Public spaces and socially sustainable lighting

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ABSTRACT

We are living in a changing time where a living democracy and sustainable development is more important than ever. Factors such as urbanization, technological development and migration is creating new needs for us as a society which has to be considered when designing for a sustainable future. The Swedish policy ”Politik för gestaltad livsmiljö” (Policy for a designed urban environment), is suggesting a new way to work with sustainability, design and architecture in our urban environment. The policy is mentioning a lot of factors that should be considered in the design of a socially sustainable urban environment but it is lacking a clear guidance on how to achieve it. For lighting designers it might be hard to know how to work consciously with these factors. The different factors needs to be put in to a lighting design context to bring clearness to the matter. This thesis had the intention to summarize the new policy and create guidelines regarding socially sustainable lighting design of public spaces. These guidelines was then implemented in a project with a client where the aim was to create a social sustainable lighting design for the shopping center ”Valbo Köpcentrum” right outside the Swedish city of Gävle.

Keywords: Lighting design, lighting, social sustainability, public space, inclusive, democratic, universal, design, user-based design, atmosphere, light topography, visual spatial boundaries, Valbo Köpcentrum, Sweden.
FOREWORD

I would like to thank my family, classmates and teachers at KTH who have been supporting me and my work during this thesis. I would also like to thank the companies Elindersten Arkitekter and Eurocommercial for providing me with a project which has been a great experience for me. I would also like to thank all the respondents on the survey and Jimmy Pettersson from SRF for their time. And also a special thanks to Lina Goldén who have been tutoring me during the thesis and have been a fantastic support.

Best regards,

Oscar Bergman
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INTRODUCTION

In the building of our public spaces it is crucial to have a goal to make the spaces as inviting and accessible as possible to make everyone in society feel involved and independent. A feeling of belonging and pride over the common urban environment contributes to a more friendly society. To work with these matters when designing can make a difference in segregation and help to make the society more equal (Kulturdepartementet 2018).

The policy ”Politik för gestaltad livsmiljö” (Policy for a designed urban environment), is suggesting a new way to work with design and architecture in our urban environment. The main focus of the policy is to establish quality urban environments by encouraging the procurement of sustainable design. The policy is mentioning a lot of factors that should be considered in the design of a socially sustainable urban environment but it is lacking a clear guidance on how to achieve it (Kulturdepartementet 2018).

For lighting designers it might be hard to know how to work consciously with these factors. The different factors needs to be put in to a lighting design context to bring clearness to the matter.

OBJECTIVE

This thesis has the purpose to summarize the general new Swedish policy ”Politik för gestaltad livsmiljö” with the aim to translate it into a suggestion for guidelines and a checklist that could work as a tool for socially sustainable lighting design of public spaces. The guidelines and checklist will then be implemented in a project with a client where the aim is to create a social sustainable lighting design for the shopping center ”Valbo Köpcentrum” (see figure 1) right outside the Swedish city of Gävle.

The project is going to involve the universal user’s journey from the beginning of the property of the shopping center to its main entrance, this includes the parking lot and a promenade outside the shopping center that leads to the entrance. The ambition is to improve the space in a way that is beneficial for the universal user and the client.
A NEW SWEDISH POLICY

We are living in a changing time where a living democracy and sustainable development is more important than ever. Factors such as urbanization, technological development and migration is creating new needs for us as a society which has to be considered when designing for a sustainable future (Kulturdepartementet 2018).

Sustainability is often defined as to "meet the needs of the present without compromising the ability of future generations to meet their own needs" and is divided into three main areas, economic, environmental and social (Thorpe 2008). Social sustainability is a complex concept that can mean different things in different contexts but includes matters that is related to social justice which includes integration, diversity, equality, child perspective, safety and culture (Wikberg Nilsson et al. 2019). To create socially sustainable environments is and should be the architects or designers specialty and task (Kulturdepartementet 2018).

In 2015 the United Nations created 17 goals for sustainable development, the Swedish government believes that one way of achieving these new goals is to create a new policy for architecture and design "Politik för gestaltad livsmiljö". The new policy’s goal is that architecture and design should contribute to a more sustainable, equal and less segregated society with carefully designed urban environments. There is a lot of authorities and stakeholders such as Boverket, Sveriges arkitekter and Statens centrum for arkitektur that is welcoming this policy that the government is suggesting. But they also ask for the goals to be concretized further into guidelines or milestones to make the objectives clearer and easier to achieve (Kulturdepartementet 2018).

In addition to this, there are different standards, legislations and literature that is approaching the issue for a better lit environment (BFS 2004:15), (Boverket 2005), (Boverket 2010), (EN 12464-2), (Starby 1989). To work with these matters as a designer can be complex since it is a lot of perspectives that needs to be considered. There are different design methods that is handling the issue in various ways and can be of help for the designer. One of these methods is called Universal design (Wikberg Nilsson et al. 2019).

DESIGNING FOR EVERYONE

Universal design is a perspective that has the ambition to meet all the different user needs. To design public environments to be available for all is a main factor for creating a sustainable society. Universal design is a democratic approach to urban design where everyone regardless of age, size, sex, nationality, abilities and disabilities should be considered as far as possible.

To achieve a universal design it is possible to use a specific design process (see figure 2) that has a focus on finding out who might be excluded in the context which gives the designer a possibility to approach the problem from an early stage in the building process. The goal for the universal design process is to make the final solution live up to these criteria;

SAFE
The design should promote safety for all by meeting the needs of everyone.

USEFUL
The design of the place should make it easier for people to be independent, by making it easier to use the public space on their own.

INCLUSIVE
The design of the place should have the solutions integrated in the environment by thinking of the different user needs in the beginning.
ATTRACTIVE
The design should promote balance in the environments with a variation of good architecture and design that merges together to a unity.

PLEASANT
The place should have inclusive and pleasant designed environments for play, activity, resting and social relations. (Wikberg Nilsson et al. 2019).

