviken is dominated by commercial floor area. The center has a very small proportion of housing.

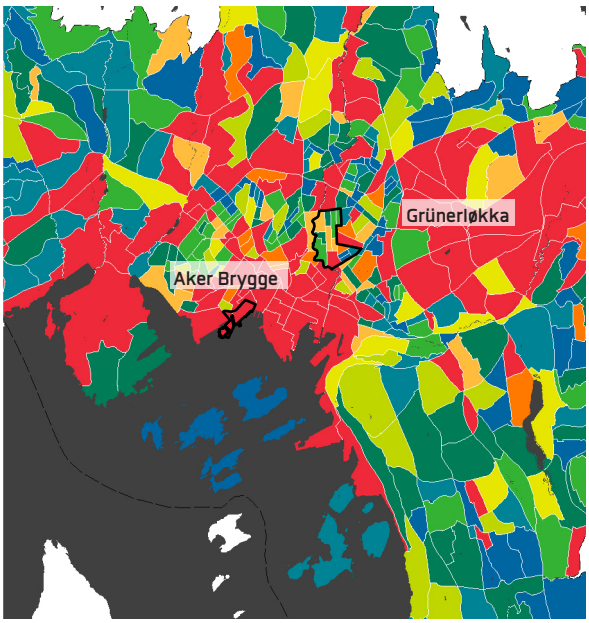
At block level it is clear that many neighborhoods are dominated by either housing or offices, few neighborhoods are really mixed.