LIGHT AND PERCEPTION OF SPACE
Light is a necessity for us to perceive space. Light intensity, color temperature, light topography and light distribution are important factors for spatial experience and can have influence on the users perception of an environment.

The intensity of the illumination can either increase or decrease the sense of activity in an environment. Users tend to choose their path depending on the brightness levels and is often favoring the brighter one, especially in environments that are not known to them. Warmer color temperatures are often associated with calmer environments than colder temperatures. Bright uniform light with emphasis on spatial boundaries are often considered to be adding visual clarity to an environment while a more pleasant and relaxing environment is created by non-uniform light with varying contrast. To create interest it is often more successful to use directed light since uniform light can be considered uninteresting.

Areas with uniform light can appear as more democratic than a focused light, however the focused light could be perceived as more intimate. The author mentions that the character of the space should be considered since it can increase or decrease the perception of the lighting.

By lighting up vertical surfaces visible walls occurs in the darkness that increases the feeling safety and spaciousness. This can be done by using vegetation in an urban environment which also increases the restoration value of the space. Lit up greenery can also provide security and attractiveness to the space if it is well-maintained.
The light topography also matters for how users perceive a space and use it. A higher pole gives a more uniform public distribution and is a cheaper option since it can cover large areas. A lower luminaire is contributing the feeling of a safer atmosphere by creating a urban room that is clearly marked and tangible. To have a variation in the light topography is suggested to be beneficial for a spacious atmosphere (Wänström Lindh 2012).

To create a space that is easy to perceive the differences in brightness needs to be sufficient, a space with a varying brightness has more visual information than one with only a few levels of brightness. To have a brightness contrast ratio of 2:1 is perceivable but not very distinct, a contrast of 5:1 is considered distinct and 15:1 is perceived as a dramatic contrast. For the best visual performance it is recommended to use a ratio of 3:1. If several brightness levels are planned to be used in a space it is recommended to use equal steps, for example 1:3:9:27, to make the space easy to perceive (Tregenza & Loe 2014).

**Municipalities Work for a Better Lit Public Environment**

To create a more cohesive, pleasant and well planned lighting in public spaces there are different initiatives from municipalities in Sweden such as Huddinge, Nacka and Piteå to name a few. The municipalities are working towards a better lighting environment with guidelines and methods to have a structured approach towards the complexity. Similarities between the different guidelines and recommendations is that they approach the urban lighting from a perspective of safety, security, orientation and atmosphere.

All of the recommendation is suggesting to highlight main urban elements, greenery and art in the city for easier orientation, visual clarity and also for an atmospheric effect. There is also a lot of emphasis on reducing glare in the public environment since it causes discomfort and reduces visibility in the public space. The different guidelines also suggest lighting on vertical surfaces to create a more pleasant nocturnal environment (Huddinge kommun 2016), (Nacka kommun 2017), (Piteå Kommun 2017).

**Standards and Legislations for Lighting.**

The Swedish standards for lighting has specific recommendations for activities regarding light levels and color rendering in public areas as well as general recommendations dealing with ergonomic factors. The standards is defining what is needed in terms of visual comfort and performance for people with normal visual capacity. What is not in the standard are specific recommendations for people with special visual needs since it can vary a lot from one person to another depending what kind of needs they might have.

In terms of ergonomics there are recommendations to avoid flicker and glare since it can give discomfort, reduce performance and can be unsafe in a working environment (EN 12464-2). These factors is important from a socially sustainable perspective since some users that are sensitive to this can be excluded from the specific environment (Boverket 2005).

In the Swedish Legislation 'Accessibility and usability in public spaces' it is a focus on how urban spaces should be designed to include people. Lighting and visibility is an important factor since the light can isolate or exclude people from spaces. The legislation is mentioning different factors that needs to be considered in the design of public spaces but has only a limited amount of direct tips on how to fulfill the recommendations.

The legislation is touching subjects as visual clarity, hierarchy, uniformity, contrast and colors. The factors is viewed upon from a point of view where the focus lies at creating a functional lighting solution that supports orientation and enhances visibility for visually impaired, blind and def. (BFS 2004:15).
DIFFERENT NEEDS FOR DIFFERENT USERS

From the book ‘Enklare utan hinder’ by Boverket they have described and shared different experiences with working for a more accessible city by reducing obstacles and making the solutions integrated for an inclusive urban environment. The book should not be considered as guidelines since every situation is unique and the conclusion is that there is no easy answer to the matter since it is a complex thing to meet everybody’s needs in the urban environment. In terms of better and more inclusive visual environment for there is however some tips regarding glare, reflections and contrasts. These factors can be problematic for users with special needs since it becomes harder to perceive the space, especially for visually impaired that sometimes can have trouble with visual adaption when there is big difference in light levels (Boverket 2005).

Women that are traveling by foot in public spaces is the users that are the most worried about their safety. But other factors such as age, special needs and where you live also have an influence on the feeling of safety in public spaces during nighttime. Reducing glare, lighting up vegetation, visual clarity and good color rendering is factors that is associated with improved feeling of safety. This often leads to more people using the space which also leads to a secure area (Boverket 2010).
METHODOLOGY
METHODOLOGY

Since the factors that are mentioned in the policy are of a general character the intention with this thesis was to summarize the policy “Politik för gestaltad livsmiljö” and through a survey with the public, an interview as well as a literature study regarding light and social sustainability create guidelines and a checklist. The guidelines and the checklist was then used in a design project to evaluate and determine the relevance of the new tool (see figure 3).

The survey (see appendix 1) was made with a quantitative approach with forms that was shared on social media channels such as Facebook and Linkedin to the personal contacts of the author of this thesis. It was also shared to groups for visually impaired, elderly, epileptics, people with social anxiety and a general forum. This was done to have a democratic approach and to get different perspectives on how public spaces was experienced visually. Problematic areas regarding public spaces that results in an excluding environment for the users was also defined.

This was followed by a qualitative approach with a member of SRF, “The Swedish association for the visually impaired” to gain insight on how people with special visual needs is experiencing public lighting and how well the existing recommendation is meeting the needs of the users.

The results of the survey and interview was then compared with literature regarding lighting, standards, recommendation and universal design.

To establish how to work socially sustainable with lighting design a selection where made with eight guidelines and a checklist that derives from the literature, the survey and the interview.

After the guidelines was made they were used in a project with the architecture bureau Elndersten with the intention to create a lighting concept for a public space, the shopping center Valbo Köpcentrum that is planning to be renovated in the future. The aim was that the concept should con-
tain a suggestion on how the lighting could be arranged for approaching the shopping center by car or by foot. The purpose of the concept will be to use the guidelines and try to balance the needs of the universal user and the needs of the owner of the shopping center. The design had a general character and was not detailed in terms of exact luminaries or placement but focused on light levels, light distribution, visual hierarchies, colors and contrast.

The project was done with a design process (Wikberg Nilsson, 2015) with:

A research phase with a site analysis, which includes analysis of users, materials, location and existing lighting solutions. Problematic areas and user needs was defined, which together with the guidelines formed criteria for the ideation phase.

An ideation phase using the guidelines as principles for the final solution.

The design solution was evaluated through the checklist the book 'Tillgänglighetsdesign' (Wikberg Nilsson et al. 2019) by the author of the thesis with the intention to reassure that the design is more socially sustainable.
RESULT
SUMMARY OF THE POLICY

Two main perspectives, individual and democratic, could be found in the policy that were suggested to be considered to create a socially sustainable environment.

1. Individual, The design of the space should be inclusive by being available for all and designed so it is considered attractive.

2. Democratic, The design of the space should also contribute to a democratic society by marking the values of the area and be adapted to its context.

These two requirements should according to the policy results in an equal and less segregated society (see figure 4) (Kulturdepartementet 2018). The two criteria is involving the users of the space from different perspectives.

The first criteria could be viewed upon as an individual approach since it suggest you take every need in to consideration when designing and has a focus on being inclusive. To achieve this it is possible to implement a universal design perspective (Wikberg Nilsson et al. 2019).

The second criteria could be viewed upon as a democratic approach where you should consider the area and context of the design. The design of the public space should contribute to a pleasant and equal society (Woodcraft et al., 2012). This requires a more holistic approach where the context, usage of the space, different user needs and general attitudes towards a space has to be investigated.

A first step for the designer should be to investigate different individual needs for the public space and establish what can be done to improve the visual environment for all. If the needs or attitudes are contradictory they should be compared and prioritized according to importance by the designer.
SURVEY
To have a democratic approach a survey with open and general questions was made to find out the general attitude towards how the public spaces is visually perceived and to find problematic elements in the visual environment that made users feel excluded. There were 48 respondent between the ages 16-66 years old. There were 68 % being women and 32 % men. The results show that when people where asked what their general attitude towards public environments visual appearance there was mainly two categories of responses with similar character (see chart 1);

15 respondents had responses concerning that they felt that the public spaces was gray, sterile, boring and dull. The respondents requested a more visually stimulating public environment with more colors, art and interesting things to look at.

16 respondents had responses concerning visual noise and stressful environments the respondents requested a calmer public environment with less visual stimulation in forms of things such as people, advertisement and glaring lights.

When asked if they ever had felt excluded from a public space and why they had felt that way, there where no one who had felt excluded because of to low visual intensity levels in the environment. But there where ten respondents who had been excluded because of the intensity and visual noise in the public space. This could motivate a higher priority to meet the needs of those that feel excluded because of the high amount of visual noise.

INTERVIEW
To have an individual approach an interview was done with a representative from ‘The Swedish association for the visually impaired’ named Jimmy Pettersson. The interview was done to create an understanding in how people with special needs is experiencing the public environment;

The definition visually impaired is describing a condition with a visual capacity that makes the physical boundaries as...
“floating” and hard to perceive, this results for example in trouble with orientation, read regular texts and sensitivity against glare.

There are many different diagnoses that have different characteristics and demands different visual needs. The different needs can be contradictory with some being sensitive to strongly lit environments and some who require brightly lit environments to see. What is a common need for all visually impaired is that it is easier to perceive the space if there are larger uniform areas of light with no dark spots or reflections that can be perceived as differences in the ground surface. But if the path is clearly marked and it is well defined with contrast the lighting can be more varying which can be appreciated by the user.

It is most often good to use light, colors and contrast to mark differences in ground levels, obstacles or other elements. There is a possibility that the use of colors in public environments can be used at a wider range to make it easier to perceive the space, it should however be made in a logical way and colored with cohesive colored areas rather than with a lot of colors and patterns that might confuse the user.

The recommendations and legislations is overall good but is not followed in an inclusive way which can be a frustration for the visually impaired. It can be problematic to define a typical problematic environment for the visually impaired since the needs can vary depending on the visual capacity of the individual and it is common that the needs are contradictory. Examples on what often are considered as bad solutions is glaring light sources, some changing effect lights/images usually seen in advertising purposes, to big contrasts in the environment and confusing reflections (see figure 5).

Figure 5. Reflections and colored signs that might confuse the visually impaired user
1. Find out what kind of visual elements is important for the users in that space (Wikberg Nilsson et al. 2019). These elements such as, end-destinations, art, architecture, greenery in the space should be highlighted. This should create a clear visual hierarchy with a good overview. (Huddinge kommun 2016), (Nacka kommun 2017), (Piteå Kommun 2017), (Starby 1989).

2. Follow the standards and recommendations. Every design should however be looked upon differently where special needs for the space and users has to be taken into consideration (Wikberg Nilsson et al. 2019).

3. Encourage the usage of the space by making it easier to visually perceive it. This should be done by lighting up strategic vertical surfaces that lowers the contrasts in the environment (Boverket 2005), (Huddinge kommun 2016), (Nacka kommun 2017), (Piteå Kommun 2017), and use a light distribution and light topography that is appropriate for the context (Wänström Lindh 2012).