$$\frac{\text{SHOP/BUSINESS/SERVICES FLOOR AREA IN BLOCK}}{\text{GROSS FLOOR AREA IN BLOCK}}$$

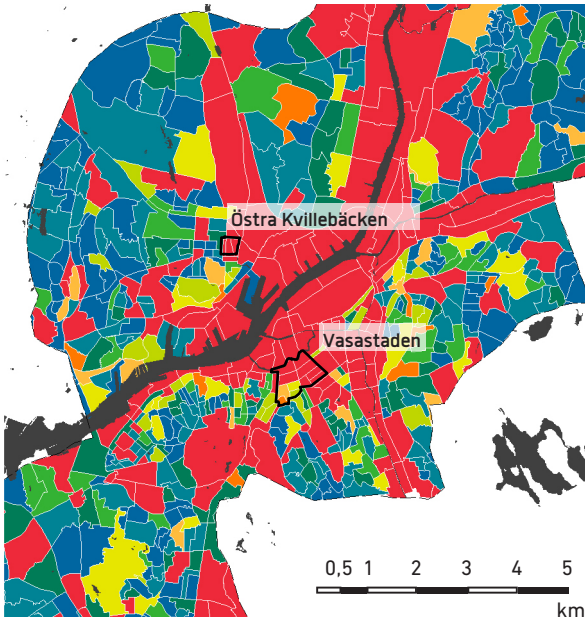




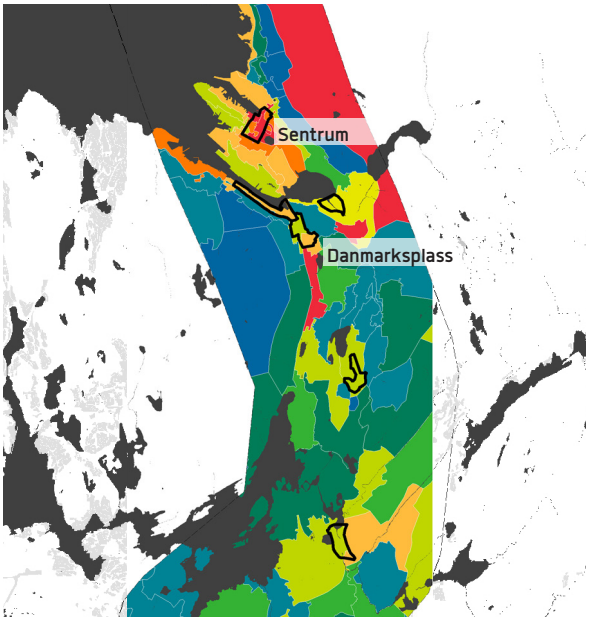
STOCKHOLM



OSLO



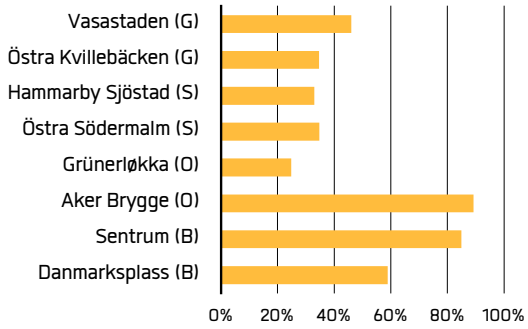
GOTHENBURG



BERGEN

Share of commercial floor area of GFA in districts

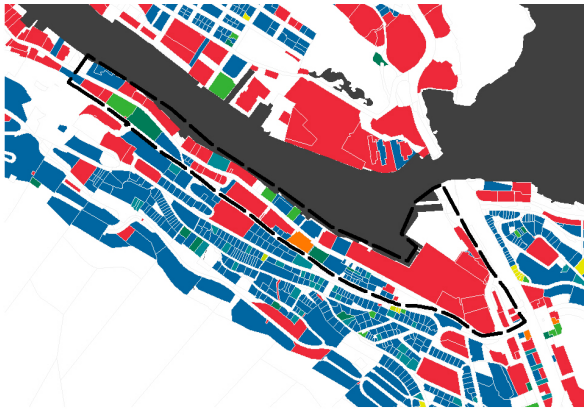
> 80 (%) 70-80 60-70 50-60 40-50
30-40 20-30 10-20 < 10



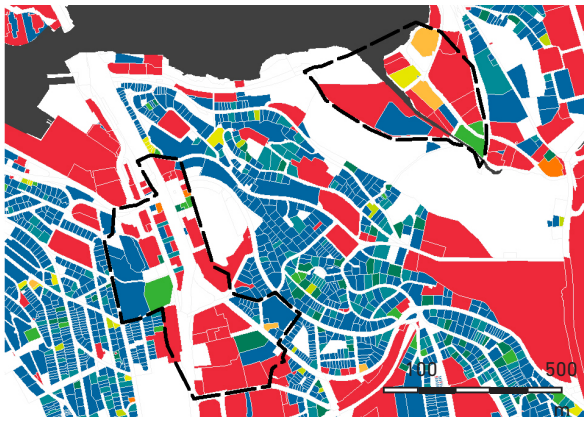
Share of commercial floor area of GFA in eight districts

>MIXED-USE

SENTRUM (BERGEN)



SOLHEIMSVIKEN (BERGEN)



DANMARKSPLASS AND MÖLLENDAL (BERGEN)

Share of commercial floor area of GFA in blocks

> 40 (%)	35–40	30–35	25–30	20–25
15–20	10–15	5–10	< 5	

CONCLUSIONS

Based on our experiences and recommendations it follows that a land use mix of 30-70% is attainable and sustainable.

LOW MIXED-USE
Aker Brygge (Oslo) has a low mixed-use. Almost 90% of GFA is commercial floor area.

HIGH MIXED-USE
The neighborhood around Götgatan on Södermalm (Stockholm) has a share of commercial floor area around 50%.

RECOMMENDATION

30-70% commercial floor area of GFA

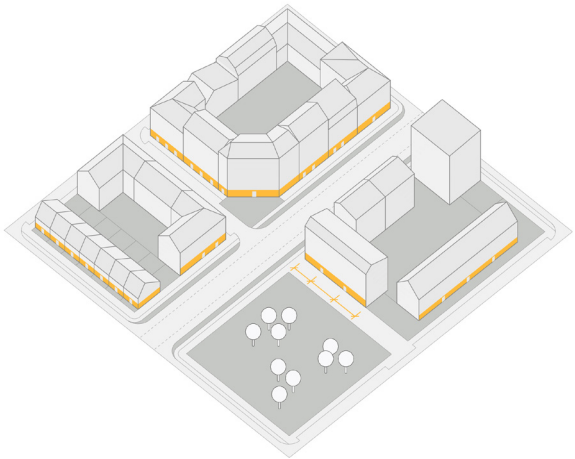
IN AREAS WITHIN 800 METERS OF PUBLIC TRANSPORTATION

5.4 ENTRANCE-DENSITY TO STREET

BACKGROUND

The quality and value of an open space is determined in large part by how it is framed. Shops and entrances along a street, square or park, will increase the likelihood that the space in question will fill up with people and be perceived as safe.

The street-wall made up of building facades lining the street or square contain several components, but most significant for the quality of the street are the types and density of entrances. Jan Gehl has shown in a number of studies (among others in Gehl, Johansen, Reigstad, 2006) that a high entrance-density is needed in order for a street space to be seen as interesting and lively by those in it. LEED Neighborhood and BREEAM Communities also recommend a density of entrances (so-called active frontages) in order to support a safe and vibrant street space. LEED Neighborhood recommends that there be no more than 10-20 meters between entrances in a mixed-use built environment.