4. Establish what kind of visual needs the different users may have in the environment. Consider if someone is excluded in the environment as a result of the design, establish why (Wikberg Nilsson et al. 2019).

5. Mark signs, physical elements, ground surfaces or obstacles clearly, with sufficient contrast (Tregenza & Loe 2014) and logical choices of color (BFS 2004:15), (Boverket 2005), (Wikberg Nilsson et al. 2019).

6. Define visual noise and stressful elements and reduce it (Rea, 2000), and still aim for an interesting and colorful visual environment.


8. Consider the contrast ratio in entrances, portals, tunnels or similiar they should have a low contrast to prevent glare, even in daytime (Boverket 2005).

GUIDELINES
The selection of guidelines (see figure 6) is a suggestion for creating socially sustainable lighting solutions. The guidelines is considering public spaces with a democratic and individual approach and is deriving from literature and supported by either the survey or the interview mentioned earlier.
1. SAFETY

Is the safety considered and looked at from different user perspectives?

2. USEFUL

Is obstacles or disturbing elements in the public space dealt with to make it easier for people to use the space independently?

3. INCLUSIVE

Is the solutions integrated in the environment instead of standardized aids or separated add-ons that is excluding the user?

4. ATTRACTIVE

Is the design a balanced environment with a variation in the lighting that merges together to a unity?

5. PLEASANT

Is the solution an inclusive and pleasant lighting environment that encourages the usage of the space?

CHECKLIST

To be able to evaluate the result of the design solution a checklist (see figure 7) was made inspired by the criteria mentioned in the book ‘Tillgänglighetsdesign’ (Wikberg Nilsson et al. 2019). The checklist has the intention to help the designer to reflect upon how well the design concept is meeting the criteria.
THE PROJECT
This project will have a focus on designing a socially sustainable lighting concept for the client with the help of the guidelines. This will after the concept is done be evaluated with the checklist.

THE SHOPPING CENTER
The shopping center in Valbo owned by the company Eurocommercial is a building from 1970 that is frequently visited by people from the nearby city of Gävle as well as from rural areas further away. The entrance, facade and the interior of the shopping center is going to be renovated in the near future by the architecture bureau Elindersten Arkitekter. The renovation is not considering the lighting solution for the light in front of the facade which includes the paths to the entrance and the parking lot (see figure 8).

The concept the architecture bureau have made for the renovation is an environment that is to be welcoming and inclusive. The feeling they want to communicate is a warm and calm feeling with room for surprise and interactions. The design of the facade and interior is consistent of triangular patterns and layers of Steni composite material with integrated LEDs (see figure 9), (see figure 10).

The concept from the architects will result in a large visible element during night and it needs to be investigated if the concept could be motivated from a user's perspective.

THE USERS
The main target group for the shopping center is families with children. The ambition is however to be a welcoming place for all of their users. As a result of the location of the
Figure 9. Illustration on new facade concept for Valbo Köpcentrum (Elindersten Arkitekter 2019)

Figure 10. Top view on the area with the new facade
shopping center about 90% of the users are traveling there by car. The other 10% is either walking or biking there from the nearby village, Valbo, or using public transportation to get there (see figure 12).

Photos were taken at the space to understand the visual environment the users experience and define problematic areas:

The overview towards the area is consistent of a lot of different elements which could be perceived as chaotic and confusing (see figure 12a).

The promenade is mainly consistent of gray urban elements which could be perceived as dull (see figure 12b).

Areas that is contributing to the usage of the outdoor space is old and not well-maintained (see figure 12c).

There are a lot of traffic on the way to the shopping center which could add to a stressful experience (see figure 12d).

The entrance is not easy to detect which could be confusing and stressing (see figure 12e).

Parking lot is flat and gray which could be perceived as dull (see figure 12f).

The user journey suggests that the environment at the shopping center is similar to how public spaces where perceived by the respondents of the survey.

On Google review you can find that the general attitude towards Valbo Köpcentrum is mainly good. Because of the character of the building being a shopping center there are different times of the week when there is a high tempo with a lot of visitors and cars (see figure 11) which is stressful for some visitors. There are also visitors describing the shopping center as dull, gray and depressing (Google.com, 2019).

The reviews on Google and the answers from the survey made earlier have similar character on the answers with some experiencing the environment as stressful and some as dull.

This suggest that it could be motivated to use more colors in the environment. It is important that the concept is not contributing to a stressful environment by adding visual noise and that the lighting is contributing to a more cohesive environment.
Figure 12. User paths to the entrance with viewpoints

Figure 12a. Viewpoint A, Overview over the parking lot with a lot of signs and cars, from a pedestrian perspective

Figure 12b. Viewpoint B, Promenade to the entrance including a majority of gray urban elements

Figure 12c. Viewpoint C, Playground next to entrance

Figure 12d. Viewpoint D, Drive to the shopping center

Figure 12e. Viewpoint E, Drive to the parking lot

Figure 12f. Viewpoint F, Parking lot towards the entrances.
NOCTURNAL LANDSCAPE

The shopping mall was visited and photographed (see figure 13) during night time to gain understanding of the present lighting solution and how it affects the space.

After the visit it was verified that the present lighting solution was not compliant with the guidelines because it:

Lacks clear visual boundaries (see figure 13a).

Contains elements that is likely to cause glare (see figure 13b).

The light sources used is resulting in an environment that could be perceived as colorless or dull due to poor color rendering and a uniform light distribution (see figure 13c).

The natural trees on border of the parking lot is dark and could be perceived as intimidating (see figure 13d).

The space lacks a clear visual hierarchy that could be perceived as visual noise and confuse the users (see figure 13e).

Important elements in the space such as the entrance is not dominant and could be hard to detect (see figure 13f).

Urban elements that is encouraging the usage of the space is not highlighted (see figure 13g).

There are mainly gray urban elements that could result in the environment being perceived as dull (see figure 13h).

This motivates that the space would benefit from another lighting solution lighting such as the architect’s concept to meet the needs of the users that are perceiving the environment as dull. There is also a possibility to reduce a lot of visual noise coming from signs and light sources which makes the architect’s concept relevant.
Figure 13a. Viewpoint A, No visible boundaries towards the end of the parking lot

Figure 13b. Viewpoint B, Glaring light sources from advertisement signs

Figure 13c. Viewpoint C, Trees looks yellow due to high pressure sodium lamps

Figure 13d. Viewpoint D, Dark border of the parking lot with natural trees

Figure 13e. Viewpoint E, Facade with confusing visual hierarchy

Figure 13f. Viewpoint F, Unclear entrance

Figure 13g. Viewpoint G, Strongly lit signs and no light on the playground

Figure 13h. Viewpoint H, Gray visual environment with broken lamps
DESIGN OBJECTIVE
Create a socially sustainable lighting concept by following the guidelines. The concept should meet the user needs of reducing stressful elements and contribute to a more interesting environment that is encouraging the usage of the space.

THE CONCEPT
The suggested lighting design was done by following the guidelines. This resulted in creating visual boundaries, reduce visible light sources and create a visual hierarchy with emphasis on the entrance, facade and the greenery. Even though the space is considered a public area the idea has been to create a more intimate and safe feeling without adding to anyone feeling excluded by the lighting solution.

Smaller changes was made to the area for a more structured visual environment that puts more emphasis on the new facade and entrance and create visible boundaries for the urban room (see figure 14).

FOLLOWING THE GUIDELINES
These are the design decisions that were made during the development of the concept while following the guidelines that was established earlier (see figure 6).

1. Visual elements that could be of interest in the space is the entrance, the new facade, the paths, vegetation, playground and signs (see figure 15). The main visual elements that should be clearly defined and easy to detect are the entrance and the facade. The playground and promenade are important for the usage of the space so the light should encourage this. The signs and vegetation will work as visual boundaries for the space and be considered as less important in terms of attention. The parking lot and the drive itself is not a visual element that should be considered interesting, but visibility is important for safety and guidance.

2. The choices of illuminance (see figure 16) is based on making the drive, promenade and entrance easy to detect by sufficient contrast (Tregenza & Loe 2014). To make it
A. Parking lot, horizontal, 15 LUX, 2200 K, 60 CRI.
B. Drive, horizontal, 50 LUX, 3000 K, 90 CRI.
C. Promenade, horizontal, 50 LUX, 3000 K, 90 CRI.
D. Promenade, horizontal, 50 LUX, 2700K, 90 CRI.
E. Store signs, vertical, 100 LUX.
F. Facade light, 100 lux, 2700K, 80 CRI.
G. Outside entrance, horizontal, 150 LUX, 2700K, 90 CRI.
H. Advertisement signs, vertical, 100 LUX, 3000K, 80 CRI.
I. Vegetation, vertical, 100 Lux, 3000K, 90 CRI.
even easier to separate the different areas they will also have different color temperature. The signs of the space has the same illuminance which will result in a more cohesive environment with reduced glare. By having a higher CRI than what is recommended the existing colors of the space will be easier to perceive. This is to meet the user needs and prevent the space feeling gray or dull at night time.

3. To encourage the usage of the space the intention was to design an intimate atmosphere, lower the speed of cars and clear the view to the entrance and facade, bollards will be used for the promenade and the drive to the parking lot (see figure 17). The promenade will also have a guiding linear light integrated in the facade. This will together with the higher lighting poles create a variation in the space that gives a spacious feeling (Wänström Lindh 2012).

To create visual boundaries for the space during night time, the facade, the vegetation and the advertisement signs will be the bright vertical elements that is framing the area (see figure 18). To meet the user needs the promenades and the drive will be lit up in a pattern similar to the triangular pattern on the facade to create a dynamic rhythm and an interesting visual environment (Wänström Lindh 2012). For people requiring a more uniform lighting because of special visual needs (Boverket 2005) the walking path is divided in two parts, one with uniform lighting and one with the more varying triangular pattern.

4. The new solution that is presented should be easier to perceive, easier to orientate in and be experienced as safer for the users (Boverket 2005), (Huddinge kommun 2016), (Nacka kommun 2017), (Piteå Kommun 2017), by using low bollards this should also decrease the amount of cars driving too fast (Wänström Lindh 2012). What could be excluding is the light distribution of the promenade and the drive, where some users might find it disturbing or confusing. The idea behind is however to add a more interesting and pleasant lighting (see figure 18a and 18b) with a varying distribution that could lower the speed of cars in the area (Wänström Lindh 2012). Since the light is directed towards the ground surface there will be a lower contrast

Figure 17. Section with light topography
Figure 18. Light distribution top view

Figure 18a. Viewpoint A, Light distribution top view
Figure 18b. Viewpoint B, The drive next to the parking lot

Figure 18c. Viewpoint C, The entrance and parking lot with different colored lines for guidance
5. Obstacles or urban elements such as benches, trash cans, and other elements is either moved to alongside the facade. To create a contrast to the green vegetation and facade a warmer red color was used for the urban elements to make the space more visually interesting with more colors. The lighting poles as well as the lines for the parking lot will be in different colors to make the space more colorful and to work as guidance making it easier for people to remember where they parked their car (see figure 18c).

6. By using well-shielded bollards that is directing the light downwards they are not likely to cause glare. The lighting poles could be provided with shields and honeycomb filters to reduce glare. Stroboscopic effects and flicker is avoided by having quality drivers and light sources. There is also no moving or dynamic light that risk causing this.

7. By rearranging the advertisement signs and reduce the amount of visible light sources the space will hopefully be perceived less stressful. The space has also been provided with visible boundaries which should result in it to be easier to perceive and experienced as safer (Boverket 2005), (Huddinge kommun 2016), (Nacka kommun 2017), (Piteå Kommun 2017).

The design of the bollards (see figure 19) needed to be considered since they are an important part of the visual environment and the lighting design. By using similar elements that were used in the concept of the architects it connects more to the area which results in a more cohesive environment. The intention of the design is also to make the space more visually interesting by having contrasting color to the green facade and vegetation.