CATEGORY A

Small units, many doors (15–20 per 100 m). Large variation in function. No blind and few passive units. Lots of character in facade relief – primarily vertical facade articulation. Good details and materials.

CATEGORY B

Relatively small units (10–14 doors per 100 m). Some variation in function. Few blind or passive units. Facade relief. Many details.

CATEGORY C

Mix of large and small units (6–8 doors per 100 m). Modest variation in function. Some blind and passive units. Modest facade relief. Few details.

CATEGORY D

Large units. Almost no variation in function (2–5 doors per 100 m). Many blind or uninteresting units. No facade relief. Few or no details.

CATEGORY E

Large units, few or no doors (0–2 doors per 100 m). No visible variation in function. Blind or passive units. Uniform facades with no relief. No details, nothing to look at.

FACADE CLASSIFICATION

Categories according to the urban design researcher Jan Gehl. Source Gehl et al 2006

>ENTRANCE-DENSITY TO STREET

SENTRUM (BERGEN)

DANMARKSPLASS AND MÖLLENDAL (BERGEN)

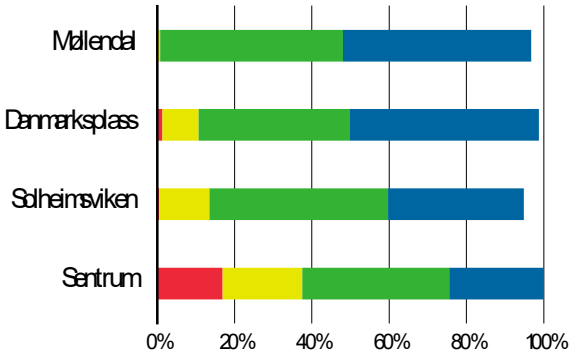
SOLHEIMSVIKEN (BERGEN)

Number of entrances per 100 m street length

> 10 (ST) 5-10 1-5 0

ANALYSIS

Many of the selected neighborhoods have a large share of streets with few, if any entrances. One exception is Sentrum. There, only pathways running through parks entirely lack entrances. The single-family dwellings in Råstøl have patches with a high density of entrances, but the alleyways between the streets tend to have a low entrance-density.



Share of street length within each category of entrance-density.

>ENTRANCE-DENSITY TO STREET

CONCLUSIONS

Based on the research and our analyses, an entrance-density of at least 5 entrances per 100 meters of street is a well-founded recommendation. It is important to note that entrances should face the street as much as possible. This not only contributes to creating safer and more lively streets, but also simplifies handicap-accessibility.

RECOMMENDATION

Minimum 5 entrances per 100 m street length

SUMMARY OF RECOMMENDATIONS

Minimum 15% public open space of the total area

Minimum 10 % public green space of the total area

Minimum 5% public park space of the total area

Minimum 10 m² public open space per 100 m² GFA

A variety of social affordances in public places

Maximum 300 m walking distance to public green space > 0,2 ha

Maximum 800 m walking distance to square > 0,1 ha

Maximum 500 m walking distance to a park > 1 ha, 50 m wide

20–30% street space of the total area

Minimum 150 intersections per km²

A variety of more and less integrated streets.

Connect new neighbor-hoods by way of well-integrated streets into surrounding neigh-borhoods.

Traffic space should aim to have at least 50% shared or pedestrian only streets.

Maximum 50% of the street section to motor vehicles.

Sidewalk width a minimum of 2 m.

Minimum 40% private open space as share of the total block area

Minimum 25% green space of the total block area

Minimum 10 m2 private open space per 100 m2 GFA

Minimum 100 m2 playspace per 10 000 m2 GFA

Minimum 1200 m2 continuous yard

Minimum 80% shared open space of private open space in block

Minimum 20 m2 yard space per child

No parking lots on ground where FAR is higher than 0,5

Maximum 40% building coverage of the total area

Minimum of 0,75 FAR on district level

Minimum of 2,0 FAR on block level.

30–70 % commercial floor area of GFA in areas within 800 meters of public transportation

Minimum 5 entrances per 100 m street length

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SPACESCAPE
Spacescape AB / Östgötagatan 100 / Box 4700 / SE-116 92 Stockholm / Sweden
Tel +46 8 452 97 67 / www.spacescape.se / info@spacescape.se