8. The light levels outside the entrance will be sufficient and have an illuminance of 150 lux to reduce contrast from outdoor and indoor and make eyes adapt easier (Boverket 2005).
FULFILLING THE CHECKLIST

To evaluate the lighting design the checklist (see figure 7) that was created was used to reflect and motivate the design.

1. Yes, the safety has been considered in the lighting design with an ambition to lower the speed of cars, have a safe passage for pedestrians and create clear visual boundaries for the space. Vegetation has also been added and highlighted in the space which should contribute to a safer experience (Wänström Lindh 2012).

2. Yes, the solution has considered the universal user and the space has been designed with an ambition to make it safer and the entrance easier to identify for guiding purposes. The colors used on the parking lot and its lighting poles is also meant to help the users to orientate and remember where they parked their car. The design is also encouraging social interactions by using a more intimate light topography (Wänström Lindh 2012).

3. Yes, the uniform linear light and tactile paving next to the facade should be consider as a part of the lighting environment contributing to a usage of the space that is inclusive and equal.

4. Partly uncertain, there is a variation in the lighting that is merging together to a unity, if or how well it is balanced is subjective. The intention has been to use a visual hierarchy using sufficient contrast in illuminance (Tregenza & Loe 2014) and color temperature to create balance.

5. Partly uncertain, pleasantness could be a subjective factor and therefore it is hard to evaluate. The design could be considered as inclusive and the lighting has both functional and atmospheric qualities with a varying light distribution that should contribute in a pleasant environment (Wänström Lindh 2012) which encourage the usage of the space. Visual noise was reduced to make the space less stressful for the users. Vegetation and colored urban elements was added to the space to meet the user needs and the visual hierarchy has the purpose to encourage usage of the space with a more structured lighting.
DISCUSSION
DISCUSSION

The result that will be discussed in this chapter will be divided into three parts; Guidelines and checklist, Project and Further development.

GUIDELINES AND CHECKLIST

The results of the literature study, interview and the survey gave a suggestion on how one could work with public spaces and lighting from a socially sustainable perspective. The guidelines is covering lighting design from a social (democratic) and individual (inclusive) perspective.

The different guidelines is concerning factors that should be considered important when designing light in public spaces. The guidelines and checklist is however not a guarantee for a socially sustainable lighting design since there is a possibility that different perspectives has been missed. The guidelines could be used for inspiration and guidance in a design project along with the designers former experiences and knowledge in lighting and user-based design.

The results from the literature, interview as well as the survey shows that even though recommendations and standards exist and is often sufficient for functional purposes for most, it should not be considered as equal to a well-lit environment for everyone. Users and space must still be prioritized higher to create a better lit environment.

The survey and the interview both described the public environment as a stressful and dull place, these words can be contradictory. But through the site analysis it seems that it in this case could be accurate. The respondents was asking for a more colorful environment in the public space which the literature supports, if it is done in a structured way that does not confuse the users. This suggest that the designer should consider the importance of colors and how it can be used for both atmospheric and functional purposes in public spaces.

The survey was done with open and general questions to not be suggestive and lead the respondents. This could have a result of being limiting for some since it requires the respondent to imagine.

The focus on users is according to the literature important for a social sustainable environment. What could be problematic is to know how thorough the user research should be done to be sufficient in a public context since they are made to be available for everyone. A universal design process is based on to not make assumptions or generalize user needs which could be hard to motivate from an economic perspective.

What is also an issue about the result is regarding the guidelines and the checklist could be viewed upon as too subjective. Words such as “Pleasant”, “Balanced environment” and “Attractive” could mean different things depending on the reader. Even though the guidelines could help the designer on the right track there is also room for interpretation when working with users and the different environments. This could influence the result of the design and should be considered. One could argue that this is the purpose of the designer and together with “common sense” to find a solution that is contributing to a visual balance and that it should be the designers expertise but there are no guarantees.

PROJECT

The design resulted in being a more varied and in some sense more structured visual nocturnal environment than the present solution. The process that led to the result became direct and straight with not much room for iterations and experimental ideas as the guidelines was limiting in what was possible. This could be considered as both positive and negative depending on what you would like to achieve. If a more artistic freedom is needed it is likely that the guidelines would seem restricting.

The complexity with different needs of users, space and client that was contradictory was problematic during the process. There was uncertainties during the project on how to prioritize different user needs as well as the clients. Therefor the phrase “available for all” mentioned in the policy could be hard to achieve in some cases.
Since the new design solution is requiring more luminaries it is also likely that it will cost more and consume more energy than the present solution. This could make it harder to motivate from an economic and environmental perspective.

FURTHER DEVELOPMENT

The guidelines could benefit from more research and discussions regarding light and social sustainability with designers, users and involved stakeholders to ensure that no aspect is missed.

General attitudes and problematic factors regarding public spaces has been defined by the thesis. This could be developed and a new survey with examples in pictures and more specific questions could be done. This would define more exact what kind of lighting environment is preferred by the public and also how a stressful lighting and dull lighting environment can be prevented.

The guidelines and checklist needs to define to what degree the user research should be done and in what range since the public context should be designed for everyone which could be problematic.

There are still uncertainties regarding how to prioritize different needs of users, environment and client to create a socially sustainable lighting environment, the guidelines should therefore benefit from a clearer strategy on how to prioritize needs.

Words that could be perceived as subjective in the guidelines and checklist needs to be redefined and it needs to be established what they actually mean to minimize misunderstandings.

The environmental and economical aspect of sustainability should also be at least considered briefly to make the design solution realistic and feasible.
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<table>
<thead>
<tr>
<th>Ålder</th>
<th>Kön</th>
<th>Vad har du för intyck av offentliga miljöer generellt, hur kommer det sig?</th>
<th>Upplever du att det saknas någotintresse att slippa av offentliga utmaningar, sällsynt vad?</th>
<th>Har du någon gång känt dig ekonomiskt at riskierad från en offentlig miljö, att denna var ansvarig?</th>
<th>Finns det någon målgrupp som du anser att det borde tas mer hänsyn till när de behöver förstå när offentliga miljöer byggs?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019/03/26</td>
<td>3:56:12 PM GMT+2</td>
<td>28 Man</td>
<td>Giltigt och trådlöst kanske, inget speciellt</td>
<td>Kanske en mer avslappnad miljö, det är ofta mycket folk och stress</td>
<td>Nej</td>
</tr>
<tr>
<td>2019/03/26</td>
<td>5:07:03 PM GMT+2</td>
<td>28 Kvinnor</td>
<td>För hög förhållande</td>
<td>Mer vakthåll</td>
<td>Pga ”fat” tillförlitlighet i det sociala landskapet. Det är oftast en ”förra” förvisning och kommer från arbetet, väl utan att det inte hjälper alla.</td>
</tr>
<tr>
<td>2019/03/26</td>
<td>5:47:02 PM GMT+2</td>
<td>30 Man</td>
<td>Mycket folk i klokträcht i raden</td>
<td>Vågledning av detta människoklass</td>
<td>Physiskt exkluderar kanske, då jag ej finns bland för mycket människor i raden</td>
</tr>
<tr>
<td>2019/03/26</td>
<td>5:59:56 PM GMT+2</td>
<td>28 Man</td>
<td>Inte bra.</td>
<td>Soknas bra daglig, bra planerad,</td>
<td>Jo, direkt skolat</td>
</tr>
<tr>
<td>2019/03/26</td>
<td>7:44:13 PM GMT+2</td>
<td>26 Kvinnor</td>
<td>Fokus på att leva upp</td>
<td>Nej</td>
<td>Man blir när blandar av kamporna</td>
</tr>
<tr>
<td>2019/03/26</td>
<td>7:53:34 PM GMT+2</td>
<td>26 Man</td>
<td>Utfor brutet fruktet Vet inte</td>
<td>Ibland finns det för 15 fodrare</td>
<td>Inte direkt</td>
</tr>
<tr>
<td>2019/03/26</td>
<td>7:54:17 PM GMT+2</td>
<td>27 Kvinnor</td>
<td>Mindre intyck av offentliga miljöer</td>
<td>Inom offentliga miljöer används det ofta och även i utomhus.</td>
<td>Øppna i klosetten där det är ett att någet att tänka på. Det kan röra sig om att slippa av i offentliga miljöer. Den kan inte tänkas på.</td>
</tr>
<tr>
<td>2019/03/26</td>
<td>8:46:16 PM GMT+2</td>
<td>29 Man</td>
<td>Olycklig fråga. Det är två frågor i enl. Generell bro och hel inte varför jag tycker de</td>
<td>Nej</td>
<td>Låt om plats</td>
</tr>
<tr>
<td>2019/03/26</td>
<td>10:27:30 PM GMT+2</td>
<td>28 Man</td>
<td>Funktionsstör, slitskant, smutsig, grön, kall</td>
<td>Värme, rekrytering</td>
<td>Nej</td>
</tr>
</tbody>
</table>
2019/03/27 4:34:34 PM GMT+2
50 Man Oppslutning, motivivering görs för att skapa hälsa och hållar gått det som tror förbättrings är bör, på det nödvändiga att ställa på, de nödvändiga anpassningar så vi lever i förbrukade miljöer.
Mar mjuka varv och material samt bekymmer, sommar har vi ofta många flyktningar men hyvlar inte, och ofta mycket miljö, det stödjer tagits bort för att i stället att undanföra.
Titel är det med många arbetssättar med justeringer som inte lyser, full med trashiga lampa.
Ja, troligen för att det var mitt lite stora på den typen av verksamhet.
Nej, men förbrukar på människans. Det är kanske fint med rött ljus men det blir andra offentligt.

2019/03/27 5:06:01 PM GMT+2
28 Man Det beror helt på vilken offentligt miljö, sjukhus är det stort bekymmer, något framtiden dunkel bekymmer, jag tycker att de öppna dessa underjubblar jag är på.
Da skulle aldrig kunna bli mer energi, något mer intressant.
Nej
Personer med perfektionsvillan

2019/03/27 8:53:25 PM GMT+2
29 Kvinna Generellt positiva då jag lätt mig vara och var på att jag skulle äta något att värde.
Inte direkt
Ja

2019/03/27 8:54:28 PM GMT+2
32 Kvinna Smärtsamt och skillt, EU-migranter som dröjer runt och gör att det inte kan respekteras, frivillig innehållning, tägare.
Övervakningskameror, oroligvakten, våldte, poliser, tvångsare taggar mot rostrika.
Könt mig orsakat, Den goda medborgaren som sköter sitt jobb och betalar sitt skott.

2019/03/27 9:24:04 PM GMT+2
32 Kvinna Rörliga och för mycket folk, jag är vidstående intresse, även om det bara min uppsättning och inte så att det verkligen är.
Lugn plats. Jag kan inte våka. I nödvändig miljöer är det ca 15 minuter sen för jag antagit, för mycket intygar med ljus, ljus, luktar mm.
Ja, som nämns ovan, för mycket gamla ljus, blåa, starka ljus, mycket ljus, lukt.
Någon specifik grupp vet jag inte, kanske de med syn och hörnärligt

2019/03/27 11:03:48 PM GMT+2
53 Kvinna Starta och jaktvis.
Vet inte
Bohusen duschar när är öppnat kan inte braa en duscha får ömman bekymmer, tvåt att bara våda vad som jag i olika kommersiella lokaler, men det är kanske för att jag hör till
Kanske de med syn och hörnärligt

2019/03/28 12:07:33 AM GMT+2
33 Man Oloka kola
Dynamik
Nej
Unga och barm

2019/03/28 2:08:50 AM GMT+2
229 Kvinna Akutten kan ibland vara jobbig när jag är trött.
Någonstans att gå undan om man, intäkter vika efter antal, tex amningsrum på köppcentrum.
Nej.
Gymnasieskolverk, det är inte alltid skolar accepterar att man behöver gå undan och vika efter ett antal. Utöver dagens skolbarn att det ska på somma gång och i en rasande fakt.

2019/03/28 6:02:36 AM GMT+2
33 Kvinna Omgående
Ja blinkande lampa
Synkronisera

2019/03/28 8:46:16 AM GMT+2
48 Kvinna I köpscentrer, helt ok mot butiker och ibland litar juget vådigt högt och det är jobbigt.
Nej
Kan, väg tar sig på Bio eller utomhusen längs på gåg hög hjul och ljuv så att det kan avgöra ett antal
Handikappade med rutetill, blinda mm som kan ha det svårt att ta sig fram själva

2019/03/28 9:29:19 AM GMT+2
34 Kvinna Dåligt, för öppet.
Avslutningar
Nej men obekvämt
Dom som har svårt att sortera intygar med olika afp-diagnoser.

2019/03/28 9:32:26 AM GMT+2
22 Kvinna Generellt trettio på de platsen där det är juv och friställ, närmare trettio med av de gärna lägen i turistburen som är vådigt "Gregogassiga" eller vådigt högt, bromsar knackat, däröver smås jen och
Ibland mer vta, där det kännas hårig och med mycket placerat på samma plats
Nej
Platsen att dra sig undan från folkmassorna kan ibland saknas, annars nej.

2019/03/28 10:01:16 AM GMT+2
30 Kvinna Starta, efter att det dock fin konst att kalla på, men ibland undrar man hur de har förstått, var på auton och det hundegs en tvåa med en död fågel bredvid mig.
Mar glad och vacker konst,
Nej
Är det först belagt med att detta alltid finns en reception utan en största löslighet.

2019/03/28 10:14:58 AM GMT+2
16 Kvinna På en del strävan är det trettio och på andra är det inte alls trettio.
Ja på sätt och vis, det är mer där vinne är mycket folk, att det finns en alternativ på vgt då ängart eller annat sätt på,
Nej
Ja ge inte riktigt

2019/03/28 10:30:04 AM GMT+2
36 Kvinna Rörliga. Det är ofta mycket mycket man skriver att saker på samma såk.
Nej
Nej
Vet inte

2019/03/28 10:33:62 AM GMT+2
16 Kvinna Jag tycker att det är bra frå om inte är för många då.
Jag har sett att det ofta är långt till bas så om man hade gott några andra försökte detta att det ofta är långt student.
Ja, det hänger ganska ofta.
Tjänstederna har ofta länga k.

2019/03/28 10:40:07 AM GMT+2
60 Kvinna Tränsig, hämnen, prang då man kan gå undan
ja, ofta. Panikbägaren
Iror många bill komma utan de inte grann.

2019/03/28 10:45:48 AM GMT+2
Kvinna Är tröttnad när jag går i inomhus områden så att jag är eskerik. Är ofta några ng som kan fångas upp mig. Önskar att det finns ett flertalet plats på täcken, så man kan visa sig när man är dräkt.
Offentliga möbler har lampor (LED eller hololjer) vars (ljud konst konst konst) linna på ett kapplåt att så ira en mobiltjänster med slumtion mot lampan så ser du, då blir det ofta otroligt dök och kan odessa inte vistas öv.
Se första punkten
Ja, gå på jugeta o tarnorna.
Personer med funktionsnedsättningar, epileptiker ibland annat

2019/03/28 10:48:17 AM GMT+2
53 Kvinna För mycket ljud
Stlöplats
Personer med perfektivalt svårgående

2019/03/28 12:34:10 PM GMT+2
26 Kvinna Generellt hårdiga. Vitt, beige och grön är mycket tysta och med regement. Samma ofta jobbig industribeklädnad
Mer färger och konst, behagligt ljud
Nej
Tvåa extremt svårt att göra alla nödpå.
<table>
<thead>
<tr>
<th>Datum</th>
<th>Tid</th>
<th>Användare</th>
<th>Aktivitet</th>
<th>Beskrivning</th>
<th>Indikationer</th>
<th>Omsorgsbehov</th>
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<tbody>
<tr>
<td>2017/03/28</td>
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<td>Kvinnor</td>
<td>Mycket Intryck, Hög musik</td>
<td>Personlig hjälp</td>
<td>Stressande med alla intryck</td>
<td>Föd med epileps och Autism</td>
</tr>
<tr>
<td>2017/03/29</td>
<td>8:32:59 PM GMT+2</td>
<td>Kvinnor</td>
<td>Helt ok</td>
<td>Tycker att det är tufft tillbakadrag för min del.</td>
<td>Nej</td>
<td>Rullstolshjulmar</td>
</tr>
<tr>
<td>2017/03/31</td>
<td>2:38:59 PM GMT+2</td>
<td>Kvinnor</td>
<td>Fin mycket stan och betong</td>
<td>Träd, träd, äng på byggnader</td>
<td>Håbar som fungerar. För höga trappor.</td>
<td>Åtta</td>
</tr>
<tr>
<td>2017/03/31</td>
<td>8:21:25 PM GMT+2</td>
<td>Kvinnor</td>
<td>Häggt och kallt</td>
<td>Väster, ljusdämmande materiel</td>
<td>Rödigt mönt med mycket saker på vinden.</td>
<td>Ujj och ljuskärlningar</td>
</tr>
<tr>
<td>2017/04/10</td>
<td>5:57:51 AM GMT+2</td>
<td>Kvinnor</td>
<td>Reflecterar inte över det om det inte är något annatunda. sådana stora, parkar och annat som går att man vill bara kvar längre än nödvändigt</td>
<td>när det ser tont ut, eller när det är nödvändigt på golfet som indikerar förbjud. Om bokhyller är placerade på ett sätt så att man inte ser att man vill se</td>
<td>Lita människor</td>
<td></td>
</tr>
</tbody>
</table>